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Vol. LXXVII.

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ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: July 2, 1915. [No. 1,962.

Page
Germany and Wireless World Service 1
Enemy Manufactures Prohibited 2
Copper 3
The Electrical Equipment of Submarines, by W. O. Horsnaill 3
New York's Co-operative Electric Vehicle Garage (*illus.*) ... 4
New Electrical Devices, Fittings and Plant (*illus.*) 5
The Work of the National Physical Laboratory in 1914-15 ... 6
New Russian Customs Tariff 6
Control Apparatus for Steel Mill Auxiliary Rolls (*illus.*) ... 7
Notes from Canada 8
War Items 9
Correspondence—
  The Railway Carriage Problem 10
  Pitting of Generator Brushes 10
  Colonial Advice to our Advertisers 10
Business Notes 10
Notes 15
City Notes 19
Stocks and Shares 23
Share List of Electrical Companies 24
Incorporated Municipal Electrical Association—
  The Use of Electric Vehicles in Municipal Service (*illus.*) (*concluded*) 25
  The "Point Five" Association 27
Submarine Signalling, by R. F. Blake (*illus.*) 28
An Electrically-Driven Mill (*illus.*) 30
Legal 30
New Patents Applied for, 1915 32
Abstracts of Published Specifications 32
Contractors' Column ... ... Advertisement page xx

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GERMANY AND WIRELESS WORLD SERVICE.

In these days wireless telegraphy is the work of all works about which the civilian may know nothing at all by actual experience. This is quite as it should be, but from a very cursory consideration of the matter and a common-sense weighing of the more reputable reports issued from various sources, it is quite evident that wireless telegraphy has played no small part in the war so far, and is regarded by the enemy as of immense importance not only during the war but also thereafter.

Let us hasten to explain that we intend to make no indiscreet disclosures, but only to comment upon the general trend of enemy wireless policy during the past 10 months, and the ambitions clearly fostered by Germany in respect of her "wireless future."

Commencing with last June, it will be remembered that on June 19th, on the occasion of his visit to Eilvese, the Kaiser exchanged wireless greetings with President Wilson and a number of other eminent Americans, but trans-Atlantic communication is said to have been imperfect at that date. Little more than a month later, every German submarine cable was cut by England within a few hours of the declaration of war, and but for wireless telegraphy, Germany would have been isolated as regards rapid communication with the outer world—particularly the States and the Far East, where such a vigorous campaign of mendacity has since been prosecuted.

Whether due to the spur of the war or whether (as is far more likely) due to full utilisation being made of equipment which had been kept in reserve and not previously used regularly at its maximum output, the capabilities of German stations are claimed to have been greatly increased since last autumn. There is no reason to doubt that this is the case, and it is quite probable that the number and power of really large stations in Germany are materially greater than is generally known.

Recently the French *Le Temps* made some remarkable statements concerning the degree to which Germany had organised her wireless news network. It is said that since the outbreak of war the power of the Sayville (Long Island) station has been raised from 35 to 100 KW., the necessary apparatus and the three 155-metre towers now in use being built in Germany and exported *viâ* Rotterdam. The effect of this is that to-and-fro wireless communication can be maintained between Germany and the German Ambassador in the States, even during the summer months, when atmospheric conditions are unfavourable in the west Atlantic.

There is said to be a German-controlled wireless station in each of the 46 States, besides 4 in Mexico and 16 distributed over South America, and all under direct orders from Sayville. This system disseminates a vast mass of the well-known brand of news prepared by Germany for export, and it is said that to-and-fro communication between

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European and American headquarters occupies 12 or 15 hours a day, most of the remaining 24 hours being spent in blocking low-power working by the Allies.

As before mentioned, it is impossible for any ordinary civilian to verify these general facts (which could so easily be verified in normal times), but there seems little doubt that the Allies would gain more than would compensate for any inconvenience inflicted on themselves, by systematically "blockading" Germany by wireless, as she is already blockaded by every other means.

What the German Pacific Squadon and commerce raiders owed to wireless—both by exchange of messages between ships and land stations and by "listening" for victims—is at least partially obvious from published dispatches and a general consideration of their career. It is certainly not too much to say that "more than one German vessel now interned, but still safe and sound in American harbours, would have been in the depths of the Atlantic or Pacific but for the extensive and excellent organisation of German wireless service."

What the enemy now owes daily to wireless in the way of reports and instructions to and from Zeppelins and submarines, and to spy messages, which traverse half the world in apparently innocent form before reaching their destination, can only be surmised by us who are not permitted to practise wireless in any form. But there is no reason to doubt that the enemy has benefited as greatly by wireless on land as by sea in the past, and may be doing so still. The organisation is undoubtedly there. The only question is whether effective "blocking" is in force. Unlike a submarine cable, the ether cannot be severed, but it can be "choked," and with the choice between rendering radio-communication more or less impossible to ourselves, and permitting the broadcast dissemination of "news" which may well have unsuspected method in its apparently reckless madness of untruth, the former appears to be the lesser evil.

Whilst more and more conclusive evidence appears daily of preparation and organisation for the collection and distribution of wireless news and instructions, as cunning and complete as that displayed by the enemy in every other direction, commercial and military, there is on foot in Germany a movement pretending that the world is in danger of subjugation to a British wireless monopoly, and urging Germany to establish a world network! Acquainted as we are becoming with the amazing intricacy and deceit of German machinations in every walk of life, there is still a grave danger that we may underestimate the power of a defeated Germany to continue such intrigues.

How far we are from having established anything approaching a wireless monopoly, and how impossible it is for any nation to do so in times such as these, when the cost of erecting opposition stations is of no moment, and no respect is paid to patents which in normal times might preserve monopolistic control to the patentees of a particular system—these points need little emphasis. As a nation we attach great importance (perhaps not sufficient importance in the past) to establishing an Imperial chain of radio-stations, and, as we can justly claim to be the centre of a united Empire spreading over the whole world, we are perfectly entitled to establish such a series of stations without incurring the charge of attempting monopoly and world domination.

With Germany the case is different. She had few colonies in the past and in future will have fewer, yet she aspires to establish a network of stations exceeding anything ever suggested in this country. Her avowed intention is to furnish an independent medium for the distribution of news and the spreading of "German genius, glory, and greatness" abroad—in fine, the stations she seeks, some of which she already has, are simply part of the great scheme for placing the world under the German yoke.

Mediæval, melodramatic and absurd as such pretensions would have appeared a few months ago, we have since learned that they are indeed the essence of modern German *kultur*. The dissemination of news and "influence" by every possible means has been reduced to a science by Germany. That the actual execution is incredibly clumsy and tactless in many instances does not diminish the excellence of the organisation *per se* or reduce its potentialities when properly administered. It is idle to deny that Germany excels in united national effort or that the interlacing of her whole industrial and social fabric does not enable her to effect results which are apparently financially impracticable. It is futile to suppose that when Germany is defeated, as she must be defeated, and subjected to a crushing financial burden, she will not remain an industrial rival of no mean order. In every branch of industry the crisis must be acute, and one of these branches is radio-telegraphy. By every indication Germany is bent on establishing a world-wireless-news service which shall rival the existing British cable system, and on backing the German Telefunken system against the British Marconi system. In order that she may not succeed in this aim it is only necessary to realise what her success would mean, to assess adequately the energy she will direct to the effort, and, finally, to see that our own wireless development is healthy, vigorous, and, piece by piece, in conformity with a pre-arranged and comprehensive scheme.

Enemy Manufactures Prohibited.

So long as men of British blood remember the barbarous methods that have been adopted by Germans, all goods suspected of the slightest trace of enemy-taint will be anathema. Teutonic writers and industrial leaders are displaying a confident belief—more or less forced, we imagine—that so excellent is the state of German electrical manufacturing and German industrial organisation, that after peace has been reached, necessity, efficiency of production, and low price will allow their goods to run freely in all markets before very long. As they "wait and see" they may find the truth to be less acceptable than their present fiction. We are, at any rate, content to believe that the revulsion of feeling that has been created wherever people dwell beneath the Union Jack, will be a serious barrier to their commercial efforts for long years to come. We never have been unmindful of the various factors which will affect the situation favourably for German manufacturers, and to some of these matters we may have occasion to refer again shortly; but to describe a thing as German will be to give it a nauseous and offensive character, and that factor will be one of the most influential at work. The Coalition Government has come into office without either political party having relinquished any of its former great principles, but the application of those principles may be varied in the presence of unprecedented conditions, and probably the future will witness the adoption of a definite policy encouraging the purchase of British manufactures with British public money. Yet it is useless for us to wait until legislative policies and enactments approve; after all, the legislature is there to do what the great mass of the people desire. Public opinion sometimes leads in sentiment before it follows in action. Even "Push and Go" men do not push and go until necessity drives.

It is as well, therefore, that the very strong anti-German feeling which exists everywhere in the United Kingdom and in the British Colonies—omitting for the moment the lands of our Allies—should find some definite expression and take such a concrete form that it shall not be subject to the dangers which might affect it if it remained an indefinite sort of sentiment simply fashionable and convenient in war-time.

We have already referred to the widespread agitation for erecting an almost insurmountable barrier against German goods, and even against German people, that exists in certain of the Colonies. Time alone will tell how far that agitation can be successful, and how far British electrical firms will find it possible to rise to the occasion, and do their part to make it so. We have also referred to the undesirability of British municipalities placing contracts with neutrals that were open to suspicion during war-time. But there is a desire in some quarters for a very definite policy to be accepted and acted upon now which shall control the course of matters quite independently of any legislative developments, and not merely during hostilities, but after they have ceased. A sign-post in this connection has been set up by the Birmingham Corporation Electricity Department, which we are given to understand has had the following special clause printed on its orders to contracting firms :—

"*A condition of this order is that the goods supplied have not been manufactured in Germany or Austria.*"

This clause represents not only the strong views held at Birmingham, but those of many other borough electrical engineers who may not yet have had an opportunity to carry their Committeemen or councillors to the length of putting down their convictions with such precision in print. The Birmingham clause, it will be observed, not only shuts the department against any German or Austrian manufactures which are already in the country and may be on offer, but as far as it is feasible for it to do so it prevents any possibility of such manufactures getting into the country through firms in neutral countries. Buyers naturally have to exercise their own discretion, and very carefully so, in the latter connection. But the Birmingham clause, if we perceive correctly, is not merely designed to guard against those two possibilities; we regard it as a policy on the part of the Corporation which will continue to be acted upon after the war. It may not indicate any particular change from the past spirit of Birmingham as a British industrial centre, but we believe that it is new as a definite clause in contract conditions there, and unless we misjudge the sentiment of these days there are scores of other Corporations and public bodies who will feel that the only course for them to adopt, in order faithfully to fulfil their trust as guardians of the public purse, is to support British industry wherever it is at all possible, and where it is not to deal only with those countries which are unmistakably neutral. Where Birmingham leads no doubt others will follow.

Copper. After a period of comparative weakness, during which prices of standard copper receded about £7 from the best figures recently registered, there has been another series of firm markets. The main outlines in the situation have not undergone any change, there being an overwhelming consumption in connection with war requirements, and every prospect of a continuance of this salient feature for a wholly indefinite period. There has been a fair amount of business doing in speculative quarters, but a considerable portion of the rather large bull account till recently open on the market, has been liquidated, and to this extent the situation, from a technical point of view, has, therefore, been improved. There is no intention on the part of leading dealers in the market to encourage speculation at this juncture, and the line they are taking is a very reasonable and proper one. Mr. Lloyd George has made it quite clear, moreover, that the Government are not going to stand any nonsense in the way of speculative movements, and it may, therefore, be taken for granted that should there be any attempt made on the London market to hoist values speculatively, swift action will be taken by the authorities. It is recognised that this action may even involve the forced closing of the London Metal Exchange, and this is a contingency which it is felt must be avoided by every possible means. There have already been too many attempts made to push up prices against buyers, and it is quite time that any attitude of this kind was rendered impossible, if not by innate patriotism, then by compulsion.

Of course, America really controls the market by controlling the output, but, on the other hand, American speculators have always made very free use of the London Metal Exchange to further their purpoess for the manipulation of the markets. The feeling as regards copper generally, is that, notwithstanding the high level of prices, the position is fundamentally perfectly sound. Producers have things practically their own way, for there is not much secondhand material to be picked up, and demands have yet to be filled to a very large extent, although the buying may be of a spasmodic character. Both Russia and France have been taking considerable quantities, and the former continues to put forward inquiries on a liberal scale. We are reaching the time, no doubt, when production should begin to tell upon the situation in America, but for the time being, producers there are able without difficulty to market every lb. of copper they produce, and they make no secret of the belief that the war demands will absorb everything which the mines, smelters, and refineries are able to turn out, and this regardless of price. Some of the leading trade experts in America believe that the termination of the war will be followed by a still greater demand for copper, for the declaration of peace must find the markets everywhere barren of supplies, yet, nevertheless, faced with a demand for industrial purposes sufficiently great to peg prices on a high figure for a long period of years.

THE ELECTRICAL EQUIPMENT OF SUBMARINES.

By W. O. HORSNAILL, A.M.I.E.E.

The present war has given special prominence to the important *rôle* played by electricity in connection with the means of offence and defence, every kind of electrical apparatus being extensively made use of both on shore and afloat. This feature is particularly pronounced in the submarine, which depends entirely upon its storage batteries for power, light and heat when submerged, while on the surface a further use of electrical energy is to be found in the wireless equipment.

The most important application of electrical power in a submarine is for the propulsion of the vessel underwater, when it is impossible to obtain the air needed for running the oil engines. Shunt motors are used for this purpose, and they are mounted on the intermediate shafts between the oil engines and the propellers, clutches being provided between these shafts and the engines, so that the latter can be disconnected when the vessel is running submerged. While cruising on the surface with the oil engines running, the motors either turn idly or are connected up as dynamos for charging the battery. So far submarines have always been fitted with twin screws, hence two motors are needed for each vessel. The power of the motors varies between 33 per cent. and 45 per cent. of the engine power, the tendency in the largest submarines being towards the lower figure. In the British "E" class the motors are reputed to be of 400 H.P. each, and the vessels are said to be capable of cruising underwater for six hours. It must not be supposed, however, that the battery has a capacity of 800 H.P. for this period, as the power needed to give the reputed submerged speed of 11 knots is comparatively small. In this connection it may be stated that the resistance to propulsion of a submarine underwater is less than half that on the surface, and this in spite of the drag caused by the conning tower and other excresences, together with the increased skin friction. The reason for this remarkable feature is that the resistance to a ship on the surface is largely caused by the waves thrown up during its passage through the water. When submerged no waves are produced, and the resistance consists entirely of skin friction. The above statement is amply supported by tests of the powers needed to propel a submarine on the surface and underwater over a range of equal speeds. Then again, the speed on the surface is 17 knots as against only 11 knots under water, and the resistance varies roughly with the cube of the speed. In view of these facts a liberal estimate of the power required when submerged gives us about 200 H.P. or 100 H.P. for each motor. The motors are made larger for the purpose of charging the battery quickly, as if they were only of the power necessary for propulsion, this operation would take a prohibitive period. Furthermore, the motors are used for reversing on the surface and for giving extra power to the engines during limited periods when a sudden spurt is needed.

The earlier batteries for submarines were of the acid type, but recently both Edison and "Alklum" batteries have been installed. In either case the cells are carried in separate watertight compartments. This arrangement is very necessary when acid is used, as, should sea water reach the cells, chlorine would be given off and would poison the crew.

In addition to the large electric motors used for propulsion many others are to be found in underwater craft for air-compressing, pumping, ventilating, heaving up the anchor, and other purposes. A detailed drawing before us of a 1,500-ton submarine in course of construction, shows no less than 12 electric motors applied to these duties, without reckoning the wireless equipment and the gyro-compass with which these vessels are now always fitted. Furthermore, all cooking is done by electricity, as any other source of heat would use up the air and give off noxious gases.

Obviously the above described electrical equipment includes motor starters, switchgear and instruments, but as these appliances are of standard patterns in use for similar purposes on shore they need not be particularised here. In fact, the entire electrical outfit of a submarine consists of standard apparatus excepting as regards the usual requirements demanded by Admiralty specifications.

The submarine has come to stay, in fact there are indications that it will eventually oust every other form of warship. If the latter proves to be the case, the underwater fleets of the future will offer a big field for motors, batteries and other electrical gear.

There are no insuperable difficulties in the way of building submarine battleships and cruisers of equal power to any surface craft now in existence, it is simply a question of development which will, no doubt, be expedited by the present war.

Not only will the Great Powers go in extensively, or entirely, for submarine fighting ships, but the smaller nations will find them an invaluable means of defence against more powerful foes.

In the face of all this future business for the electrical industry, it is our duty at the present time to devise some means for destroying submarines faster than the Germans can build them. The main difficulty is to locate underwater craft when submerged, and any instrument which can do this will deserve the undying gratitude of the nation. German submarines spend much of their time lying on the bottom during daylight hours, as this plan conserves their supplies of oil and electricity; and if our ships can only discover their exact position, it is comparatively easy to capture them. Already submarine sound instruments are proving of value for discovering submarines when under way below the surface, but obviously such apparatus is useless for finding vessels lying still on the bottom.

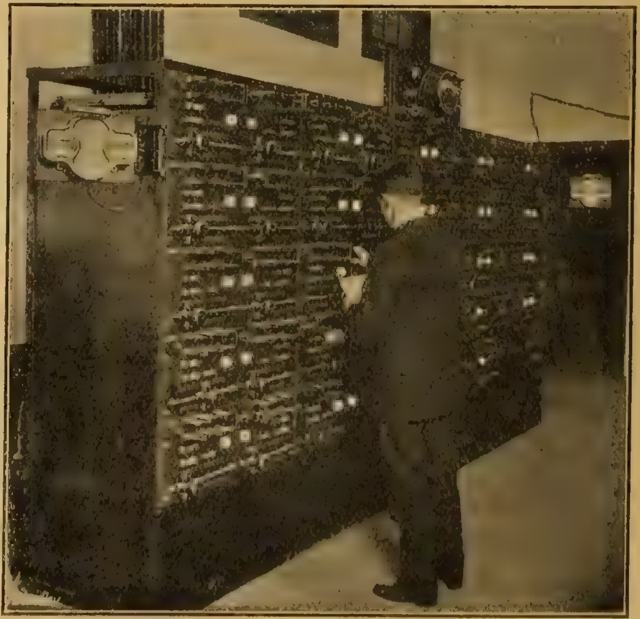
NEW YORK'S CO-OPERATIVE ELECTRIC VEHICLE GARAGE.

The new co-operative electric vehicle garage, situated at Central Park West and Sixty-Second Street, New York, is now in full operation with a quota of 100 privately-owned electric pleasure-cars garaged and cared for beneath its roof, and, although it has only been open since February last, the scheme is reported to be succeeding beyond the fondest hopes of the originators. The establishment is the largest electric vehicle garage in New York, and the task of establishing it was not an easy one; the various difficulties were, however, all overcome by the New York Electric Vehicle Association, with the assistance of three of the leading American manufacturers of electric vehicles—the Detroit, Baker, and Rauch & Lang concerns—all of whom have made the new establishment their New York headquarters.

The garage, which also comprises handsome showrooms for new cars facing Central Park, has a total floor area of 30,000 sq. ft., more than half of which is devoted to the storage of cars, the rest being taken up by offices, service, stock-rooms and repair-shops. The garage proper embodies a number of unusual features, more particularly with regard to the electrical and battery-charging equipment. The charging board is one of the largest so far constructed, and controls 48 charging outlets of varying capacities, it being able to deal with batteries ranging from 24 lead cells, with a charging rate of 8 amperes, to a 60-cell Edison battery requiring 100 amperes. The average charging time is from four to six hours. The leads from the charging board are so arranged that the batteries can be charged *in situ* on the cars without it being necessary to shift the latter from their usual positions in the garage. The necessary current is taken from the mains of the New York Edison Co., six cables, having a combined capacity of 3,200 amperes at 120 volts, or 400 kw., being employed to conduct the current to the charging board. The meters have a capacity of 200 kw., almost sufficient to warrant a special

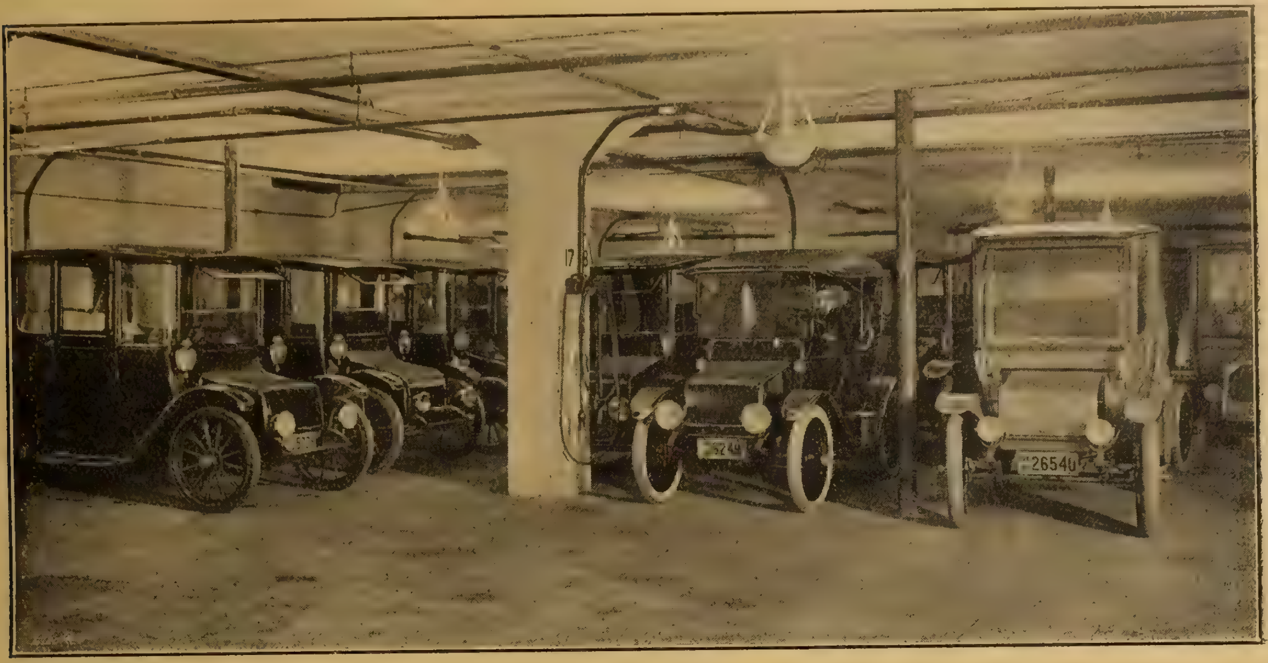
The New York Electric Vehicle Association's Co-operative Garage.

Washing an Electric Car.


Vehicle Battery Charging Control Board.

panel in a generating station. Within the building there are about 8,000 ft. of copper wire of large capacity, and 1,400 ft. of conduit, exclusive of the connecting cables used in the electrical system of the garage.

The fact that the undertaking is being run under the ægis of the New York Electric Vehicle Association, which comprises in its membership all the leading electric vehicle interests in the American metropolis, has placed an official seal on the establishment as being as perfectly adapted for its purpose as is possible, thereby assuring for it a standing that, it is claimed, no other electric vehicle garage possesses. The cost of garage service at the establishment is £9 per month, this charge including the garage, washing and cleaning of the car, and the charging and periodical inspection of the battery.



View of the First Floor, New York Electric Vehicle Association's Garage.

Our illustrations give some idea of the scope and working of this establishment, which will, no doubt, at some future date, find its counterparts in this country,

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Union Flexible Coupling.

Messrs. Boving & Co., Ltd., of Union Court, Old Broad Street, E.C., have recently placed on the market a new form of flexible

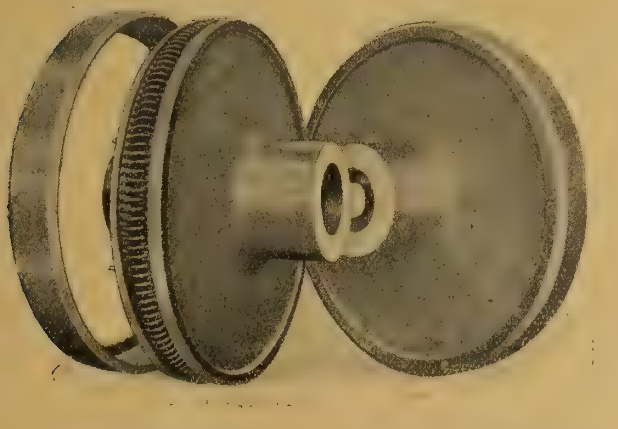


Fig. 1.—Union Flexible Coupling, showing arrangement of Spring.

coupling which, we understand, is successfully meeting a wide range of uses, having been applied to large slow-running rolling mills, high-frequency generators running at 1,850 r.p.m., and to turbine and Diesel engine plants.

Its construction is exceedingly simple, consisting of two facing disks, with inwardly projecting teeth near their peripheries which engage with the coils of a circular helical spring, the arrangement being indicated in fig. 1. Both halves are left free for either radial or axial movements; while the subdivision of the transmitting units allows each to be comparatively weak and flexible, yet collectively to form a powerful coupling.

Since each coil of the spring transmits only a small portion of the load, the spring does not tend, as a powerful spring would, to overshoot the normal position when the load is momentarily released, and thus accentuate torque variations. For low speeds cast-iron disks and steel springs are employed, while for high speeds or in large sizes, an all-steel construction is employed. The clutch sizes listed range from 7 lb. to nearly 7 tons in weight.

"Witton" Ironclad High-Pressure Switchgear.

A representative example of a mistake-proof ironclad switchboard, manufactured by the General Electric Co., Ltd., of Witton, is shown in the accompanying fig. 2. This switchboard was constructed for a large steel works which had rapidly to be adapted for the production of war munitions. It was built up of a number of "Witton" mistake-proof switch panels, each self-contained, and on arrival at the works the only erection work necessary was the connecting together of the different panels and the connecting up of the cables.

This switchboard, which is one of a large number of similar pattern now passing through the Witton works, was constructed to control, amongst other plant, a 750-kw. motor-generator manufactured by the General Electric Co. to convert three-phase power

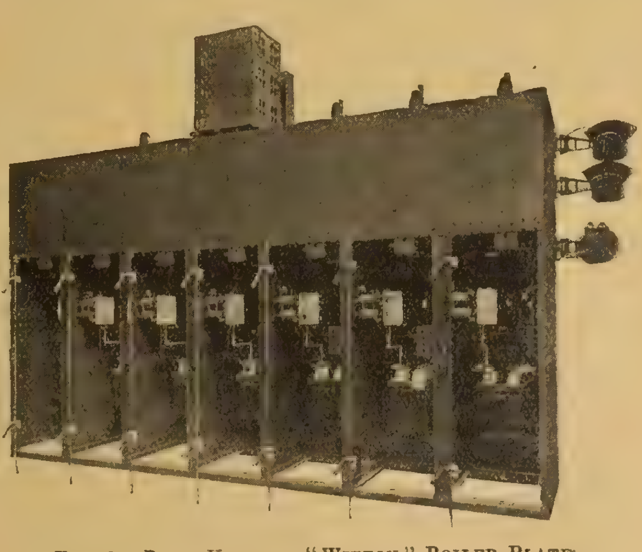


Fig. 2.—Back View of "Witton" Boiler Plate Mistake-Proof Main Switchboard.

at 3,300 volts, 50 cycles, to continuous current at 550 volts on the three-wire system, a static balancer being part of the equipment.

THE WORK OF THE NATIONAL PHYSICAL LABORATORY IN 1914-15.

The annual report of the Executive Committee shows that the work of the Laboratory was greatly affected by the war, and some 50 members of the staff joined the Colours—nearly 25 per cent.; adequate provision was made for their payment, the retention of their posts, &c. Forty-two members have been sworn in as special constables. Under the circumstances, the normal research work of the Laboratory has been delayed. Owing to the war, the formation of the National Research Laboratory for Telegraphy and Telephony at the N.P.L. has been postponed. The Committee on the Lighting of Factories and Workshops has completed its first report. Great accuracy has been attained in the reproduction of the fundamental electrical standards; five mercury tubes made at the N.P.L. compared with five made at Tokio showed a mean difference of only eight parts in one million, and Weston cells made at Petrograd agreed with the Laboratory standards to within one part in 100,000. Inductance standards are equally satisfactory, and the range and accuracy of the measurement of large high-frequency currents have been greatly improved. The speed of measurement of alternating currents has been increased, and the research on the rise of temperature of underground cables has brought out a series of interesting results. Progress has been made in the photometry of electric standard lamps.

The electrical tests made in the Physics Department amounted to the following totals:—Electrical Measurements, 191 (previous year, 259); Electrotechnics, 5,080 (3,828); Photometry, 410 (1,142). The income for the year fell to £39,653, a reduction of £4,060, and the fees for tests fell by £5,124 to £20,017. Special investigations brought in £1,612, as against £2,533. The Treasury grant for Aeronautics rose from £5,311 to £7,475. The total expenditure was reduced from £40,968 to £39,573, and the net result was a credit balance of £81, as compared with £2,745 in the previous year. The sum to the credit of the General Fund is now £2,347. The Hon. Sir C. A. Parsons has presented a sum of £1,000 to the Committee for additions to the equipment.

The report of the Director includes a list of the members of the staff on active service.

Physics.—In July last year Drs. Giebe and Schultze, of the Reichsanstalt, visited the Laboratory and compared a resistance coil with the N.P.L. standards; its absolute value was also determined with the Lorenz apparatus, the greatest difference from the mean of nine measurements being 2·9 parts in one million. Comparison with the coil standards showed that one International ohm = 1·00052 true ohms, a result identical with that obtained in 1913. The Reichsantalt absolute measurements were in very close agreement with those made at the N.P.L. The investigation of the Weston normal cell was completed, and the results are being prepared for publication. A cell containing a small quantity of free acid with a grey depolariser (the grey colour being due to the presence of minute globules of mercury) appears to be the most constant form.

The Schuster magnetometer is practically complete. The horizontal-intensity magnetograph is capable of measuring changes of one-millionth of the C.G.S. unit of magnetic intensity lasting for one second only. It was found that unless the damping of the suspended system was critically aperiodic, the magnitude of the changes could not be accurately estimated.

An inductometer with a wide range of self-inductance has been constructed. Two standard self-inductance coils from the Reichsanstalt were compared with the N.P.L. standards, the latter coming out respectively 14 and 8 parts in 100,000 lower than the former. Future coils will be wound in single layers on marble bobbins, to ensure that the temperature coefficients shall be both small and definite. The dimensions of the primary standard of mutual inductance were all carefully remeasured, and slight changes were found, which, however, almost compensated for one another, the final value for the mutual inductance being seven parts in 1,000,000 less than the old value. A 600-watt alternator, giving frequencies from 150 to 800 cycles per second, has been installed. Methods of measuring large high-frequency currents were investigated, and it was found that air-core current transformers gave very accurate results up to 2,000,000 cycles per second; small iron-cored transformers also gave excellent results, and current transformers of this kind are quite suitable for very large high-frequency currents. With the aid of large standard condensers, the range of working of wavemeters has been extended to wave lengths of 50,000 m. Progress has been made with the research on magnet steel for the Institution of Electrical Engineers.

Electrotechnics.—The new realisation of the pentane unit of light in electric sub-standards is now complete. The unit so obtained agrees with the original N.P.L. unit of candle-power within less than 0·1 per cent. It has been found that the changes usually ascribed to the humidity of the atmosphere may, in part, be due to changes of temperature, but the usual method of analysing the results does not readily permit the two effects to be differentiated. The work on the cascade series of lamps has been completed up to the set running at 1·5 watts per candle; direct comparison between the fundamental set and the 1·5-watt set gave the same result as that by the cascade method, the Lummer-Brodhum photometer head being used always. The colour of the light depends mainly on the temperature of the filament, irrespective of whether the radiating substance is carbon or tungsten; the group of lamps giving light of the same colour as that from the pentane lamp operates at 1,610° C., whilst that running at 1·5 watts per candle has an operating temperature of 2,300° C. The series is being continued by means of gas-filled standard lamps up to an efficiency of 0·6 watt per candle.

Experiments were made which established the relation between the lumens per watt of carbon and tungsten lamps and the temperature of their filaments, as follows:—

$$\mathrm{Log}_{10}\,\mathrm{L/W} = 21{\cdot}51 - 4{\cdot}58 \log_{10} \mathrm{T} - 185 \log_{10} (1 + 155/\mathrm{T})$$
$$\mathrm{Log}_{10}\,\mathrm{L/W} = 23{\cdot}31 - 5{\cdot}1 \log_{10} \mathrm{T} - 185 \log_{10} (1 + 155/\mathrm{T}).$$

These expressions have a physical basis, and agree with the observed values from the lowest to the highest values of temperature in carbon and tungsten (vacuum) lamps. The colour of light from molten platinum was found to be identical with that from a carbon-filament lamp operating at 4·75 watts per mean spherical candle, corresponding with about 3·8 watts per M.H.C.P. The value of the coefficient of reflection of the white cards used in connection with illumination photometers has been investigated. Measurements in connection with the Home Office Committee on Factory Lighting have occupied much of the time of the department.

(*To be continued.*)

NEW RUSSIAN CUSTOMS TARIFF.

The Board of Trade have recently issued a Blue Book showing the rates of duty leviable on goods imported into Russia under the new decree which has just been passed. The following are the new rates of duty on electrical and similar goods, and the old rates have been added for purposes of comparison; it should be particularly noted that the decree re-introduces the differential duties established by the General Tariff in respect of various classes of goods imported over the European land frontier, a distinction which was abrogated by the Russc-German Commercial Treaty; so far as these goods are concerned, the rates of duties established by the General Tariff for imports over the European land frontier are in nearly all cases 20 per cent. higher than the corresponding rates for imports by sea. The Blue Book containing the complete tariff may be purchased from Messrs. Wyman & Sons, Fetter Lane, E.C., at a cost of 7d. Poud = 40 funts = 36 lb.

	Old rate. Roubles. Per poud.	New rate. Roubles. Per poud
Asbestos manufactures in combination with other materials or not	3·50	3·85
Moulded carbon wares for electrotechnical purposes such as arc light carbons, plates, cylinders, &c., weighing less than 10 funts each	6	8·80
Weighing 10 funts or more each	1	1·10
Pipes of porous clay and moulded parts of Pipes—		
Unglazed	·10	·11
Glazed	·15	·22
Mineral tar, bituminous mastic all kinds of fusible asphalts	·30	·33
India-rubber (caoutchouc and gutta-percha), prepared and manufactured:—		
1. Soft:—		
(*a*) In sheets, slabs, threads, or dissolved; wares not specially mentioned and not in combination with other materials	Per funt. 0·20	Per funt. 0·22
(*b*) Manufactures not specially mentioned in combination with other materials; rubbered cloth ...	0·30	0·33
2. Hard (vulcanised):—		
(*a*) Unwrought sheets, slabs, sticks, pipes, &c.	0·20	0·22
(*b*) Manufactures not specially mentioned, whether in combination with other materials or not ...	0·50	0·55
3. Boots and shoes of caoutchouc or gutta-percha, combined or not with tissues, leather, buckles, &c.	0·42	0·46$\frac{1}{5}$
4. Tissues impregnated with india-rubber, for fillets of cards:—		
(*a*) With felt...	0·15	0·16½
(*b*) Without felt	0·30	0·33
Steel rails, even perforated or grooved ...	Per poud. ·99	Per poud ·99* 1·18$\frac{4}{5}$†
Copper, aluminium, nickel, &c., and alloys:—		
In pigs, ingots, shavings, filings, scrap and powder	5	5·50
In bars, rods and sheets, even if polished or with designs rolled or stamped on their surfaces—		
(*a*) Of a thickness of ½ mm. or more	6	6·60
(*b*) Of a thickness of less than ½ down to ⅓ mm. inclusive ...	6·40	7·04
(*c*) Of a thickness of less than ⅓ mm.	7·10	7·81

Note.—Sheets of copper cut otherwise than in rectangular form pay the respective duties specified under (2) above together with an additional 10 per cent. The additional 10 per cent., however, does not apply to sheets of other metals and alloys referred to above cut in the same manner. Copper and copper alloys, as well as the other metals and their alloys referred to, if rolled or wire drawn and of a diameter or width of 12½ mm. or less, pay duty as wire.

(*To be continued.*)

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* Imported by sea. † Imported over European land frontier.

CONTROL APPARATUS FOR STEEL MILL AUXILIARY ROLLS.

The manufacture of steel being essentially a series of processes, immunity from defects in design of the machinery used for any stage in the process, however relatively insignificant its function, is of vital importance.

In no branch of the industry have greater improvements been made during recent years to produce absolute reliability, simplicity, and greater output, than in the electrical equipments for controlling the reversible motors driving the live rolls.

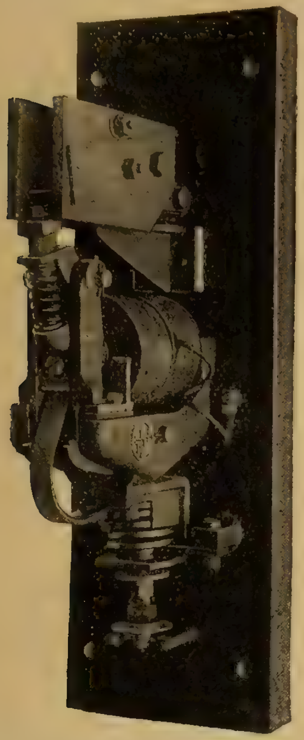

Fig. 1.—Contactor with Shunt Operating Coil fitted with Mechanically-interlocked Accelerating Relay.

Control apparatus for this service is subjected to the most severe conditions to which electrical apparatus has been applied for commercial purposes, as the motors driving the rolls have to be started, checked, started again or reversed as often as 20 to 30 times a minute throughout a day of 20 hours.

The controlling device originally used was the well-known hand operated dial type adopted for other industries, consisting of contacts for reversing the armature connections, and introducing or cutting out resistance in series with the motor armature for starting and reversing the main armature current passing through these contacts. The earliest forms, as for other industries, consisted of fixed contacts mounted in one plane on slate or other insulating material over which were moved contacts mounted on or geared to the operating lever. These dial type controllers were at one time superseded by the well-known drum type controller as used for tramcars. The magnetic blow-out can be more conveniently applied to this form of controller, which has the additional advantage that the wear caused by arcing on the moving contacts is less, due to the fact that a different contact is used for each division of resistance, whereas in the dial type the same moving contact is subjected to the arcing of each resistance step.

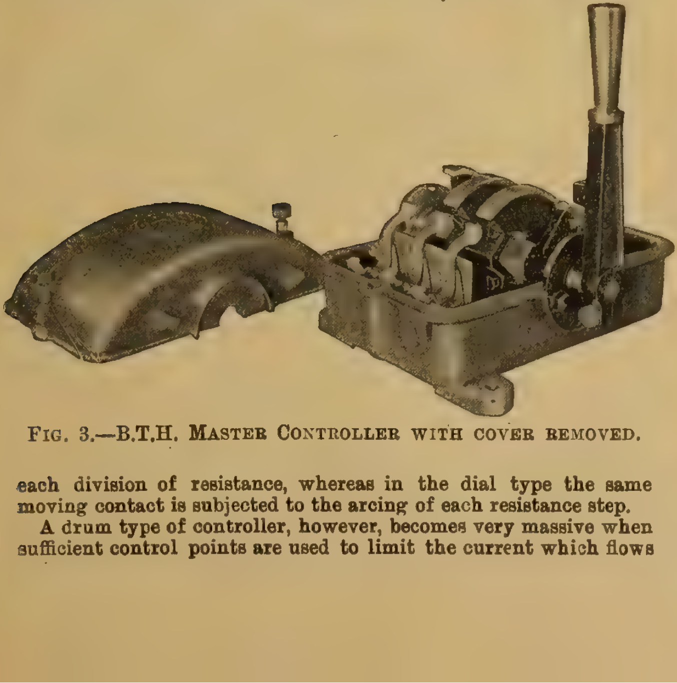

Fig. 3.—B.T.H. Master Controller with cover removed.

A drum type of controller, however, becomes very massive when sufficient control points are used to limit the current which flows on the first notch to a low value, and the moving parts become so heavy as to cause fatigue to the operator. For this reason the dial type, which in its later forms was a sound mechanical structure was, in many cases, preferred to the drum type.

No form of hand-operated main current controller yet designed, however, contains the essential features for the satisfactory control of auxiliary rolls.

The usual practice adopted when starting a motor, of delaying movement of the controller handle from step to step until the motor has accelerated, and the current decreased to approximately its steady value, cannot be observed in this service, where the operator's whole attention must be applied to the billet being rolled, and not to the protection of the motor or gears. Some form of automatic protection is therefore necessary, and this must be applied so as not to delay notching an instant after the current has decreased to the required limit for cutting out the next step of resistance. For this reason dashpot control is not suitable.

These considerations lead to the conclusion that the best solution of the problem is obtained by the use of a manually-operated master controller and electrically-operated contactor switches, the contactors closing partly under the influence of the master controller and partly of the main current.

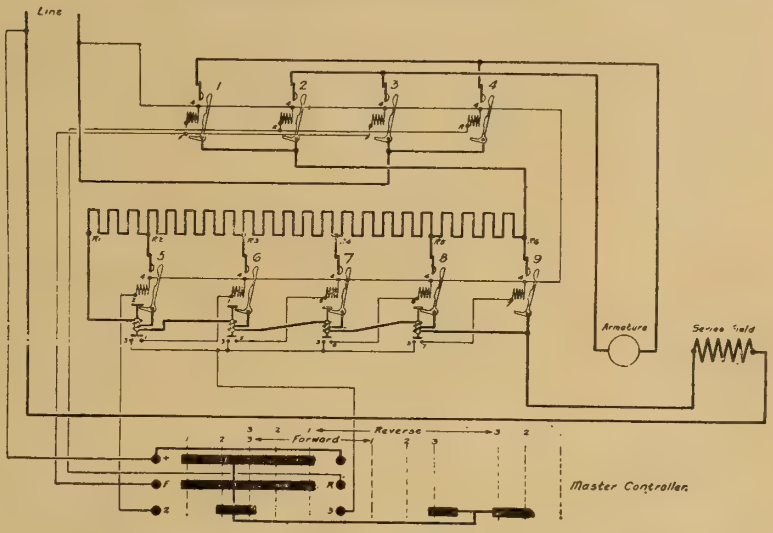

Fig. 2.—Connections of B.T.H. Control Panel, consisting of Contactors Fitted with Mechanically-interlocked Current Limit Accelerating Relays.

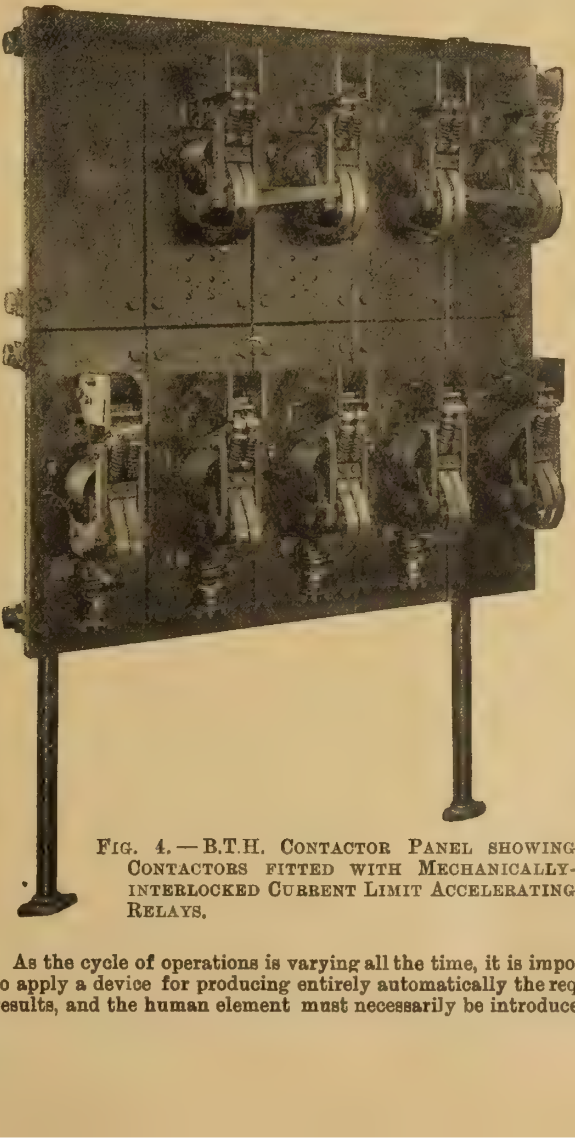

Fig. 4.—B.T.H. Contactor Panel showing Contactors fitted with Mechanically-interlocked Current Limit Accelerating Relays.

As the cycle of operations is varying all the time, it is impossible to apply a device for producing entirely automatically the required results, and the human element must necessarily be introduced

This form of controlling device is now being generally adopted for the control of auxiliary rolls. Such a system, to be satisfactory for use in a steel works, must be free from the mass of small wiring and auxiliary contacts usually associated with the earliest forms of automatic devices.

A contactor having the necessary rugged characteristics and simplicity of construction for the service, is found in the type universally adopted for railway service, which has solid main contacts pressed together by strong spiral springs. Fig. 1 shows the type in question for direct-current circuits, which has very few parts, all parts being easily accessible for inspection, cleaning and renewals.

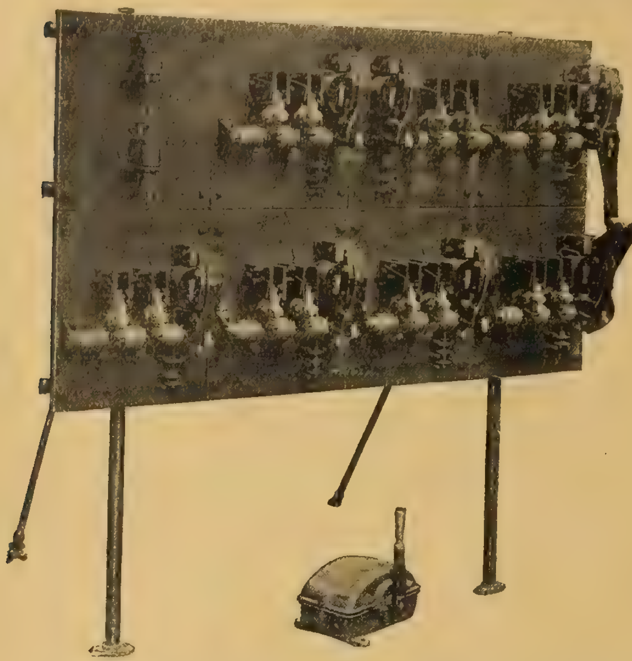

Fig. 5.—B.T.H. Contactor Panel and Master Controller, suitable for use with a Reversible Induction Motor.

The method of making the current limit relay part of the contactor, adopted by the British Thomson-Houston Co., Ltd., of Rugby, who were the first to introduce contactor systems for the control of live roller gear in this country, enables a very simple wiring system to be adopted, as shown in fig. 2, which is a typical diagram for live roll service. Referring to the diagram, contactors 1 and 2 are mechanically interlocked, so that they cannot be closed together; so also are contactors 3 and 4. Each current limit relay consists of a main coil and iron plunger, the plunger carrying a contact disk which bridges two contact posts when in its lower position. The plunger is held mechanically in its upper position by the moving arm of the contactor when the contactor is open, as shown in the view. When the contactor closes, the plunger is mechanically released, and is only held in the upper position by the magnetic effect of the main current. When the main current has decreased to a predetermined value due to the speeding up of the armature, the plunger falls to its lowest position, thus closing the operating coil circuit of the next resistance contractor, which closes, causing the main current to increase and accelerate the motor. This is repeated for each resistance step.

The type of master controller used by the B.T.H. Co. is as shown in fig. 3. This has three control points—forward and reverse. The first point closes the armature circuit through a very high resistance. This serves as a check point when the controller handle is thrown from forward to reverse. The second point corresponds to slow running of the motor, and is used for turning the billet. When the controller is on the third step the rest of the resistance contactors notch up automatically under the influence of the current limit relays.

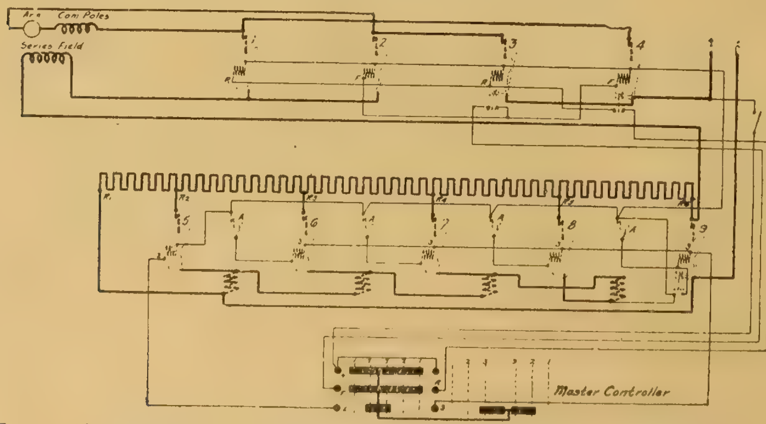

Fig. 6.—Connections of B.T.H. Control Panel, consisting of Contactors and Series Contactor-type Accelerating Relays.

The great advantages obtained with the contactor equipments over the hand-operated main controller equipments have been as follows:—

The wear on the motor, shaft and pinions, and the consequent repairs, are greatly reduced, due to the fact that the current limit relays prevent these parts being subjected to excessive stresses. The contactors having a quick make-and-break action, and being fitted with separate blow-out devices, are more suitable for controlling heavy currents without excessive wear than are ordinary controllers, and although better able to deal with heavy currents than the hand-operated controller they are not subjected to such heavy currents, due to the fact that the current is controlled within limits by the relays. The quantity of steel rolled in a given time is increased, as the operator can move the controller handle as rapidly as he likes without fear of breaking pinions or shafts, the motor being automatically accelerated or reversed in the shortest safe time. Another important feature is that these small master controllers can be used by the operator without fatigue.

Fig. 4 shows a typical contactor panel for direct-current circuits, and fig. 5 for alternating-current circuits as made by the B.T.H. Co.

Diagram fig. 6 shows a control equipment for direct-current circuits, for which another form of current limit relay is used, the control system being otherwise the same as described above.

The relays in this case are small series contactors, the main contacts of which are in the control circuit, the operating coils being in the main circuit. These series contactor relays which are shown in fig. 7 are a B.T.H. Co. patent. They have the property that they can be adjusted so that the contacts will remain in the open position if a current of more than a desired value be switched through the operating coil, and will close automatically when the current has decreased to a desired value.

In the diagram, fig. 6, the main contactors which are operated by shunt-wound coils are marked 1-9 inclusive. The contacts of the relays are marked A, the main coils of the relays being shown immediately below the contacts. A main contactor in closing to short-circuit one of the divisions of the starting resistance completes a circuit through the operating coil of the relay controlling the contactor next to close in the sequence. The instantaneous increase in the line current caused by short-circuiting a division of the starting resistance causes the relay contacts to remain open until the motor has accelerated and the line current has decreased to a safe value. The relay then closes completing the circuit to the operating coil of a main contactor, which then closes. The main contactor in closing energises the coil of the next relay, and so on. The control system shown in fig. 6 is being successfully used for rolling mill service.

NOTES FROM CANADA.

[From our Special Correspondent.]

Like other countries, Canada is making strenuous efforts in regard to trade. The Department of Trade and Commerce has already prepared several special bulletins dealing with the trade of Germany and other subjects of interest, and is doing all it can to assist manufacturers, giving them information as to opportunities for trade and other matters.

The Canadian Manufacturers' Association is now similarly exerting itself, and, besides fostering a "Made in Canada" campaign, designed to induce people in this country to buy home-made goods in preference to any others, the Association at a recent meeting discussed the plans of the recently-formed "Export Association of Canada, Limited," which will endeavour to develop the trade of the Dominion with foreign countries.

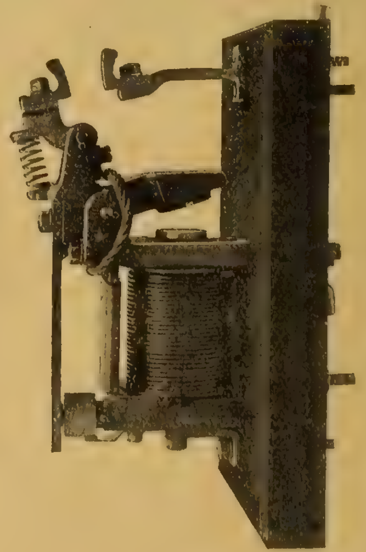

Fig. 7.—B.T.H. Series Contactor.

It was stated that the first duty of this Association would be "to strengthen the trade ties between the various Dominions of the British Empire and to take advantage of the great opportunities for trade with them, both now and after the war."

The development of trade with Russia, France and Belgium, as well as China and South America, was also spoken of, and it is apparently intended that an office shall be opened in London, which will act as a commission agent for the manufacturers and provide for the transportation of goods.

Some little time ago telephonic communication was established between New York and San Francisco—a few days back it was the turn of Toronto to be put in direct connection with that distant city, and according to the daily papers the voices were perfectly plain and conversation was carried on with ease—a noted singer in "Frisco" entertained the Toronto audience with a song. Montreal has also been put in touch with the Californian city in the same way.

The writer of these notes has on more than one occasion within the last two years or so suggested that it would be a good thing for British engineering trade with this country if facilities could be afforded to young men here to get their engineering training in British workshops instead of going to the U.S.A. for it and becoming, as they inevitably do, to all intents and purposes, American engineers, imbued with the notion that everything worth having is made across the border, and being, of course, entirely ignorant of, and altogether out of touch with, any British products or methods, etc.

This idea is set forth in very similar terms by a writer in the *Engineer* for April 16th, 1915, on page 383. It is to be hoped that some day a little notice will be taken of the suggestion, as the arguments in its favour are undoubtedly based on solid facts.

Mr. Hamilton Wickes is quite right when he urges British manufacturers to make greater efforts to secure Canadian trade—if they wish to have any at all. In the writer's own experience it is much easier to get information from the great country to the south than to write home, wait a long time, and then perhaps have one's inquiries for prices answered with no information as to whether the figures given are f.o.r. factory, f.o.b. British port, Canadian duty paid, or any such important details. Such a state of affairs is not exaggerated at all.

The B.E.A.M.A. and similar bodies might do worse than take measures not only to impress upon their members the necessity for giving certain important details when quoting, but also, as far as possible, supply the information or state how and where it may be obtained. Perhaps they already do this, but, if so, the members must, many of them, be sadly neglectful of such advice.

Very few firms, except those who actually have their own men out here, ever take the trouble to quote their goods f.o.b. a Canadian town or city, even when specially asked to do so. If the necessary information is not available at home, steps should be taken to make it so somehow or other.

There is no doubt about it, and nothing is likely to change the situation, that the consulting engineer or other individual who requires prices and other particulars will invariably make use of those which are furnished in the handiest form and leave the others aside if he can possibly arrange his work with any degree of satisfaction in this way.

WAR ITEMS.

German Engineering during the War.—At a recent meeting of the Association of German Engine Builders, Herr Fr. Frölich discussed the position of German engineering during the war. While admitting that there had been a considerable falling-off in the number of new contracts, he claimed that the machine-tool and agricultural-implement makers had more than enough work on hand. As many branches of industry (Herr Frölich thinks) are likely to be extremely busy as soon as peace is restored, he suggested that the works should prepare themselves for the coming boom (!) by extending their plant and by making other necessary alterations. It was probable that after the war there would be less preference shown in Germany for foreign machine tools, typewriters, sewing and shoe-making machines, and agricultural implements, and now was the time to start systematic preparation to supplant such machines. Herr Frölich referred in ecstatic tones to the achievements of the German engineering industry in meeting the enormous demands of the Army for munitions. Deliveries were being expedited, and the system of employing middlemen in contracts, which in the beginning of the war adversely affected the efficiency of the engineering supplies, had been abolished. While the home trade had been supported by the war, export trade had suffered considerably, and this was particularly important, because normally about one-third of the total output of German engineering works was exported. Herr Frölich gave reasons for believing that after the war the German engineering works would be able to resume unweakened their competition in the world's markets with their old opponents, provided the Government took measures to safeguard Germany's interests abroad. Otherwise, "the coming military victory" might be accompanied by heavy economic losses.—"The Ironmonger."

Scheme for Training Munition Workers.—The Engineering Department of King's College, London, is organising a scheme for training unskilled and semi-skilled men in the use of tools, so as to fit them for work at the munition factories. The work is to begin at once, and will proceed throughout the summer vacation, and, if the need is still great, will be continued during the winter. The Industrial Reserve, 227, Strand, is helping the College both in the supply of men who can be usefully trained for such work, and in finding places for them in factories when trained. The work will be done in two shifts, from 9—12.30 and 1.30 to 5 p.m., Monday to Friday inclusive, so that forty men can be taken each day. The average course is expected to last for three or four weeks, though this will naturally depend on the previous training and progress of the student. The fee charged will be the nominal one of 2s. 6d. per week, which will only go a small way towards defraying the running expenses of the scheme. £150 has already been contributed by a subscriber to the Industrial Reserve, and it is hoped that further contributions will follow. There is no doubt that such a scheme, which has already been initiated at Sheffield, Birmingham and Manchester, will be of the utmost use in making available for the public service a great amount of willing help which is at the present moment unfocused and untrained. The College and the Industrial Reserve are already in touch with firms manufacturing munitions, and there should be no difficulty in finding places for sufficiently qualified men. This scheme, as well as the advanced testing work which the department will be able to do for the Ministry of Munitions, will be under the direction of Professor A. H. Jameson. Inquiries and applications should be made to the Secretary, King's College, Strand, W.C.

The Manchester School of Technology has similarly arranged with the local Munitions Committee to provide classes in the workshops of the School for preliminary training. The Nottingham Society of Engineers is holding a special meeting on Monday evening next, at which the Munitions Committee will be represented, to discuss the best way in which the Society can assist the Committee.

500 Iron Crosses for the A.E.G. Men.—The activity of the Berlin A.E.G. in the financial year which ends in July is reported to have been divided into two parts. In the first place there are the Army orders, which were very considerable, but the profits on which had been over-estimated. Secondly, there are the regular electrical contracts, which are declared to have been normal, both in the inland market and for export to neutral countries. Taken as a whole, the turnover has been very satisfactory. For the rest, the exports in general have been interrupted by the war, but no doubt is entertained that, after the return of peaceful times, the former relations will be re-established quickly in some cases and less rapidly in others, owing to the splendid organisation and the indispensability of the manufacturers of the German electrical industry. Equal confidence is entertained by industries in general in regard to the future. For the moment it is stated that nothing can be said concerning the dividend for the past year, but the liquid state of the company's finances, which has always been made a prominent feature, is particularly great at present, and the company also holds War Loan securities of the value of £600,000. About 18,000 employés are in the field, where 450 have fallen, and as many as 500 have received the Iron Cross. It is calculated that the voluntary war grants made to dependents of workmen called up for active service will soon reach £250,000.

Employment of Disabled Sailors and Soldiers.—With reference to the announcement in our last issue to the effect that the Council of the Institution of Electrical Engineers desire to call attention to the demand for employment from disabled sailors and soldiers, we understand that the Committee which deals with the question of the employment of these men is the Association for the Employment of ex-Soldiers, 119, Victoria Street, Westminster, London, S.W., to whom all applications for further information and for lists of the local branches of the Association should be addressed. Many of the men could, no doubt, after some training do useful work as switchboard attendants. Attention is also drawn to the report of the Local Government Board Committee upon the provision of employment for sailors and soldiers disabled in the war, copies of which can be obtained from any bookseller, at the price of $1\frac{1}{2}$d. each.

Australia.—A Sydney firm wishes to add British agencies for lampholders and electrical accessories. Reference, 31,674h.

An Adelaide firm wants British agencies for piping, air lift pumps and electric motors. Reference, 31,639f.

A Melbourne firm wants names of British makers of hardware, tools and electrical goods. Reference, 31,639q.

A Melbourne agent wants to hear from British makers of electric cranes, wires, cables and pumps. Reference, 31,639.

Inquiries respecting any of the foregoing should be addressed to the Board of Trade Commercial Intelligence Branch, London.

Board of Trade Inquiries.—The June 21st list (No. 26) of inquiries received for sources of supply of goods includes the following:—

Clocks for electrical trade signs and other electrical purposes.
Permanent magnets.
Wood or ebonite separators for portable batteries.

Personal and Roll of Honour.—Matters of personal interest arising out of the war will be found to-day and in future under our General Personal Section on a later page.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Railway Carriage Problem.

I strongly concur with your excellent leader on the carriage problem—you have got right down to the root of the evil undermining our commercial system in holding the railway companies responsible for exploiting trade, and bleeding commerce in this country at every possible turn. I may say I have heard from absolutely reliable authority of an instance where a consignment of printers' blocks was dispatched from the Midlands to Plymouth, and the charge for carriage on the same was more than the actual value of the goods themselves, leaving a small loss on the transaction. The same blocks from any town on the Rhine in Germany would have been delivered at Plymouth for considerably less than a third of the English railway charge. If this does not constitute a great scandal to traders in this country, I should like to know what does?

Henry L. Dobson.

Levenshulme, Manchester, *June 22nd*, 1915.

Pitting of Generator Brushes.

Some time ago I had occasion to work on a 500-KW. turbine set which was giving commutator trouble similar to the set mentioned by Mr. Johnstone. The + brushes were also the ones to suffer most, perhaps due to leakages in the circuit somewhere or other in the − side, and thus overloading the live side of the machine. I should take a potential test in the first place and start from the generator brushes, gradually working away.

I cured my set by undercutting the micas between the segments of the commutator to a depth of about $\frac{1}{16}$ of an inch, after which I changed the hard carbon brushes for a better class of the graphite type, which have a carrying capacity double that of hard carbon. On full load I adjusted the brush rocker wheel until I obtained sparkless commutation.

Mr. Johnstone will perhaps pardon me if I differ from him in saying that his set is not sparking badly under the brushes. It is the minute crackling sparks which eat away the centre portion of the brush face, and are hard to see unless looking end on the brush during the latter part of a big run. If the machine were not sparking, the brush would polish up like glass, and the commutator take on a clear purple tint; it is then in perfect condition and should not be messed with, except for renewing brushes or grinding down. I could give Mr. Johnstone a diagram of the tool and guide for cutting out the micas if he intends setting about the machine. The Morgan Crucible Co., Battersea, would supply him with the proper brushes.

Henry Fowler.

Liverpool, *June 28th*, 1915.

Colonial Advice to Our Advertisers.

I should like to call the attention of the advertisers in your paper to the difficulties experienced by engineers in the Colonies in obtaining particulars of the articles advertised and illustrated in your paper.

Having been a central-station engineer at home for some years before coming out to this colony, I notice very much the difference between home and Colonial undertakings with regard to obtaining up-to-date and new appliances and apparatus, and the chief complaint, if such it can be called, is that with a few prominent exceptions most of your advertisers neglect to mention the names of their Colonial and foreign agents in their advertisements, and even in pamphlets sent through the post.

I often see an illustration and advertisement of a piece of apparatus which is apparently what I am in want of, but it is seldom if ever that any price or even an approximate idea of the cost is given, and my only course is to write home to our London agents, putting them to the trouble of obtaining information and prices which particulars eventually reach me from six to eight weeks' after the inquiry has been made. At the end of this time I may find that the apparatus is not exactly what I require, and I am, therefore, again six to eight weeks away from obtaining what I want, or if it does happen to be the article, I have again to write back, and a further three weeks is lost before the order reaches London, whereas if advertisers would give some approximation to the cost and the names and addresses of their principal Colonial or foreign agents, inquiries could be made quickly and expeditiously in the country, to the advantage both of the buyer and of the manufacturer.

This is a matter which evidently does not appeal to the average manufacturer, simply because he has never placed himself in the position of the Colonial buyer, and I venture to say that the additional advertising space required, if any, for lists of the principal agents, would well repay the outlay.

By giving assistance to this object of putting the home manufacturers in closer and quicker touch with Colonial and foreign buyers through their agents in the respective countries, you will, I feel sure, be conferring a benefit on manufacturers and buyers alike.

B. Sankey,
Municipal Electrical Engineer.

Port Elizabeth, South Africa, *June 10th*, 1915.

BUSINESS NOTES.

Consular Notes.—CHOSEN.—The American Consul at Seoul reports that information to hand from Kongju, the capital of South Chusei Province, says that a 50-H.P. electric light plant is to be established there to supply, approximately, 1,500 lamps. The initial capital of the company is $12,500. It is anticipated that the machinery will be ordered from Japan, although no definite decision has been reached as yet as to the type to be employed. Correspondence should be addressed to the Kongju Electric Co., Kongju, South Chusei Province, Chosen.

CUBA.—Senores Maristany and Estrada have been granted permission by the Cuban Government to install an electric light plant at Campo Florida, Habana Province; Senores Pollo and Herrara have been authorised to install a similar plant at Coliseo, Matanzas Province, and Senor Cuesta has been authorised to install a similar plant at Arrogos de Mantua Penar del Rio Province. In each case, it is specified that the concession will be void if the plant is not in working order within one year.

FRANCE.—A recent American Consular report on the trade of France contains some interesting information regarding the electrical industry before and since the war. According to this report the general conditions prevailing in the electrical industries of France in 1914 up to August 1st were not unfavourable. Although a tendency to weakness had set in during the latter part of the first half of the year, the orders received equalled those taken during the first six months of 1913. Immediately after war began business came to a standstill. It soon revived, however, and the year ended with a smaller volume of trade than in 1913, but all the factories were in active operation with curtailed capacity. It is estimated that in 1914 the orders for heavy electrical machinery fell off by about 30 per cent., for transformers about 20 per cent., for traction apparatus about 60 per cent., for general lines of electrical goods about 20 per cent., and for turbines about 50 per cent. There was also a considerable reduction in the sales of cables, practically no orders for apparatus for the extraction of nitrogen from the air, and but few for ozonization of water. Trade in electric cooking and heating apparatus has never been of great importance in the country, owing to the high cost of electrical energy, there being no special rates for current applied to heating and cooking.

There were much smaller orders placed in 1914 with French manufacturers for the equipment of overland central power stations than during the previous year (which was an exceptional one for this branch of the industry), as few new stations were established and none of great importance. The business of the existing plants, which had been expanding during the first six months of the year, fell off considerably in the second half, owing to the abnormal conditions prevailing.

None of the leading French railway companies contracted for new electrification of their roads in 1914. The work on the suburban lines of the Western Railway which had been commenced is still progressing, and the Southern Co. (Midi) has ordered additional electric locomotives for use on its lines from Tarbes to Paris and from Villefranche to Perpignan, where already three electric locomotives and a number of motor cars had been placed in service.

There was a notable increase in the manufacture of metal-filament lamps in France in the early part of 1914, so that, notwithstanding the falling off during the second half of the year, the total annual production was about 30 per cent. in excess of that of 1913. The change from carbon to metal-filament lamps being practically completed, a reduction in the rate of increase in their manufacture during 1915 is expected, even if business conditions are normal. Owing to keen competition existing, the lamp prices quoted during the first six months of 1914 were very low, but toward the end of the year, in consequence of the decreased production caused by the scarcity of labour and material, the prices became more favourable, the increase ranging from 20 to 30 per cent. Generally speaking, there was a tendency to lower prices for other electrical products owing to the keen foreign competition, especially with German and Swiss goods. An exception might be made as regards motors employed in steel work, for which there was a large demand. Many of the companies, taking advantage of the slackness of trade, re-equipped and modernised their plants. As with lamps, scarcity of material and labour and the suppression of an important part of the competition, has resulted in raising prices to a better level. In the last annual report from the Consulate-General, attention was called to the appearance of high capacity 1,000 to 3,000-C.P. half-watt tungsten lamps. Such lamps are now being made of small capacities, which allow them to be adopted for domestic lighting; 50-C.P. lamps are being sold for normal voltage, *i.e.*, 100 to 250 volts. The half-watt lamps for lower voltages are rendering efficient service when used as automobile headlights, battery flashlights for army use, &c. The fact that soon the manufacturers will be able to obtain 25-C.P. lamps that consume 1 half-watt per C.P. will result in a reduction in the cost of electric lighting. Water sterilisers, the sterilising being accomplished through ultra violet rays given by mercury vapour quartz electric lamps, are being successfully used for army field sterilising outfits and in military hospitals, thereby providing sterile water for soldiers in service on the field and for nurses and wounded in hospital. The hydro-electric development, which has temporarily been brought to a standstill owing to the war, will, after the hostilities are terminated, be taken up with renewed activity, and in this branch there should be a good market for electrical machinery, the greater part of which was previously imported from Germany.

Most factories in France that were previously used for the manufacture of electrical apparatus are now being employed in the manufacture of ammunition, &c., for the army, with the result that there is now a good opportunity for the importation of all classes of electrical goods into this country, especially electric motors of capacities up to 50 H.P.

China.—In a report by H.M. Consul-General at Yunnan-fu on the trade of Mengtsu, shortly to be issued, it is stated that the great drawback to British trade in the Province of Mengtsu hitherto has been the lack of any British firm to represent United Kingdom manufacturers and push the sale of their goods; but there is a good prospect of this deficiency being remedied in the near future. The present time is exceptionally favourable for such an enterprise, as the two German firms which have hitherto supplied local buyers with machinery, piece-goods, dyes, paper, &c., can now obtain no further supplies, and the Chinese would welcome the establishment of a British firm in Mengtsu. There are inquiries for irrigation pumps, electric light machinery, flour and rice mills, material for the installation of water-works in Yunnan-fu, locomotives and trucks for the Pishihchai Railway, and other items, but these can only be dealt with by a man on the spot who is prepared to make a contract for the goods delivered c.i.f. at Haiphong, possibly assist to some extent in their erection, and arrange the question of exchange. The representative of the machinery department of a Hong-Kong firm is now in the Province looking into these matters, and there is a good prospect of at least some of the inquiries resulting in the placing of orders with United Kingdom manufacturers.—*Board of Trade Journal.*

France.—Inquiry is made for the names of United Kingdom manufacturers of mechanical ploughs, reaping machines and harrows (worked by gas and petrol engines, steam or electricity), also motors (of 2 to 12 H.P.) suitable for agricultural use. (Reference G.W.[illegible] 1,256.) Communications to the Secretary, British Chamber of Commerce, 9, Rue des Pyramides, Paris.

Private Arrangements.—John Boult & J. H. Boult (trading as John Boult), cycle agent and electrical engineer, 3, Grosvenor Street, Chester.—A meeting of the creditors herein was held at the Westminster Hotel, Chester, last week, when Mr. Dodds, solicitor acting for the debtor, stated that the liabilities amounted to £631, and the assets were estimated to produce £692, while there were preferential claims to be deducted amounting to £10. It was reported that the business had been carried on in partnership by the debtors since May, 1912, each partner having put in about £100 cash. John Boult was stated to have had no hand in the management of the business, this having been left to J. H. Boult, his cousin. John Boult was said to have a separate business at Liverpool, which was carried on in his own name, and in connection with which no partnership existed. It was decided that a deed of assignment of the assets of the Chester business only be executed in favour of Mr. C. Turner, of Sheffield, as trustee, with a Committee of inspection consisting of the General Electric Co., Mr. A. Cripwell, and Mr. Parkin S. Booth. The following are creditors:—

Drake & Gorham, Ltd.	£101	B.I. & Helsby Cables, Ltd.	£24
General Electric Co.	43	Tucker, J. H., & Co.	21
Fuller Accumulator Co.	38	Macintosh, C., & Co.	14
Glover, W. T., & Co.	36	Ward & Goldstone	16
Baxendale Bros.	33	Wilson, J. J.	13
Sloan Electrical Co.	34	Ferranti, Ltd.	12
Edison & Swan	33	Credenda Conduits	13

Bankruptcy Proceedings.—J. W. & T. W. Tattersall (Tattersall & Tattersall), electrical engineers, Willesden Lane, N.W.—Last day for proofs for dividend, July 10th. Trustee: Mr. E. S. Grey, Official Receiver, Bankruptcy Buildings, W.C.

Dissolutions and Liquidations.—Felgate Installation Co., Ltd.—Creditors must send particulars of debts, &c., to Mr. A. G. West, 51, Market Place, Reading, the liquidator, by August 5th.

Pillings & Co., builders and electricians, 13, Cross Street, St. Leonards-on-Sea.—Messrs. F. Pillings and R. E. Seggie have dissolved partnership. Mr. Pillings will attend to debts, and continue the business.

Australian Trade.—A correspondent who is representing in London a firm of engineers and contractors which has been established in Australia for 30 years, and has branches in each State and workshops at Sydney, equipped with modern tools and appliances, is open to receive proposals relating to the manufacture in Australia, under licence, of approved specialities and to arrange fresh agencies and purchase new lines in engineers' requisites. Communications addressed to "Sydney Agent," care of the Editors, will be forwarded.

New "Mazda" Half-Watt Lamps.—The British Thomson-Houston Co., Ltd., of Mazda House, London, E.C., have issued an eight-page illustrated pamphlet concerning "Mazda" half-watt lamps, giving particulars of new sizes, ½ and 1 ampere, and information as to reduced prices. The new lamps are made for 25, 50—60, 100—130, and 200—255 volts.

Trade Announcement.—Mr. L. H. Euler, A.M.I.E.E., has changed his address from Broad Street Buildings, E.C., to 46, Roan Street, Greenwich, S.E. Telephone, New Cross 463.

Advance in Prices.—The Bastian Meter Co., Ltd., have announced an advance of 20 per cent. in prices of Bastian meters from July 1st, consequent upon increased cost of raw material and labour.

Book Notices.—*Alignment Charts.* By E. S. Andrews. London: Chapman & Hall, Ltd. Price 1s. 3d. net.—In this booklet the author explains the method of constructing and using the alignment charts which have come into common use in recent years, and which are capable of effecting a great economy of time and labour. In these charts the desired result is arrived at by laying a straight-edge or stretching a thread across two graduated parallels representing two of the variable quantities, and reading off the third quantity at the intersection of the straight-edge with a third graduated line. This process corresponds to the solution of a linear equation of the first order between three variables, any two of which are given; the author gives a simple proof of the validity of construction, and shows how it can be applied to simple formulæ. When the formula involves the products of the terms, it is put into logarithmic form, and then can be dealt with in a similar way, the parallels being graduated logarithmically. When there are more than three variables, the solution is obtained in two stages, and the principle may similarly be extended to any number of variables. The method is of great value, and the author's explanations are clear and concise.

"Trade Products of the British Empire" is the subject covered in a special supplement issued with the July number of the *Chamber of Commerce Journal.* It is a statistical account of the resources of the British Empire as a supplier of foodstuffs and of raw materials for British industries, with statistics and notes as to foreign sources of supply. The prevailing conditions render such an account of exceptional interest just now.

We have just received the issue of Messrs. W. T. Glover & Co.'s Almanac for 1915-16. This annual has now reached its 14th year, and differs from all other publications of the kind in being issued at Midsummer; this, however, is only one of its many unique features. It stands alone in that every day in the year receives special attention in the shape of a device, a useful extract from some technical treatise, an interesting view of one of Glover's cable installations, or a humorous item in the shape of a sketch or a clever literary composition. The only fault that we have to find with it is that the temptation to "look ahead" is apt to prevail over the more pressing demands upon our time; but that is really a subjective not an objective fault, arising out of the high quality of the contents. The leaflet for July 1st shows the well-known trade-mark of the company, and indicates that the firm was established as long ago as 1868.

"Tramway Track Construction and Maintenance." By R. Beckerstaffe Holt. London: *Tramway and Railway World* Offices. Price 10s. 6d.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIV, No. 6. June, 1915. Washington: The Institute. Price $1.

"Science Abstracts." Vol. 18, part 6. June 25th. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each section.

"An Improved Governor for Water-Turbines." By Percy H. Pitman. Excerpt from the *Proceedings* of the Institution of Mechanical Engineers.

"Shall the Government Own and Operate the Railroads, the Telegraph and Telephone Systems? Shall the Municipalities Own their Utilities?—The Negative Side." Six addresses. New York: The National Civic Federation. Price 50 cents.

"Alternating Current Work." By W. Perren Maycock. London: Whittaker & Co. Price 6s. net.

Railway Station Lighting.—The Caledonian Railway Co.'s central station at Glasgow, which was originally lighted by 120 10-ampere open-type arc lamps with opalescent globes, running four in series on 230 volts, mounted at a height of about 22 ft., and spaced from 60 to 80 ft. apart, is now lighted by 500-watt Osram "Atmos" type lamps, which occupy the positions previously occupied by the arc lamps. The result has been very satisfactory, as there is a reduction of 300 watts on each circuit of four lamps, while the illumination of the station has been increased and considerably improved. The horizontal illumination in the main hall of concourse is 2 foot-candles maximum, with a minimum of 1·7 foot-candles, while along the platforms the variation is between 0·8 and 1·6 foot-candles.

For Sale.—The Ely Valley Lighting Co., Ltd., of Cardiff, have for disposal the following plant:—Locomotive multitubular boiler; 75-KW. and 150-KW. generating sets; three-panel switchboard; oil-cooled transformers. Particulars are given in our advertisement pages.

LIGHTING and POWER NOTES.

Barnet.—Workhouse Lighting.—The B. of G. has referred the whole question of electricity supply to a small Committee with power to take the advice of a firm of consulting electrical engineers with regard to the condition of the present plant, and the probability of its expansion, also as to whether it would not be better to take the whole supply from an outside source.

Bexhill.—Year's Working.—In his report on the Corporation's electric light undertaking for the year ended March 31st, 1915, the Borough Accountant states that the gross profit amounted to £6,218, as against £6,524 in 1914; after meeting debt charges, costs of meters, public lighting, depreciation, &c., a sum of £2,128 is carried forward, as against £1,817 brought into the accounts. A total sum of £1,472 has been credited to depreciation.

Bentham.—E.L. Scheme.—Mr. Best, [illegible] promoter of an E.L. scheme for Bentham, has written to the Sett[illegible]e R.D.C. relative to the Council's refusal to allow poles to be erec[illegible]ted on the highway from Low Bentham to High Bentham, for o[illegible]verhead wires. He points out that unless the poles are allowed to [illegible] be erected it will be impossible to supply current to High Bentham [illegible]. At his suggestion a Committee has been appointed to meet a de[illegible]putation from the Electric Supply Co. with a view to underground [illegible] cables being laid for only a short distance along the route.

Blackpool.—Year's Working.—The annual accounts of the electricity department show a total revenue of £47,326, a gross profit of £23,260, and a net balance, after meeting financial charges, of £8,499 (about £1,000 better than the previous year), which was disposed of as to £5,000 to general district fund, and £3,499 to reserve. The latter fund was drawn on for over £5,000 during the year, and has a balance of £8,093 in hand. In all, 5,842,433 units were generated, as against 5,410,377 in the previous year.

Bolton.—Year's Working.—The report of the electricity department shows that 13,688,272 units were sold last year, including 7,367,698 for power, and 4,500,000 for tramways. The working cost amounted to ·645d., and the inclusive cost to 1 137d. per unit, while the maximum load was 5,557 kw., or about 900 kw. less than in 1914. The total connections in kw. amounted to 19,452, an average of 4·9 kw. per consumer, and included 1,546 motors of 16,641 h.p. used by 620 consumers. The gross profit on the year was £29,916, as against £30,301 in 1914, and after meeting financial charges and capital contributions, a surplus of £145 remained.

Bradford.—Year's Working.—At a meeting of the Electricity Committee, held last Friday, the city treasurer presented the annual financial statement relating to the electricity undertaking, which shows that the profit for the year was £18,955, as compared with £14,905 in the preceding year, an increase of £4,050. The sale of electric current yielded an income of £138,000 (£3,500 in excess of the previous year), generation costs amounted to £39,700 (an increase of £7,000), and the cost of distribution had increased by £850 to £6,340. The gross profit on the undertaking was £500 in excess of that of the previous year; £22,900 (£1,000 more) was absorbed in payment of interest on loans and income-tax), whilst £33,000 had gone in sinking fund charges, this being £4,000 less, in consequence of the decision of the Finance Committee of the Council to apply the principle of accumulating sinking funds in respect of the various undertakings of the municipality.

Bridlington.—Year's Working.—The report of the Corporation's electrical undertaking for the past year, shows the effect of the war, which has resulted in an enormous reduction in lighting in this coast resort. The revenue amounted to £7,606, and the gross profit to £3,764, leaving a deficit, after meeting loan charges, &c., of £314, as against a net profit of £1,373 in the previous year. The balance of profit at March 31st, 1914, stood at £3,057.

Canada.—The City Council of Vancouver, B.C., is investigating for itself the water power possibilities of several sites in the vicinity with a view of establishing a municipal light and power plant. One of these sites is located on the Cheakamus River, 16 miles north of Squamish, the second on the Indian River at the head of the North Arm of Burrard Inlet, and the third on the Bridge River, 10 miles west of Lillooet.

The B.C. Power and Electrical Co. holds the rights on the Cheakamus River, capable of producing 100,000 h.p. The minimum cost of generating and transmitting to Vancouver is estimated at $52 per h.p. and the maximum $80 per h.p., depending on the form of construction.

It is claimed that power can be generated for three-tenths of a cent. per kw.-hour. The maximum cost of the construction of the plant is estimated at about $3,900,000.

The one on Indian River is 25 miles from the city and is capable of developing at a single power house 40,000 h.p. It is claimed that this could be easily increased to 50,000 h.p. Additional power may be developed by building a second power house four miles further up the river. This development could be made at a cost of $60 per h.p. at the power house switchboard, or $80 per h.p. at the receiving station in the vicinity of Vancouver.

The other power site is approximately 150 miles from Vancouver at Seaton Lake. There 200,000 h.p. may be developed, and by additional storage this amount could be increased to 400,000 h.p. The cost at the power-house switchboard is estimated at $35 per h.p. and $65 per h.p. in Vancouver.

At the request of the Council, the supervising city engineer is preparing a report on the power possibilities of Seymour and Capilano Creeks.

The 11th unit, completing the plant of the Electrical Development Co. at Niagara Falls, has been installed. The full capacity is now 147,000 h.p., but the maximum generating capacity by charter is 125,000 h.p., the additional plant being spare. Four 13,000-h.p. and seven 15,000-h.p. units are installed, consisting of Morris turbines and Canadian G.E. generators.—*Canadian Engineer.*

Continental.—Spain.—A concession has been granted for the establishment of a plant to utilise the water power of the River Mero near Combres (Province of Coruna), in the generation of electrical energy for power purposes.

In the annual report for last year of the Sociedad Altos Hornos de Vizcaya, of Bilboa, the largest metallurgical undertaking in Spain, it is announced that at the Sestao Works of the company, large, medium and small rolling mills are now electrically driven, an electricity generating plant comprising two steam turbines and alternators of a capacity of 3,500 kw. having been installed. It is also intended to convert the sheet and plate-rolling mills to electric driving.

Italy.—According to the *Daily Chronicle*, the Italian troops have destroyed the hydro-electric station at Tonale, on the shore of Lake Garda, and thus deprived Riva di Trento and the Austrian villages on the lake of electric light and power.

Darlington.—L.G.B. Inquiry.—An inquiry was held on [illegible] June 23rd, relative to the Council's application for sanction to borr[illegible]ow £34,950 for electricity purposes.

Dewsb[illegible]ury.—Price Increase.—The Electricity Committee has foun[illegible]d it necessary, on account of the increased price of coal, to increase th[illegible]e price of electricity as and from July 1st next, to lighting consumers [illegible] by 10 per cent.; to rateable value consumers by 12½ per cent.; and t[illegible]o heating and motive power consumers by 15 per cent. The increases [illegible] will continue in force until December 31st next.

Dublin.—Mr. Ruddle, city [illegible] electrical engineer, has reported to the Electricity Commit[illegible]tee agreeing with the city treasurer's statement that the credit [illegible] balance on capital account for loans now stands at £40,084. There [illegible] is available for short extensions, house services and meters, £6,500, [illegible]or, including cables in stock and paid for, £9,500, which will only [illegible] last until the end of the year with great care. The only other [illegible] sums available are £7,997, ear-marked for supplemental work o[illegible]n cables and substations in the city area, and £9,200 for North [illegible] Lotts and Island Bridge. Mr. Ruddle advised that applications be [illegible] not encouraged from which no reasonable profit can be made o[illegible]n the capital expended.

Gillingham (Kent).—School Lighting.—[illegible] The Education Committee has decided to invite the manag[illegible]ers of the Wesleyan Day Schools to apply to the Board of Educat[illegible]ion for its opinion as to having the E.L. installed in non-provided sc[illegible]hools, the T.C. bearing the cost of the installation, and charging [illegible] the Committee with a sum that will cover the cost of current [illegible], hire of fittings, and the installation.

Glasgow.—An arrangement has been come to be[illegible]tween the Tramways and the Electricity Committees of the T.C[illegible], by which the latter has been granted sanction to take the t[illegible]ramway depôt buildings and ground in David Street, for [illegible] the purpose of a sub-station.

Glossop.—The T.C. has received intimation that a[illegible] a result of the Corporation's opposition, the Stalybridge Joi[illegible]nt Tramways and Electricity Board has abandoned the proposal [illegible] to seek powers to acquire the undertaking of the Glossop Urb[illegible]an District Supply Co., and to supply current in the borough.

Haworth.—The U.D.C. has decided to withdraw it[illegible]s petition against the Keighley Electric Lighting (Extension) Pro[illegible]visional Order.

Hornsey.—The T.C. has been informed that in accordance with the terms of the order obtained in 1912 arrangements have been made for the Tottenham District Light, Heat and Power Co. to take over the supplying of electricity to St. Andrew's Church and other premises in Alexandra Park Road, Wood Green. The [illegible] L.G.B. has sanctioned the raising of an additional £2,000 for the extension of mains. This is a part of a £6,000 loan to which it gave assent before the war broke out.

Huddersfield.—Price Increase.—The Corporation has given notice of an increase in the price of electricity to all consumers by 12½ per cent.

Leeds.—Year's Working.—The units sold for all purposes by the electricity department last year amounted to 43,145,978 as against 31,011,268 in the previous year, an increase of 39 per cent. The total number of consumers is now 14,121. As regards lighting revenue the annual report points out that this is even now £3,065 less than it was in 1907-8, although the number of lighting consumers has grown from 5,504 to 10,759; however, during the year the private lighting output increased by 11 per cent. to 6,429 271 units; power units to 21,728,063 and heating units to 440,161, a combined increase of 16 per cent.; while tramways supply reached 13,823,011 units, an increase of 159 per cent. Street lighting units, as might be expected, fell by 19 per cent. to 678,370 units. The aggregate h.p. of motors in use by consumers was 31,114; and kw. of heating apparatus in use, 1,494 (as against 966). The annual revenue for different classes of load is interesting:—For private lighting, 17·88 units were sold per 35-watt lamp, bringing in 4s. 4d.; for public lighting, 75 units, bringing in 6s. 3d.; for motors per h.p. installed, 698 units, bringing in £2 6s. 7d; and for heating per kw. installed, 295 units, bringing in £1 3s. 6d. Despite increased working and financial charges, the increased output resulted in a fall in average costs, coal being ·18d. as against ·19d.; total works costs ·38d. against ·42d.; all-in cost (including contribution to capital expenditure, ·07d.) amounting to ·88d. against 1·01d. per unit. The total receipts were £170,031, and the gross profit, £103,606; after meeting financial charges including £12,053 capital expenditure, the surplus was £12,171. On 26,600 kw. of plant installed the net amount of capital debt outstanding amounts to, roughly

£35 per kw. The capital expenditure is divided up as to 37·6 per cent., generating station; 57·4 per cent., mains, transformers, meters, &c., and the remainder for Roundhay undertaking purchase, capital discounts, &c. The maximum load reached 16,460 kw.; the plant capacity was increased by a 7,500-kw. turbo-generator, and decreased by the sale of 3,840 kw. of obsolete plant.

London.—Hampstead.—The accounts of the electricity undertaking for the year ended March 31st show a net surplus of £2,766, as compared with £6,257 in the previous year; the net income was £69,724, as against £71,887, a decrease of £2,163; the units sold in 1914 were 5,872,308, and in 1915, 5,550,078.

Fulham.—The Electricity Committee report that the accounts of the electricity undertaking for the year ended March 31st last, show an excess of income over expenditure of £3,262, as compared with £5,321 for the previous year. This surplus is after debiting the revenue account with approximately £2,500 for new house services and meters installed during the year, which was formerly a capital charge. The total available surplus on the account is £6,673, and the Committee recommends that £3,000 be transferred to machinery maintenance reserve account, and £3,673, the balance, be retained on current account.

Westminster.—The Guardians have been recommended to continue, for a further period of 12 months, the agreement with the Dowsing Radiant Heat Co., Ltd., for the hire of radiant heat plant, at a cost of £12 12s. per annum. This charge includes the upkeep of the plant, but the electricity is supplied by the plant of the infirmary.

St. Pancras.—Some correspondence has taken place with the L.C.C. in regard to the loan for four new boilers, £22,530, which was sanctioned recently. In view of the necessity of restricting expenditure, the contractors are to be approached with a view to postponing for the present the completion of the last two boilers, and thus meeting the wishes of the County Council.

Manchester.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £432,470 for the purpose of the new electricity generating station at Barton.

Mansfield.—Loan Sanction, &c.—The T.C. has received sanction to a loan of £2,000 for plant needed to supply current to the military camp near the town, and the B. of T. has sanctioned the use of overhead lines for the supply. The T.C. has decided to advance all charges for current by 10 per cent. from July 1st.

Mansfield Woodhouse.—Restricted Lighting.—The U.D.C. having decided, under existing conditions, to have none of the public electric lamps lighted during May, June, July and August, has applied to the Mansfield T.C., who supply current, for an allowance in the account. The request has not been entertained.

Newton Abbot.—Restricted Lighting.—On account of restricted lighting, the Urban Electric Supply Co., Ltd., has reduced the public lighting account of the U.D.C. by £200 for the present year.

The company has informed the B. of G. that the charges for current will be raised by 16 per cent. from July 10th.

Reigate.—Proposed Loan.—A L.G.B. inquiry was held on June 21st, relative to the application of the T.C. for a loan of £1,000 for mains, services and transformers. There was some opposition on account of the high rate of interest on loans taken up now.

Salford.—New Turbine Plant.—The T.C. has decided, by 28 votes to 9, that the cost of the 5,000-kw. turbo-alternator (£19,225) which is to be purchased, be defrayed out of the depreciation fund.

Scarborough.—Price Increase.—The Scarborough Electric Supply Co. has decided to increase, after June 30th, the charge for electrical energy for all purposes by 10 per cent.

South Africa.—*The S.A. Railways and Harbours Magazine* gives some particulars of the power station at Luderitzbucht, now being worked by members of the S.A. Engineers Corps, under the control of Lieut. Davies. The plant is mainly for supplying the diamond mines, and consists of seven large gas producers and one small one, with the necessary purifying plant, and the following Körting gas engines:—One of 155 h.p., two each of 600 h.p. (four cylinders), and two each of 1,000 h.p. (four cylinders), in each case coupled to a Siemens-Schuckert alternator. Current is supplied to the mines at 30,000 volts pressure. A large pumping and air-compressing plant is installed, and the coal yards contain about 2½ years' supply of Welsh anthracite for the gas plant.

Stalybridge.—Loan Sanction.—The Joint Electricity and Tramways Board has received sanction from the L.G.B. for the borrowing of £4,000 for transformers and mains.

Stirling.—The surplus on the Corporation electric light undertaking for the year was £519. This sum is to be added to the reserve fund.

Stoke-on-Trent.—Year's Working.—The accounts of the Potteries electricity undertaking presented last week show that the total revenue was £55,159; the total works expenditure, £32,418; and the gross profit, £22,741; while loan and interest charges accounted for £21,565. The total units sold amounted to 7,432,910. The total expenses amounted to £55,046, compared with £58,723 in the previous year, or a reduction this year of more than £3,600; against the loss of £6,162 in the previous year, there is a profit of £71, which justified the Committee's power supply scheme. Last year 10,500,000 units were generated, an increase of 1,500,000, on a reduction of over 4,000 tons of coal, showing a saving of £2,800. But for the war a profit of £6,000 would have been anticipated.

Loan Sanctions, &c.—The T.C. has made a further advance of 10 per cent., making 20 per cent. increase, in the price of current, owing to the high price of fuel. The Local Government Board has sanctioned loans as follows:—£19,150, excess expenditure to March 31st, 1914; £130, wagon shed at Hanley; £6,266 mains; £3,482, machinery, services, and sub-station equipment. Regarding a further loan for a rotary converter at the Longton sub-works, the L.G.B. intimates that it is in communication with the Treasury. The remainder of the loans asked for, which amount in all to £56,230, has not been sanctioned.

Tunbridge Wells.—Year's Working.—The annual report of the electricity department shows a total income of £18,613, an increase of exactly £2,000 during the year. Units sold for private purposes increased by 23 per cent. The capital expended on the undertaking amounts to a little over £100,000, whilst the liability is under £30,000. The gross profit increased from 8·9 to 9·8 per cent, and the net profit increased from £2,165 to £3,167. The total increase in units sold was 208,000.

Wallasey.—Price Increase.—The T.C. is recommended to increase the charges for current as from the end of September as under:—Lighting, to 4d. per unit, with a reduction to 3½d. on all current consumed over 2 units per quarter per each 8-c.p. lamp wired; free wired installations, 1d. per unit increase; motors, to 2½d. per unit; heating and cooking, to 1½d.

Wrexham.—Prov. Order.—The T.C. has informed the R.D.C. that it is intended to apply to the B. of T. for a prov. order extending the area of supply to the Garden Village outside the borough, and suggesting that other places in the rural area should be included. The R.D.C. has decided that the several parishes in the district concerned shall be consulted in the matter.

TRAMWAY and RAILWAY NOTES.

Australia.—The lease of the Melbourne Tramways and Omnibus Co. expires in about a year, and, according to the *Argus*, the Tramway Trust, which was created to act as the executive of the municipalities in their relations with the Tramways Co., has initiated proceedings for the purchase and transfer of the company's holdings. It has ascertained that the company is prepared to treat with it as to terms, and the constituent municipalities are now being asked to approve the proposed step. There appears to be some doubt as to the attitude of the Government in the matter, as it is said that a section of the members would like to see it in control of the tramways.

Birmingham.—The T.C. has applied to the B. of T. for an extension of time to September 2nd, 1918, for the completion of the light railways authorised by the 1912 order, and the Quinton order for 1913.

Blackpool.—Female Labour.—Ten women car conductors are now employed on the cars, their wages being the same as those paid to male employés—5¾d. per hour—but the hours worked being fewer.

From May 14th to June 17th the receipts on the cars amounted to £7,805, a decrease of £1,377 on the corresponding period of 1914, and since April 1st the decrease recorded is £3,475.

Bolton.—Wages Increase.—The Tramways Committee has offered to pay its employés an advance of a farthing an hour from the first pay day in October, which the men's society has decided to accept along with the condition that no further application for an increase of wages is to be made until July, next year.

Continental.—Switzerland.—The Swiss Federal Railway authorities have decided on the construction of a large new hydro-electric station at Massaboden, near Brigue, to supply the necessary electrical energy for the propulsion of the trains through the Simplon tunnel. The plant, which will replace the temporary power station at the north end of the tunnel, will be equipped with two turbines working under a head of 141 ft.

Glasgow.—In supplement to the analysis of the report on the year's working of the Corporation tramways, an official report was issued early this week, in which it is pointed out that the amount of line and single track open was over 198 miles. There were in use 857 cars, of which 385 were fitted with vestibules. The passengers carried numbered 336,260,758; the average traffic revenue per car-mile was 10·612d., and per mile of single track operated, £5,404.

Hull.—The Corporation Tramways Committee has decided to employ women as conductors. The Lord Mayor said it was not their intention to employ women if men were available. It was proposed to pay the women conductors 27s. per week, the same as men, and to allow the drivers a war bonus of 2s. a week for lifting the overhead trolley at each terminus.

Ilford.—The Tramways Committee has decided not to take action on the question of considering the advisability of obtaining expert advice to assist the Council in formulating a scheme by which the undertaking can be placed upon a sound commercial basis.

Keighley.—The T.C. has applied to the B. of T. for an extension of time to September 20th, 1916, and to September 20th, 1917, for the completion of works authorised by the Tramway Orders of 1903 and 1909.

London.—L.C.C. Annual Accounts, &c.—For the year ended March 31st, 1915, the County Council's system extended over 150 street-miles of tramways, 5¾ miles being horse lines; only 146 miles, however, were in operation. The services on the remaining horse tramways have now been suspended pending electrification. The total income for the year amounted to £2,399,847 (including £10,800, horse tramways), and the working expenses to £1,700,571 (including £16,327, horse tramways), leaving a gross surplus of £699,276. Against this has to be set debt and other charges amounting to £732,448, leaving a deficiency to be met out of general reserve fund of £33,172. There will be nothing available for the renewals fund which, on March 31st last, amounted to £402,045, and the general reserve fund, after meeting the deficiency mentioned, amounted to £163,050. The total operating expenses (including £42,209 war service allowances) amounted to 6·89d. per car-mile, as against 6½d. per car-mile in 1913-14. The total receipts in respect of electric traction amounted to 9·77d. per car-mile, as against 9·21d. in 1913-14. The passengers carried totalled 550,497,993 (including 3,244,661, horse tramways), and the car-miles run were 58,706,161 electric, 272,631 horse, a total of 58,978,792. The electric traction receipts for 1913-14 were for 136 track-miles, £2,181,344; and for 1914-15 for 140 track-miles, £2,323,130; the average receipts per mile showing an improvement. The capital debt at March 31st, 1915, amounted to £13,744,806, and the net debt to £9,836,187. Capital expenditure amounting to £1,930,396 had become obsolete, owing to the electrification of the horse tramways, and £966,232 was still to be provided for under this head, as also £5,006 under a similar head for electric traction.

The report draws attention (as usual) to the amount paid in rates on permanent way for the year, £87,827, equal to ½d. in the £; to annual saving to road authorities by the Council maintaining paving along tramway routes, £134,400; cost of street improvements charged to tramways, £673,775. In all it is estimated that local rates are relieved by £298,376 a year. A total of 45,785,729 passengers travelled in workmen's cars (2d. return and 1d. single tickets, average length of route, 5 miles).

The report deals at some length with through running facilities which have been introduced with adjoining tramways and with the London Electric Railway Co. (Highgate—Charing Cross), and concludes by pointing out the improving receipts up to the outbreak of war, the extra cost of coal since the war £15,757, and the cost of war allowances £42,209.

The annual estimates of the Highways Committee for 1915-16 show in respect of the tramways a net deficiency of £91,614.

However, since this result was arrived at, the tramway strike has taken place, which it is considered will result in a net loss of £100,000, and together with other charges it appears that the reserve fund may be exhausted and a further amount be left to be found from other sources.

One can quite appreciate that the Committee views "with concern the probable financial results for the current financial year having regard to the heavy additional charges on the undertaking and loss of traffic revenue owing to the war and the strike." Apparently the only crumb of comfort held out by the Committee is the prospect of reduced debt charges in "a few years' time."

South Africa.—For the half-year ending December 31st, 1914, the Pretoria Corporation tramways showed a net loss of £5,379.

At Germiston a public meeting recently passed a resolution earnestly requesting the Tramways Committee to take steps to minimise the loss on the tramway system.

The Johannesburg municipal tramway system for March made a profit on the month of £2,233.

Stockport.—Reserve Fund.—The Tramways Committee has decided to invest the reserve funds of the tramway department in the new War Loan.

West Hartlepool.—Year's Working.—The result of the working of the Corporation tramways for the year ended March 31st, was a net profit of £3,018, which was placed to the reserve fund, now amounting to £4,614. Compared with the previous year, all the routes showed increased receipts, the total being £4,000 ahead of that of two years ago. The passengers carried numbered 4,261,917, or 8·89 per car-mile, representing 9·77d.; operating expenses were 5·80d., leaving gross profit amounting to 3·97d. per car-mile.

TELEGRAPH and TELEPHONE NOTES.

German Cables.—The severed cable communication between the United States and Germany, *via* the Azores, has not been restored because of the opposition of Great Britain and her allies. The German Government submitted to the United States a proposal to repair and re-open the cable if the consent of the British Government could be obtained. This proposal was communicated through Ambassador James W. Gerard, at Berlin, to Secretary Bryan, under date of February 27th, 1915, but no response was ever made by the British Government. Without the consent of the British Government it would be worse than useless to repair and re-open the cable, for the reason that Great Britain, if opposed to its use during the war, could cut the cable just as easily after its restoration as in the early days of the war.—*T. and T. Age.*

Panama Canal.—In order to avoid confusion in the sending of wireless telegrams, a general order has been issued by the authorities of the Panama Canal, prohibiting the sending of long-distance messages by vessels within the jurisdiction of the canal.—*T. and T. Age.*

Tireless Wireless.—Two years ago a wireless message was sent from a steamer off the coast of Japan to a man in Peking, China. The message went all over China in search of the man, and was finally delivered to him in December, last year, after being 22 months on the way. This is a victory for wireless.—*T. and T. Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—Aug. 11th. One 1,000-KW. D.C. generator complete, liquid starter, &c., for City Council. See "Official Notices" June 4th.

July 27th. A.C. and D.C. meters and maximum-demand indicators, for the City Council. See "Official Notices" June 25th.

August 11th. Victorian Railway Commissioners, Spencer Street, Melbourne. Twenty miles of vulcanised-rubber electric light wire (Contract No. 28,925). Local representation. Deposit, ½ per cent. of amount of tender.*

Adelaide.—August 18th. Magneto and trembling bells, for P.M.G.'s Department. See "Official Notices" to-day.

Perth.—August 11th. Bolts and nuts, tubular brackets, side brackets for tubular iron poles, &c., Cordeaux and other insulators, copper wire, &c., for the P.M.G.'s Department. See "Official Notices" to-day.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

Barking Town.—July 16th. U.D.C. 1,000-KW. turbo-alternator with condensing plant; cooling tower and pipework; chain-grate stoker, boiler pipe work, &c.; economiser; rotary converter; H.T. switchgear; H.T. main. See "Official Notices" to-day.

Dublin.—July 12th. Corporation. 122,000 carbons. See "Official Notices" to-day.

Edinburgh.—July 12th. Corporation. One 1,000-KW. motor converter and transformer. See "Official Notices" June 25th.

July 14th. Corporation. Electric lighting installation at public wash-house, McLeod Street. Mr. F. A. Newington, Engineer, Dewar Place.

Erith.—July 5th and 19th. U.D.C. One water-tube boiler with superheater, economiser, automatic stoker, steel chimney, induced-draught plant, steam valves, steam pipes, and all auxiliaries. One 2,000-KW. turbo-alternator, with condensing plant, switchgear, and all accessories. See "Official Notices" June 18th.

Kingston-upon-Hull.—July 22nd. Corporation. One 5,000-KW. turbo-alternator with exciter; one condenser outfit complete. See "Official Notices" to-day.

Manchester.—July 9th. Washed and dry coal slack during the year ending June 30th, 1916, for the Electricity Department. Mr. F. E. Hughes, Secretary, Town Hall.

Morecambe.—July 24th. Corporation Electricity Department. 2,000 tons of coal or slack. See "Official Notices" to-day.

Rangoon.—August 11th. Installation of a system of fire-alarms, for the municipality. Specification (10s.) from Messrs. Ogilvy, Gillanders & Co., 67, Cornhill, E.C.

South Africa.—August 3rd. 200 H.T. links for power station (Contract No. 998), for Johannesburg Municipal Council. Specification, &c., can be seen at the B. of T. Commercial Intelligence Branch in London, and obtained from the Controller of Stores, Municipal Offices, Plein Square, Johannesburg.

Tasmania.—Launceston.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

Trowbridge.—July 7th. Public lighting for three years, for the U.D.C. The Surveyor.

Walsall and West Bromwich.—July 5th. Lighting; heating apparatus; drainage and septic tanks, for Unions Joint Committee. See "Official Notices" June 18th.

Warrington.—July 7th. 6,000 tons of slack coal for the electricity works for six months, or, alternatively, 10,000 tons during the 12 months. Specifications (one guinea, returnable) from Mr. F. V. L. Mathias, Electrical and Tramway Engineer.

CLOSED.

Bolton.—The Electricity Committee has accepted the following coal tenders for next year:—

J. Hilton & Sons.—3,000 tons 6-ft. slack.
J. B. Scholes & Sons, Ltd.—5,000 tons rough 4-ft. slack, and 15,000 tons of Ellerbeck rough Arley slack.
Earl of Ellesmere.—2,600 tons of rough dry slack.
John Briggs & Sons.—3,000 tons of best slack.

Brighton.—The B. of G. has accepted the tender of Mr. H. J. Galliers, of Brighton, for electrical fittings, at £64.

Hull.—The Board of Guardians has accepted the tender of Messrs. Clark & Graham for electrical work and supplies during six months.

London.—The Alpha Manufacturing Co. has lately received the following contracts:—

Metropolitan Asylums Board.—Electric heating at head office, and lighting at the Western Hospital Fulham.
The lighting of H.M. Auxiliary Stationery Office, Borough Road.

The following tenders have been received by the London Education Committee for installing electric light in two schools:—

County Secondary School, South Hackney.

Alpha Manufacturing Co.	(accepted)	£562
A. Hawkins & Sons		564
G. Weston & Sons, Ltd.		697
Titan Lift Co., Ltd.		746

Sebbon Street, Islington.

T. W. Vaughan & Co. (1914), Ltd.	(accepted)	£306
A. Hawkins & Sons		383
Alpha Manufacturing Co., Ltd.		391
T. H. Smerdon		418
Albion Electrical Co., Ltd.		420
Titan Lift Co., Ltd.		431
G. Weston & Sons, Ltd.		432
Temple Bros.		445

St. Pancras.—For the supply of coal for 12 months for the electricity generating stations only four tenders were received which included delivery. In regard to the contract of Messrs. Beattie & Co., which expired on June 30tb, the Committee had pointed out to the firm that the shortage of supply, which resulted from the diminished output of the collieries and the use of the railways by the Government for military purposes, had had to be made up by the Council at much higher prices than that contracted for. Messrs. Beattie, with a view to meeting the Council, after negotiation with the colliery, have offered that, if their contract is accepted by the Council for the ensuing year, they will make a reduction in respect of the first 1,000 tons of Newdigate beans of 5s. 2d. per ton, and the first 500 tons of Newdigate nuts of 5s. 5d. per ton, the remainder of the quantities to be taken at the prices quoted in their tender.

The Committee recommended that the tender of Messrs. J. H. Beattie & Co. be accepted for coal for the year ending June 30th, 1916, as follows:—

5,100 tons of Haunchwood hard steam coal, at £1 8s. 5d. per ton, for Regent's Park station.
9.600 tons of Newdigate beans, at £1 1s. 11d. per ton.
1,000 tons of ditto, at the reduced rate of 16s. 9d. per ton.
4,800 tons of Newdigate D.S. nuts, at £1 3s. 11d. per ton.
500 tons of ditto, at the reduced rate of 18s. 6d. per ton, for the King's Road station.

Subject to the provision that, should any action of the Government lead to a reduction in prices at the collieries, the present prices shall be correspondingly reduced.

Luton.—The T.C. has been recommended to accept the tender of the British Thomson-Houston Co., Ltd., at £2,250, for two 500-kw. converters; and that of the B.I. & Helsby Cables, Ltd., for 5,600 yards of ·15 sq. in. h.t. cable, at approximately £990 per mile.

Nuneaton.—The T.C. has accepted the following tenders for the electricity works:—

W. Lucy & Co., Ltd.—House-service cut-outs: 10 and 15-ampere sets, 6s. 8d. per set; 50-ampere sets, 9s. per set; street-lighting brackets, 15s. and 16s. 9d. each.
Nuneaton Engineering Co., Ltd.—House-service joint boxes: small, 4s. 6d. each; large, 5s. each.
Mr. W. Jeffcoate.—1,260 tons fine smudge coal, 8s. 4d. per ton delivered.

Oldham.—The Education Committee has accepted the quotation of the Corporation Electricity Committee for carrying out the lighting of Higginshaw Mixed School (approx. cost £200).

Rugby.—The U.D.C. has accepted the tender of the Macintosh Cable Co., Ltd., for cables; and that of the British Thomson-Houston Co., Ltd., for a transformer control panel. The lowest tender for cable was rejected, as it was ascertained that the firm tendering had practically the whole of its share capital held in Germany.

Southampton.—The Electricity Committee has accepted the offer of Messrs. Bradbury, Son & Co. for 3,500 tons of Tamworth coal, at 22s. 10d. per ton; and is to invite alternative tenders for the supply of coal during periods of three, six and twelve months.

Watford.—The U.D.C. has accepted the tender of Messrs. E. Foster & Co. for 2,000 tons of Newdigate peas coal for the electricity works, at £1 1s. per ton, subject to 2d. per ton extra per 2½ per cent. rise in miners' wages during the contract period of 12 months.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Monday, July 5th. At 5 p.m. At Albemarle Street, W. General Meeting.

NOTES.

Engineering Congress at San Francisco.—We have received from the Committee of Management of the International Engineering Congress, to be held in September, a copy of the general programme covering the conventions of the four American Societies of Civil, Mechanical, Mining, and Electrical Engineers. It gives particulars of the excursions, &c., and contains a form for use in informing the Committee of one's plans and requirements in the way of accommodation, &c. Copies of the booklet can be obtained from Mr. W. A. Cattell, secretary, International Engineering Congress, 417, Foxcroft Building, San Francisco, Cal., U.S.A.

Electric Dust Vans: Birmingham.—The electric supply department has ordered two Mossay electric vehicles, which are to be hired to the refuse disposal department, with a view to demonstrating to other users of haulage vehicles their suitability for town work. These two vehicles are to be used in the Harborne district in the collection of house refuse from portable ashbins, the refuse being taken to California tip; they will replace four horses, and a spare horse, drawing four-wheeled wagons. As a preliminary, several tests were carried out with an Edison electric dust-van, and Mr. Jackson, the superintendent of the refuse disposal department, reports that they fully demonstrated that one electric could easily displace two horses, and in Birmingham, where 275 horses are engaged in refuse disposal work, this would reduce by half the clerical work in weighing and inspection of vehicles; it would be more cleanly, and owing to the possibility of using electric light, would reduce accidents, which occur through bad lighting of the present vehicles. A horse and wagon removes three loads a day, stopping at 150 houses, which rules out the petrol vehicle.

Mr. Jackson gives, as a basis of comparative cost, the following figures:—

Capital Cost.

Edison. 3-ton.	Mossay. 2½-ton.	Mossay. Revised estimate for 3-ton.	Two horses and wagons. 3-ton.
£1,075	£650	—	£250
Running cost per 135 miles per week.			
£11 1s. 1d.	£10 9s. 5d.	£11 2s. 4d.	£10 4s. 0d.

In the estimate 10 per cent. depreciation and interest at 4 per cent. per annum are included; the driver's wages are reckoned at 35s. per week, or 5s. more than for horse drivers, and electricity is reckoned at ½d. per unit, obtained from the destructor plant. Judging from the details mentioned in the report, for which we are indebted to Mr. Jackson, it would appear that the electric-vehicle cost is, if anything, overstated, especially if a number of such vehicles are to be employed.

Institution and Lecture Notes.—Tramways and Light Railways Association.—The seventh annual Congress of this Association is to be held at the Institution of Civil Engineers Great George Street, Westminster, S.W., on Friday, July 16th, at 10.30 a.m.

The papers to be read are as follows:—

"Glimpses into the Obvious," a paper on tramway management, by Mr. A. V. Mason, M.I.E.E., general manager and engineer of the South Metropolitan Electric Tramways and Lighting Co.

"Tramways during War Time," by Mr. J. W. Dugdale, general manager, Oldham Corporation Tramways.

"Electric Battery Vehicles as Adjuncts to Tramways," by Mr. W. H. L. Watson.

An informal dinner will be held in the evening at the Trocadero Restaurant.

Society of Engineers (Incorporated).—On June 17th the members of the society and their friends visited the works of the Edison & Swan United Electric Light Co., Ltd., at Ponders End, Middlesex.

Appointments Vacant.—Deputy general manager of electricity supply department (£650), for Municipal Council of Sydney, N.S.W.; chief assistant electrical engineer (£120), and switchboard attendant (30s.), for Leek U.D.C.

Electrical Prosperity Week.—Sectional Committees to supervise the Electrical Prosperity Campaign in every State of the Union have been appointed by the Executive Committee of "Electrical Prosperity Week." Nearly 200 of the leading electrical men of America, representing all the interests of the electrical industry, have been invited to take charge of local campaigns. Pledges have been received at the Executive Offices of the Society from the leading industries in other fields that the electrical industry can be assured of their support. The Society will issue before July 1st a prospectus of the campaign and all proposed plans.

Parliamentary.—The following Acts have received the Royal Assent:—

Ormskirk Gas and Electricity Act.
Bristol Tramways Act.
Metropolitan District Railway Act.
Sheffield Corporation Tramways Act.

Accident.—Albert Craven, of Blackpool, a jointer in the employ of British Insulated and Helsby Cables, Ltd., met with an accident while working in an electric manhole at Blackburn on June 24th. A lighted candle fell on some insulating material lying at the bottom of the manhole, which was instantly filled with flame. Craven was severely burned on the hands, face and neck

Australian Contracts and Arbitration. — With further reference to the subject of municipal contracts and arbitrators in connection therewith, with which we dealt editorially in our issue of May 28th, the *Melbourne Argus* just to hand states that consideration has been given to this question by the Melbourne City Council. The report of the Legislative Committee bearing on the subject has now been adopted in the following terms:—

"In the existing conditions of contracts, which are supervised by the city surveyor or the city architect, it is provided that where disputes or differences arise in connection with the contract, the same shall be referred to and settled by the city surveyor or city architect, as the case may be. The conditions of contract for electric supply works provide that disputes shall be referred to and decided by arbitrators, one to be appointed by each party, and an umpire, to be appointed by the arbitrators. The Committee consider that the principle for settlement of disputes should be uniform in all contracts entered into by the Council, and, after consideration of the principles contained in the conditions of contract of various bodies, they are of opinion that the appointment of one arbitrator, to be agreed upon by the parties, and to be named in the contract, will meet all requirements. They therefore recommend adoption of this principle by the Council, and that the arbitrator shall be a member of the Royal Victorian Institute of Architects, the Victorian Institute of Engineers, or the Electrical Association of Australia, as the case may require."

A fourth alternative in the direction of a representative of the Master Builders' Association was negatived, after discussion, by 14 votes to 7.

Italy's Electrical Trade in 1914.—The following is a summary, from the *Revista Teenica d'Elettricità*, of the progress of Italian electrical trade in the past year:—Imports of machines weighing above 1 metric ton amounted to 32,000 metric quintals, against 2,000 for 1913, of which the contribution of Germany was 26,500, accounting for the greater part of the increased imports; those of Switzerland showed a slight advance, while the shipments from England and Austria were less than in the previous year. Imports of lighter machines showed a diminution, being 12,500 metric quintals, against 15,000 in 1913. England and Switzerland each made small advances on their previous year's shipments, while those of Germany suffered a decline, the greater portion of which is claimed as evidence of Italy's improved manufacturing powers. On the other hand, imports of transformers markedly advanced, being 24,600 metric quintals, against 13,300 in 1913, Germany supplying about half, and other countries furnishing small increased supplies. Germany's share of the aggregate of Italian electrical imports totalled 48,000 metric quintals, against 34,000 in 1913, the total Italian imports of this group amounting to 73,700 metric quintals. Of electrical apparatus weighing less than a metric quintal, the imports last year were 7,500 metric quintals, against 8,600 in 1913. Imports of arc lamps continued their previously marked decrease, being only 250 metric quintals against 550 in 1913, and 660 in 1912. Incandescent lamps figured for 9,250,000 articles against 9,670,000 in 1913. Imports of electric furnace carbons sprang from 8,000 metric quintals to over 120,000; while carbons for other electric uses receded from 10,000 to 9,900 metric quintals. Bare copper wire (0·5 mm. diameter) rose from 8,700 to 10,000 metric quintals, while covered wire imports fell to 2,100 against 3,600 in 1913; cable imports recorded 6,200 against 8,350 metric quintals in the preceding year—the falling-off in each case being attributed to the increased production of Italian works. As regards Italian exports of electrical wares, diminution is noted in heavy and light machines and in transformers; and insulated copper wire fell from 10,000 to 7,500 metric quintals, but cables rose from 13,000 to over 26,000 metric quintals, the chief client being Argentina, whose higher purchases compensated for losses elsewhere. Electrical apparatus figured for less than 400 metric quintals. Carbons for electric furnace electrodes rose, however, from 400 in 1913 to 2,300 metric quintals, and other carbons from 9 to 200 metric quintals an improvement indicative of future possibilities. Taken altogether, however, the export trade is considered to afford few motives for satisfaction.

Fatalities.—ELSWICK-ON-TYNE.—An inquiry was held on June 23rd, at Newcastle-on-Tyne, as to the deaths of Thomas Leadbitter Harrison, 28, Hobson Colliery, Burnopfield, and Edwin Stanley Bubb, 18, who died as the result of an accident at the Western Power Station of Messrs. Armstrong, Whitworth and Co., Elswick-on-Tyne.

Thomas Nichol, an engine fitter at the works, said some hydraulic and electric pumping plant was being erected at the station, and on June 11th, the day of the accident, witness and others were fixing a pressure pipe to a tank. The work was commenced before the electric light was required. Harrison, Bubb and other men wanted to finish the work, and did not leave at the usual time for supper, but witness went for his. On returning he found that Harrison had been killed. Two men were applying artificial respiration, and three other men had been removed to the infirmary. Examination showed that the insulation of a wire had been damaged and the wire exposed. He concluded that an iron girder had been charged with electricity through the insulation of the wire being damaged and the wire coming into contact with the girder. In answer to a representative of the Home Office, witness said the only place they could put the pole for lifting weights was on the girder. The pole was not in use at the time of the accident. He thought the pole must have rolled on to the wire.

John Thomas Temple, an enginewright, said he had just sat down for supper when he saw Stuart Bubb fall from the tank to the ground. On reaching the top of the tank by a ladder, witness found Stanley Bubb partly immersed in the water, and leaning against the partition of the tank partly unconscious. A man named Havery was in a similar condition. Witness called for assistance, and Harrison went to get hold of Havery, stepping past witness. To support himself Harrison got hold of the girder, and as soon as he did so his legs dropped into the tank. Witness then knew that the girder had become electrified, and he called for the current to be cut off. As soon as this was done Harrison released his hold of the girder and fell into the tank. Artificial respiration was tried for ten minutes, or it might have been longer.

The Home Office representative commented on the time stated by witness that artificial respiration had been applied. He pointed out that it should not be given up under two hours. There was a case on record where a man was brought round at the end of that time, and after life had been pronounced extinct by a doctor. The fact was not generally known amongst medical men. He thought it would be well if instructions were issued to ambulance men on that point.

A verdict was returned to the effect that Harrison and Bubb died from electric shock received through taking hold of a steel girder, which had been electrified through an electric cable becoming damaged.

GATESHEAD-ON-TYNE.—An inquiry into the death of Thomas Lewis, a youth employed at the Redheugh Steel and Iron Co.'s works, was held on June 24th. Archibald Allen, aged 16, said that on June 18th they went to work, and at 11.40 p.m., during a rest interval, witness and Lewis strolled through the works and Lewis went towards a pole where an electric lamp was hanging. Lewis put his hand out as though to touch the wire, and lifted his foot to get on to a sleeper. The lad then fell back, and when witness touched him he received an electric shock. Efforts were made to get him off the wire which he was holding, but these failed, and witness went for assistance. When he got back Lewis was on the ground apparently dead. Richard Stamp, a furnaceman, said he saw Lewis holding the lamp wire with both hands. Witness made several attempts to free Lewis, and received a severe shock, but eventually got him off. Thomas R. Parry, Dunston, electrical engineer, said there was evidently a fault in the insulation of the lamp which caused the casing to be alive. He suggested that the suspension wire became alive through coming into contact with the shade of the lamp, and that could only have occurred by pulling the lamp up by the suspension wire. The jury found that the boy had been accidentally killed by improperly taking hold of a lamp suspension wire which had by some unaccountable means become charged with electricity.

BURY.—On Monday, a verdict of "Accidental death" was returned in the case of Alfred Nicholson (27), electrician, of Manchester, who, while working on a ladder at the Radcliffe Paper Mill, fell to the ground and fractured his skull.

Ediswan v. Siemens Rifles.—A friendly shoot between the "Ediswan" Rifle Club and a team from Siemens Rifle Club was decided on the "Ediswan" range last Saturday. There was a very good muster. Siemens put 17 men in the field, including Mr. Holmes (sales manager), Mr. Hicks (assistant sales manager) and Mr. Pryor (hon. sec. to the club). The "Ediswan" team were equal in number, and included Messrs. Child and Elliott (joint sales managers), and Mr. Corbett (hon. sec.). The shoot resulted in a win for the home team by 1,284 to 973. Spoons were given for the highest score on each side, also wooden spoons for the lowest scores, and a mystery prize completed the trophies.

The prizes in the team match were awarded as follows:—

Highest score, "Siemens," Mr. Fowler, 97.
"Ediswan," Mr. Black, 91.
Lowest score "Siemens," Mr. A. N. Other, 2.
(Booby spoon) "Ediswan," Mr. Elliott, 48.
Mystery, "Ediswan," Mr. Swallow, 87.

After the "shoot" the party, of nearly 50, adjourned to the staff café for tea, and a vote of thanks to the hosts was proposed by Mr. Holmes, and responded to by Mr. Elliott, after which the latter presented the prizes. Having taken tea, another match of six a side was decided in favour of the "Ediswan" men, by 518 to 492.

Diesel Engine Users' Association.—At the June meeting of the Association, the question of a suitable allowance for depreciation of Diesel engine plant in connection with income-tax assessment was considered. It was generally felt that the present practice of allowing only 5 per cent. for depreciation, and that only on the diminishing capital value, was quite insufficient for the purpose. Mr. Arthur D. Bird, of Messrs. Humphreys-Davies & Co., who had been invited to attend the discussion, referred to Sec. 12 of the Customs and Inland Revenue Act, 1878, which enacts that a "just and reasonable allowance should be granted as representing the diminished value by reason of wear and tear during the year, of any machinery or plant used for the purpose of the concern." The two principal questions, therefore, for consideration were:—(1) What was wear and tear?, and (2) What constituted a just and reasonable allowance? With regard to the first question, the legal allowance was limited to the physical deterioration of machinery and plant in use, and no deduction for any loss arising from obsolescence was legally claimable. For this reason, among others, it was important that the annual allowance for depreciation should be fair and ample, and that reliance should not be placed on a claim for the difference between scrap value and the original value at the end of the life of the plant. In support of this point, he mentioned the decision in the appeal of the London County Council Trams *v.* Edwards, in which it was held that the unexhausted value of the London County Council trams, track, &c., which had been replaced by electric traction, was not an admissible deduction in arriving at the taxable profits. Mr. Bird referred to the case of a company generating current, subsequently ceasing to do so and purchasing its supply elsewhere; also to the case of new plant being installed upon a larger site. In these cases the losses arose from causes other than of obsolescence of plant; in the first case there was a change of business, and in the second case the plant had become useless, due to the original site having become too small. It was also pointed out that any allowance other than an annual deduction for wear and tear was a concession by the Board of Inland Revenue and had no statutory force; further, that it was conditional upon the replacement of the obsolete plant. Mr. Bird also referred to the method adopted by the Inland Revenue Authorities in granting allowances for wear and tear, viz., upon the reducing balances of value, and he pointed out that where an allowance was limited to 5 per cent. per annum on the diminishing value, a residual or scrap value of 4 per cent. was only reached after about 60 years. An allowance at the rate of 10 per cent. per annum reduced the capital figure to about 4 per cent. after 30 years. At the time the arrangement was come to for granting allowances for depreciation in respect of machinery and plant at electricity generating stations, the Diesel engine was practically unknown for central station work, and it could, therefore, not be urged that such an arranged allowance covered depreciation of that particular class of plant; further, any such arrangement could not be considered to be binding for all time. As a matter of law, the Commissioners of Taxes were the tribunal who determined the allowances to be made, and they were empowered to vary them annually if the circumstances warranted it. Mr. Bird also made a comparison between the allowances granted to gas companies under the scheme entered into with the Inland Revenue Authorities, from which it appeared that they had obtained various concessions which were not accorded to electricity generating undertakings. After some discussion the question was adjourned for further consideration.

The next meeting of the Association is to be held on July 21st, when the questions of lubrication and of cracked pistons are to be further discussed. Information and particulars concerning the Association can be obtained from the acting hon. secretary, Mr. Percy Still, 19, Cadogan Gardens, London, S.W.

Russian Copper Production.—The increasing production of copper in Russia in 1910, 1911 and 1912 rendered it probable, according to the report of the Russian Copper Syndicate Medj in 1912, that the country would become entirely independent of any external supplies in the course of the year 1915. This assumption was apparently based upon the fact that the output had reached, at 33,100 tons in 1912, the highest level ever attained, and that it would continue to expand. In 1913, however, the outturn declined to 32,800 tons, and the returns for 1914 indicate a further reduction to 31,900 tons. It appears that since October operations at one works of the Caucasian Copper Industry Co. have been at a standstill, the resumption of work at one factory of the Siemens (Successors) Co. has been prevented, and a restriction in the number of workmen at all the other works has prevailed. As, however, the production in the first half of 1914 receded by 640 tons as compared with a total fall of 900 tons for the whole of the year, it does not seem as if the war has exercised a very determined influence on the copper industry taken as a whole. The syndicate controlled 91·8 per cent. of the total output in 1914 as compared with 95·7 per cent. in the previous year. The total consumption of copper in Russia last year is recorded at 33,300 tons as compared with 32,900 tons in 1913, so that the imports must have amounted to 1,400 tons, of which 425 tons were purchased in the United States. It is estimated by the syndicate that the production will reach 34,800 tons in the present year.

Educational.—Two Heating Studentships, tenable in the Faculty of Engineering of University College, London, each of the value of £50 a year, together with College fees, may be awarded in July by the Institution of Heating and Ventilating Engineering. Particulars can be obtained from the Secretary of University College, London, to whom applications must be made not later than Wednesday, July 7th, 1915.

Electrical Standardisation in China.—The Engineering Society of China recently held its annual meeting at Shanghai. The chief item in the report dealt with the Electricity Standardisation Committee, which has temporarily suspended its labours owing to the war. The chairman, Mr. A. C. Clear, read the report of the Committee, which stated that the various societies of the world had been approached, and all had expressed their appreciation and approval of the scheme. As soon as the decision of the British Committee is obtained, the report continues, the Chinese authorities might be approached and every effort made to push the matter through.—*Eastern Engineering.*

Volunteer Notes.—Engineering Institutions' Volunteer Training Corps.—Company orders, by Lieut.-Col. C. B. Clay, V.D., Commandant, for week ending July 10th, 1915:—

On Mondays, Wednesdays and Fridays, drills at 6.30 and 7.30 p.m. Technical instruction will be given by Instructors of the London Electrical Engineers for one hour, and squad and platoon instruction for one hour on Monday and Wednesday.

On Friday, Company and squad drill.

Orderly Sergeant, N. H. Fullarton; Recruit Orderlies (Squad 3), C. F. McInnes; (Squad 4), W. H. G. Saunt.

E. G. Fleming,
Company Commander and Acting Adjutant.

3rd. Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, July 1st, 1915:—

Week-End Parades.—Saturday.—The Battalion will parade outside Baker Street Station at 2.30 p.m., and proceed by train to Wembley Park. "A" Company, under the command of Mr. F. H. Stevens, will take up a defensive position between the Brent Reservoir and the Metropolitan Railway line. "B," "C" and "D" Companies, under the command of Mr. H. O. King, will detrain at Kilburn Station and endeavour to effect an entrance into Wembley Camp. All roads north of the Brent Reservoir and south of the Metropolitan Railway line will be out of bounds. Grounds under standing crops are out of bounds. Mr. W. Ridd will be umpire.

Sunday.—As last week.

A. G. Joiner, *Captain and Adjutant.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Walsall T.C. has increased the salary of Mr. A. Prentice, station superintendent at the electricity works, from £225 to £250 per annum.

The Nuneaton T.C. has granted the electrical engineer leave of absence, he having accepted a position as lieut.-commander in the Royal Naval Volunteer Reserve, and has voted him an allowance of £200 per annum during his temporary absence, this to be modified in the event of his promotion to higher rank.

Having regard to the fact that it would be advisable to have a recognised deputy electrical engineer in control of the St. Pancras electricity works in the absence of the chief electrical engineer, it is proposed to alter the title of Mr. J. T. Baron, resident and supervising engineer, to that of deputy electrical engineer (resident), such alteration to be made without any increase of salary.

Mr. W. H. Ellis, assistant mains superintendent, Chester Corporation electricity department, and lecturer in Electrical Engineering at the Chester Technical Schools, was married to Miss L. M. Laird, of Chester, on Wednesday, June 23rd. The bride was given away by her father, Mr. W. D. Laird, Wh. Sc.

Mr. Thomas H. Clementson, assistant superintendent of the Clyde Valley Electrical Power Co.'s station at Motherwell, was recently presented by the staff with a marble clock on the occasion of his marriage. Mr. Howie, the works chemist, made the presentation.

Tramway Officials.—Mr. J. C. Whiteley, who has been appointed engineer and manager of the South Shields Corporation Tramways, was, on Saturday last, the recipient of a fumed oak rolled top desk, subscribed for by the staff and employés of the Chatham and District Light Railways Co. Mr. W. Jensen, the general manager, in making the presentation, referred to the valuable assistance he had received from Mr. Whiteley during the past eight years. Mr. Bexley, cashier, seconded Mr. Jensen's remarks, and Mr. Taylor, carpenter, spoke on behalf of the workmen.

Mr. F. Jeffery, inspector on the Bournemouth Corporation Tramways since their construction 13 years ago, has resigned chiefly from health reasons, and the staff have presented him with a silver watch and an illuminated address.

The Ilford U.D.C. has granted the tramways manager, Mr. L. Harvey, permission to join the Volunteer Munitions Brigade.

General.—Mr. E. R. Peacock, who served on the committee representing the holders of the 5 per cent. first mortgage bonds of the Barcelona Traction, Light and Power Co., has been appointed president in place of the late Dr. Pearson.

Mr. H. E. Apps, an electrical engineer in the employ of Messrs. Sandycroft, Ltd., Sandycroft, has received a commission, and is being drafted to the South Wales Borderers.

Mr. E. J. Nally, general manager of the Marconi Wireless Telegraph Co., of America, has gone to the Pacific Coast and Hawaii, in connection with wireless service soon to be extended to Japan, for which preliminary tests are now in progress with the Japanese Govermental stations, now approaching completion.—*T. and T. Age.*

Roll of Honour.—Mr. A. P. Featherstonhaugh, who had been 14½ years on the staff of the County of London Electric Supply Co., Ltd., has been killed in action. Mr. Featherstonhaugh had served in the London Rifle Brigade since November, 1908, and held the rank of Sergeant. Mr. G. Boast, also in the service of the County of London Co., was killed in action while serving with the 23rd County of London Regiment; and Mr. P. G. M. Brown, another employé of the County Co. was killed in action while serving with the London Rifle Brigade.

Private Arthur Sykes, of Blackpool, who was killed in action during the charge of the 8th Liverpool Irish, on June 16th, was employed by Mr. Kay, electrician, of Blackpool.

Private George Robinson, of the Liverpool Scottish, was killed in action on June 16th. His officer stated in a letter to his widow that he fell in a charge which would stand for ever as a glorious achievement in the history of the battalion. Private Robinson, who was 30 years of age, was an electrical engineer with Messrs. Dick, Kerr & Co., Preston.

Private Robert John Marsh, 15th Battalion of the 48th Highlanders, Canadian Regiment, who has died of wounds received in action in Flanders, was an electrical engineer of Toronto. He was a native of Blackburn.

Private John A. Henderson, 6th Manchester Regiment (Territorial Force), who was apprenticed with the British Westinghouse Co., Ltd., has been wounded in the left thigh in action in the Dardanelles, and is in hospital at Malta.

Sergeant Jas. Gordon, 5th South Lancs. Regiment, on the staff of the B.I. and Helsby Cables, Ltd., of Prescot, has been killed in action. He was 22 years of age.

Private R. J. Thomas, 1st Dorset Regiment, who was on the clerical staff of the British Westinghouse Electric and Manufacturing Co., Ltd., has died in Flanders from gas poisoning. He was 31 years of age.

Private Tom Healey, till recently employed by Mr. W. Caton, electrical engineer, Oldham, has been killed in action in the fighting in the Dardanelles. He was 19 years of age, and was serving in the 10th Manchester Regiment.

Private W. Bramwell, of the Royal Scots Fusiliers, a reservist who upon the outbreak of war was called up from his employment at the United Electric Car Co.'s works, Preston, has been killed at the Front.

Private Norman Lloyd, of Higher Broughton, has been killed in action. He was an engineer employed at the British Westinghouse Works at Trafford Park, and was 28 years of age.

Private Peter O'Hare, 2nd York and Lancaster Regiment, formerly employed at the British Westinghouse Works, has been killed in action.

Private George Wood, in the employ of the St. Helens Cable Co., of Warrington, has been wounded in the chin.

Private Joseph Bond, of Warrington, originally reported killed in action, is now stated to be in a hospital in France suffering from wounds. He is 25 years of age, and an employé of the St. Helens Cable Co., Ltd.

Captain A. B. Layton, of Stockton Heath, near Warrington, electrical engineer and departmental manager at the soap works of Messrs. J. Crosfield & Sons, has been slightly wounded.

Sergeant Sam Marsh, who was for nine years engaged as a fitter at the Middleton Electric Traction Co.'s shed, has been awarded the D.C.M.

Corporal Frederick James Blewden, 1st Battalion Canadians, was killed in action in France on the night of June 15th. He was a son of Mr. J. Blewden, car-shed and workshop superintendent, Portsmouth Corporation Tramways, and was connected with tramway work practically the whole of his life, dating back to the horse-car days in Liverpool. He went to Portsmouth in 1901, when his father was appointed car-shed and workshop superintendent of the Corporation tramways there. In April, 1912, he emigrated to Canada, and from that time until the outbreak of war was employed as an electrical fitter by the Ottawa Tramway Co.

Amongst members of the 4th Battalion South Lancs. Regiment (Warrington), who have fallen in action, are Private Chas. Knowles and Private Arthur Earley, who were on the staff of the St. Helens Cable Co., Ltd.

We read in the *Times* that Second Lieutenant Laurence Turnbull, 3rd, attached 2nd, Bedfordshire Regiment, who was killed in France on June 16th, was educated at Stephens' Institute of Technology, New Jersey, U.S.A., and on the completion of his college career he obtained an appointment with the Westinghouse Electric and Manufacturing Co., in New York. He returned to England in October last. He had only been at the Front three weeks.

Major J. F. S. Lloyd, of the 6th North Staffs. Regiment of the Territorials, who was killed while with the Forces abroad, was a director of the Weldless Steel Tube Co., of Birmingham. He was 34 years of age.

Second Lieutenant Norman C. Lowson, Special Reserve, Royal Engineers, Glasgow Territorials, son of Mr. James Lowson (senior partner in Messrs. W. C. Martin & Co., electrical engineers, Glasgow), has been mentioned in Sir John French's latest dispatch for gallant and distinguished conduct in the field. He is a B.Sc. in engineering of Glasgow University. His father, Major James Lowson (ret.), who is chairman of the Scottish Local Section of the I.E.E., served 25 years with the old 1st Lanark Rifles.

Corporal A. Evans, of the 20th Hussars, who was engaged at the works of the Rees Roturbo Manufacturing Co., Ltd., of Wolverhampton, has been killed accidentally by a bomb in France.

Three members of the staff of Siemens Dynamo Works Co., of Stafford, have been mentioned in dispatches, viz., Sergeant G. Jackson, who is recommended for the Distinguished Conduct Medal, Lance-Sergeant Wollacott, and Corporal Robinson. All belong to the Coldstream Guards. Private W. Tomlinson, of the same regiment, who was with the same firm, has been wounded in action by shrapnel.

Obituary.—Mr. C. E. Spagnoletti.—We deeply regret to learn that Mr. Charles Ernest Spagnoletti, M.Inst.C.E., Hon. Member and Past-President of the Institution of Electrical Engineers, passed away on June 28th, at his residence at Hampstead, at the advanced age of 83 years. He had been ill for a week with pneumonia. Mr. Spagnoletti, who was of Italian noble descent, was born in London, and as a lad was in the employ of the Electric Telegraph Co. As a young man he became chief of the G.W. Railway telegraph department, and during his connection with that and other railway companies (the Metropolitan and District systems) he invented and developed many signalling devices and apparatus and other electrical inventions for use in the operation of railways. When the City and South London tube railway was constructed, about 1890, the deceased gentleman was its consulting electrical engineer, and at different times since then he has acted in a similar capacity for other undertakings — the phonopore and the electrical omnibus coming in for a share of his attention. It is 30 years ago this year since he filled the office of president of the I.E.E. when it was known as the Society of Telegraph Engineers and Electricians. Mr. Spagnoletti was one of the original members of the Institution, his membership dating from the year 1872. He has been actively interested in many other societies, and in years gone by played a prominent part as a juror and in other capacities in connection with important home and international exhibitions. Of late, owing to advancing years, he has been less closely identified with the public side of electrical affairs, but by many of the old guard he is intimately remembered, and news of his loss will be learned by them with much regret. Members of the Electro-Harmonic Society will be interested to know that Mr. Spagnoletti was one of the first to approve of the objects of that Society; indeed it may be said that he was the first private individual to be approached by those who had the initiation of the Society in hand, and he gave the proposition then put forward by Mr. H. Alabaster his whole-hearted support. The funeral takes place this afternoon (Friday), at four o'clock, at West Hampstead Cemetery.

Mr. A. C. Hurtzig.—We deeply regret to record the death of Mr. Arthur Cameron Hurtzig, M.Inst.C.E., which occurred at his residence at Dulwich on June 26th, at the age of 62 years. Mr. Hurtzig's name will be familiar to our readers by reason of his connection with the Chester Corporation hydro-electric scheme. Mr. Britton's scheme was finally submitted to and approved by him. One of us has had the pleasure of serving on several Committees with the deceased gentleman, and no one could wish to have a more genial and kindly colleague.

The death occurred suddenly on June 19th of Mr. Albert Shillito, of Chelmsford, who was formerly electrical engineer at Eton College. He was 52 years of age.

NEW COMPANIES REGISTERED.

Lowa Engineering Co., Ltd. (140,720).—This company was registered on June 19th, with a capital of £1,500 in 1,000 participating preference shares of £1 each and 10,000 ordinary shares of 1s. each, to carry on the business of electrical, mechanical, sanitary, gas, hydraulic and general engineers and contractors, steel converters, tinsmiths, coppersmiths, metal workers, builders, fitters, wire dealers, galvanisers, japanners, enamellers, electro-platers, manufacturers of theatrical and general stage effects and scenery, fans, lamps, engines, rheostats and electrical apparatus, etc. The subscribers (with one participating preference share each) are: W. Adams, 74, Vauxhall Bridge Road, S.W., engineer; R. F. Hutchinson, 74, Vauxhall Bridge Road, S.W., engineer. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Qualification, £50. Registered office: 74, Vauxhall Bridge Road, S.W.

Electric Lamp Repairs Co., Ltd. (140,740).—This company was registered on June 22nd, with a capital of £5,000 in £1 shares, to carry on the business of collectors and repairers of electric lamps with broken filaments or blackened bulbs, manufacturers of and dealers in electric fittings and globes, etc., and to adopt an agreement with Refilments, Ltd. The subscribers (with one share each) are: G. O. Barras, 2, Edridge Road, Croydon, engineer; E. G. K. Calder, Rosslyn, The Chase, Coulsdon, Surrey, electrical engineer. Private company. The number of directors is not to be less than two or more than seven; the first are H. Lintott (chairman), G. O. Barras, and E. G. K. Calder. The two last named are joint managing directors, with £400 each per annum (free of income tax) as remuneration. Remuneration of H. Lintott £250 per annum (free of income tax). Qualification, 100 shares. Solicitors: Lord & Gunn, 4, Dove Court, Old Jewry, E.C.

Watson & Sons (Electro-Medical), Ltd. (140,765).—This company was registered on June 23rd, with a capital of £25,000 in £1 shares (7,000 preferred), to take over the electro-medical businesses (1) carried on by W. Watson & Sons, Ltd., at 196, Great Portland Street, W., and (2) carried on by L. B. Miller at 66, Hatton Garden, E.C. The subscribers (with one share each) are: C. H. Watson, 313, High Holborn, W.C., manufacturing optician; G. Pearce, 196, Great Portland Street, W., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are C. H. Watson and F. W. W. Baker (both permanent). Remuneration, £50 per annum, divisible. Registered office: 196, Great Portland Street, W.

Peerless Seamless Rubber Co., Ltd. (140,731).—This company was registered on June 21st, with a capital of £2,000 in £1 shares, to carry on at Richmond and elsewhere the business of manufacturers of and dealers in india-rubber goods, raw and waste rubber and rubber substitutes, reclaimed rubber, gutta-percha in raw and manufactured states, fibre and other compounds, celluloid and asbestos goods, packing materials, bottle stoppers, corks, bottles and machinery for bottles, electric cables, wires, fittings and machinery, leather cloth, waterproof and fireproof materials, moulds and machinery for rubber goods, motor tires and accessories, manufacturers of and dealers in motor cars, cycles and boats and accessories, etc., and to adopt an agreement with J. Briere and R. Dequin. The subscribers (with one share each) are: J. Briere, 203, Richmond Road, East Twickenham, motor engineer; R. Dequin, 3, Chudleigh Villas, Whitton Road, Twickenham, manufacturers' agent. Private company. The number of directors is not to be less than two or more than three; the first are J. Briere and R. Dequin. Qualification, £100. Registered office: Station Yard, Richmond.

London Glass Works, Ltd. (140,783).—This company was registered on June 25th, with a capital of £30,000 in £1 shares (29,000 pref.), to carry on the business of glass manufacturers, manufacturers of and dealers in table and household glassware, bottles, jars, lamp and electric light globes and bulbs, and all kinds of glassware for lighting and heating purposes, etc. The subscribers (with one share each) are: C. Brooks, 70 and 71, Chiswell Street, E.C., merchant; H. W. Hill, 80, Finsbury Pavement, E.C., clerk. Private company. C. Brooks is permanent governing director, with power to appoint other directors. Registered office: 70 and 71, Chiswell Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Brilliant Arc Lamp & Engineering Co., Ltd.—Particulars of £3,000 debentures, created June 18th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: the company's undertaking and property, present and future, including uncalled capital. No trustees. A memorandum of satisfaction in full on June 18th, 1915, of debentures dated December 11th, 1914, and November 17th, 1913, securing £100 and £300 respectively, has also been notified.

Defries & Goldman, Ltd.—Particulars of £200 debentures, created June 10th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Oriental Telephone & Electric Co., Ltd.—A memorandum of satisfaction to the extent of £900 on June 9th, 1915, of debenture stock covered by trust deed dated June 28th, 1905, and a deed of acknowledgment dated June 12th, 1907, securing £200,000, has been filed.

Telephone Co. of Egypt, Ltd.—A memorandum of satisfaction to the extent of £850, on June 9th, 1915, of debenture stock, covered by trust deed dated July 27th, 1904, and three supplemental deeds of acknowledgment dated February 21st, 1906, March 4th, 1908, and October 27th, 1909, securing £200,000, has been filed.

North-Eastern Electric Smelting Co., Ltd.—A memorandum of satisfaction in full on April 20th, 1915, of debentures dated November 13th, 1914, securing £4,500, has been filed.

Carleon Electrical Co., Ltd.—Mortgage, dated June 8th, 1915, to secure £1,500, charged on leasehold premises, formerly part of Lonesome Farm, Norbury, comprising factory and workshops. Holders: Bonecourt Surface Construction, Ltd., Parliament Mansions, Victoria Street, S.W.

South London Electric Supply Corporation, Ltd. (50,392).—Capital, £310,000 in 10,000 preferred shares of £5 each and 65,000 ordinary shares of £4 each. Return dated April 6th, 1915. 6,000 preferred and 65,000 ordinary shares taken up; £4 per share called up on the ordinary and £5 per share on the preferred. Return states £310,000 paid; but last balance sheet says £260,000 on ordinary and £30,000 on preferred, which appears to be correct. Mortgages and charges: £130,000.

Bath Electric Tramways, Ltd. (74,278). — Capital, £230,000 in £1 shares (75,000 preferred, 125,000 preferred ordinary, and 30,000 deferred ordinary). Return dated April 1st, 1915. 75,000 preferred, 75,606 preferred ordinary, and 30,000 deferred ordinary shares taken up; £1 per share called up on 75,000 preferred and 75,606 preferred ordinary shares; £150,606 paid; £30,000 considered as paid on 30,000 deferred ordinary shares. Mortgages and charges: £155,739.

Simplex Conduits, Ltd. (88,290).—Capital, £100,000 in 10,000 preferred of £5 each and 50,000 ordinary shares of £1 each. Return dated March 23rd, 1915. 10,000 preferred and 40,000 ordinary shares taken up; £5 per share called up on the preferred; £50,000 paid; £40,000 considered as paid on the ordinary. Mortgages and charges: Nil.

Urban Electric Supply Co., Ltd. (57,986).—Capital, £640,000 in 80,000 ordinary shares of £3 each, 50,000 preferred shares of £5 each, and 150,000 unclassified shares of £1 each. Return dated April 14th, 1915. 80,000 ordinary and 50,000 preferred shares taken up; £3 per share called up on the ordinary and £5 per share on the preferred; £490,000 paid. Mortgages and charges: £408,201.

CITY NOTES.

Rangoon Electric Tramway and Supply Co., Ltd.

The annual meeting was held on June 23rd at 3, Great Winchester Street, E.C. Sir F. W. R. Fryer, K.C.S.I., who presided, said that after providing for all charges, including depreciation and reserve, there remained £8,076 for distribution among the ordinary shareholders, as against £11,674 in the previous year. The directors recommended the payment of a dividend at the rate of 3 per cent., carrying forward £2,765 to the next account. Up to July 31st of last year the receipts showed a considerable increase over the corresponding months of the previous year, the increase to July 31st being approximately Rs. 20,000 and, had conditions remained normal, there would have been every reason to anticipate a record year. As it was, they ended up with a decrease on the tramway receipts as compared with last year of Rs. 49,000. Since the end of March last, however, traffic had shown a tendency to improve, and it was believed that confidence was being gradually regained and that traffic would again come up to reasonable expectations. During the year the experimental motor omnibus service had been maintained with the results shown in the report. In the private lighting and power department there had been an increase in receipts of 11½ per cent. The working expenses showed a small *pro rata* increase, which was, unfortunately, likely to advance considerably in the future owing to the increased cost of coal and other stores. Negotiations had been proceeding for some time between the municipality and the company for an increased amount of lighting and a revision of the existing arrangements; the directors, fully recognising the public nature of the company's operations, were desirous of meeting the demands of the authorities as far as they could be met with due regard to the interests of the shareholders. With the increased number of installations, the house wiring and supply department had increased its gross receipts, and the profit had also shown a satisfactory increase. A provident fund for the benefit of the staff was started on July 1st, 1914, and all the members under agreement had joined it. The staff had agreed to become subscribers to the fund, and the company's contribution increased the savings by nearly 100 per cent., and so added considerably to the advantage of the service. Owing to the high cost of coal and materials, the board felt that the advantages which they were giving both from the tramways and from the public and private lighting could no longer be continued at the present low rates; but it was only fair to the shareholders that some slight addition to the existing charges be made in order to meet the present high costs. The board had this very important question under their consideration at present. To meet the increased demand for public and private lighting, considerable capital expenditure had already been, and must in the immediate future be, further incurred. That had only been deferred owing to the stringent financial conditions prevailing since last August. In connection with the directorate Mr. Frank Tobin and Mr. James Taylor had resigned their seats on the board, purely for personal reasons. To fill the vacancies the board recommended the appointment of Col. A. C. de Joly de Lotbiniere, C.S.I., C.I.E., R.E., and Mr. H. D. Dickie. For some time past it had been felt that the directorate would be strengthened by the addition of a gentleman having expert knowledge, and in Col. de Joly de Lotbiniere they had a man who had filled the important position of electrical adviser to the Indian Government, during which time he carried through the Mysore and Kashmir schemes.

Mr. James Halliday seconded the motion, and the report was adopted.

Replying to a vote of thanks for presiding, the Chairman said there was every prospect that they would see a great expansion in the electric supply department of the company in the near future. Many projects were before the board at the present time to that end, but it was difficult to go forward with them while the war lasted. He trusted also that they would see the tramway traffic improve; in fact, it already showed a tendency to do so.

North Melbourne Electric Tramways and Lighting Co., Ltd.

The results for the year ended September 30th, 1914, show an increase in earnings due to the development of the district served by the company, which benefited both tramway and lighting departments; the extension of the lines over Flemington Bridge also contributed towards the tramway earnings. Revenue per c.m., 10.97d.; car miles run, 463,293; total passengers, 2,874,021; as compared with 10.35d. per c.m., 443,817 car miles, and 2,590,690 passengers in the previous year. Three hundred and ninety-nine lighting consumers have been connected, making the total connections 1,489. Revenue increased by 15 per cent., expenses by 6 per cent., and net revenue by 38 per cent. Capital expenditure during the year amounted to £5,398. The directors record their appreciation of the excellent services rendered by the manager, Mr. Murdoch, and the staff.

Annual meeting: To-day.

Official Notices re Companies.—The following companies will be struck off the register at the expiration of three months, unless cause is shown to the contrary:—

British Automatic Telephone Syndicate.
British Magneto Co.
Consolidated Electric Works and Appliances.
Eclipse Boiler Furnace (London and South).
Gamble's Patent Telephone Recorder Co. (Continental).
Haywards Heath Electric Supply Co.
Magnetic Separator.
Pacific Radiotelegraph Co.
Premier Electric Control.
Radio and Electric Power Co.
Rail and Road Traction.
Silent Day Engine Syndicate.
Spiral Turbine Syndicate.
Sunturbo Engineering Co.
Tramway Construction Syndicate.
Tungsten Metal Co.
United Electrical Construction Syndicate.

Sheerness and District Electric Power and Traction Co., Ltd.

The total revenue during 1914 was £13,350, and the working expenses £11,489, leaving £1,861. Interest on loan required £543, and debenture interest £1,368, leaving a surplus of £119, which reduces the balance at the debit of revenue account to £1,326. The revenue of the electricity department was £8,842, and the expenses £8,912, representing a decrease in revenue of £625 and in working expenses of £3,151. The units sold were 1,368,885, a decrease of 102,355 due to the outbreak of war and the shortage of labour. The consumers number 270, as compared with 259 in 1913. The traction undertaking (light railways and omnibuses) produced in gross receipts £4,456, and the working expenses were £4,396, resulting in a surplus of £59, as compared with £105 in 1913. The passengers carried increased from 639,000 to 976,440, with the same mileage open and the same number of cars and omnibuses.

British Electric Traction Co., Ltd.

The annual meeting was held on Friday last at the Holborn Restaurant.

Mr. E. Garcke, who presided, said that the simplest way of describing the results of the year's operations was to say that they were as in 1913, only better. They were proposing to pay the same dividend on the preference stocks, viz., £52,467, and they placed to reserves and carry forward £82,589 in all, compared with £73,615 in the preceding year. Last year they placed £50,000 to reserve against investments. This year they carried it forward because they did not wish to disturb the estimate of the dividends upon which the scheme of rearrangement was based. The first half of last year gave promise that the results of the whole year would be much better than the figures now produced, but the outbreak of the war altered that as it had altered everything. It was not easy to describe in a few words what had been the effect of the war upon their business as a whole, for the various departments had been differently affected. The tramways and light railways serving holiday centres had suffered serious loss of traffic. On the other hand, the tramways in manufacturing districts, especially those where materials of war were produced as at Barrow, on the Clyde, and at Tyneside, showed large increases of traffic, and some of the smaller towns where troops had been stationed also showed an expansion of business, but the money receipts had not increased in direct proportion to the number of passengers carried, because soldiers in uniform had been allowed to travel at reduced rates and various other concessions and expenses due to the war had had the result that the average fare per passenger showed a slight diminution, and the net profits had in some cases been reduced. The war had hit the motor omnibus part of the business very badly. They were in course of building up a large, and they hoped, profitable business with motor omnibus services in connection with their tramways and light railways, and to some extent in other districts, but on the outbreak of war all their best vehicles were impressed by the Government, and it had been found impossible to obtain replacements because the War Department had also impressed the entire output of the leading motor omnibus factories. Of course they had been paid the fair value of the vehicles, but they had not obtained any compensation for the loss of business. The electrical supply side of the business had, on the whole, been well maintained. In some respects the sale of electricity had been reduced owing to less light being used; on the other hand, the demand for electric power had increased. The Brush Company had been very busy, partly because the new turbine which the company was manufacturing proved a big success. Considering all things, the business results of their operations during the year, might be regarded as satisfactory, and they also showed the advantages of a large combination of varied elements, for while some of their departments had suffered, others had prospered, and on balance they showed some advance. Questions affecting both capital and labour had been placed on an entirely new plane, and the war conditions had uprooted many of their former theories and had in various ways upset their normal business practice. The associated companies had encouraged their employés to enlist for service during the war, although the drain upon the personnel had led in some cases to a reduction of the services, and in nearly all cases to difficulty in operating the undertakings. Altogether about 2,500 of their employés were now serving in the Forces, and of the head office staff alone about 60 young men, including several secretaries, had gone to the Front. One effect of the war was an all round increase in wages, which was a serious matter to the associated companies, as they were unable to obtain compensation by raising fares or increasing the price of their electricity. In the case of the Brush Company the increase in wages amounted to about £12,000 per annum. He feared that the general increase in wages would produce many difficulties later. The huge destruction of fixed and circulating capital which was unavoidable in the case of war, would have to be made good by retrenchment and economy. They would all have to work harder and spend less. It would not be possible to maintain the present high level of wages, and much distress he feared would follow. However, those were difficulties of the future, and the best way of meeting them was to deal effectively with present difficulties. As far as the particular industries in which that company was concerned he saw no reason to be pessimistic, for he felt sure that when the war was concluded, local authorities and others who had electrical contracts to place would not again be so unwise as to place them in Germany for the sake of a slight advantage in price. Therefore despite present and future anxieties he looked forward with confidence to their being able to maintain the position they had attained and the progress they were making. Of course in the present conditions they were not starting any new enterprises, except such as were necessitated by the war. All capital expenditure, however, could not be suspended by public service undertakings, whose gradual growth was the law of their existence. Several of their associated companies had therefore obtained Treasury consents for issues of capital, some of which had already been successfully made. In regard to the accounts, their investments on undertakings stood at £4,771,842, or nearly £100,000 more than in the preceding balance sheet, and on that larger amount the average yield had been 4.55 per cent., as compared with 4.47 per cent. last year. They could well understand that the yield would have been better had it not been for the war. In spite of the adverse conditions they had sold investments of the book value of £59,379 at a net loss of only £117. Proceeding to explain the position in regard to the scheme for the re-arrangement of the capital, the Chairman said they could not ignore the fact that the interests of the preference stockholders and those of the ordinary shareholders were not identical. They submitted the scheme last year to the stockholders and asked for their views upon it, and the replies they had received showed unmistakably that the majority considered the scheme fair and equitable to all parties. As a result of discussions, however, a few small modifications had been suggested which the directors were willing to adopt. At present there were two classes of preference stock and two classes of ordinary, and there were the income certificates; and all the stocks behind the debentures ranked equally as regarded capital. The total capital was £2,947,380 besides £266,371 income certificates. The net effect of the proposal was to write down the capital by £908,372 and to divide it into two classes only, viz., 6 per cent. cumulative participating preference stock with priority as to capital, and ordinary stock ranking after the preference as to capital and dividends. The preference stock would be issued to the holders of the existing 6 per cent. preference stock, who would receive the same amount in new stock as they held at present. Holders of the present 7 per cent. non-cumulative preference stock would receive 35 per cent. of their present holdings in new preference stock, and the holders of the income certificates would receive 10 per cent. of their present holdings in new preference stock. Of the new ordinary stock there would be issued to the holders of the present 7 per cent. non-cumulative preference stock, 65 per cent. of their present holdings, making with the 35 per cent. which they would receive in new preference stock 100 per cent., equal to the amount of their present holdings. The present preference stock holders were not asked to bear any portion of the reduction of capital, which fell entirely upon the ordinary stockholders. The holders of the existing 6 per cent. preferred ordinary stock would receive 50 per cent. of their present holding in new ordinary stock, and the holders of the existing deferred ordinary stock would receive 30 per cent. of their present holdings in new ordinary stock. The holders of the income certificates would receive 25 per cent. of their holding in new ordinary stock, making with the 10 per cent. in new preference stock, 35 per cent. of their present holdings. It might be thought by some that the scheme ought to be postponed because of the uncertainties of the future, but the directors did not take that view. They did not think that the war would materially affect the capital values of their undertakings. The estimate of dividends which he submitted last year showed that after the re-arrangement they should be able to pay 4 per cent. per annum on the new ordinary stock and increase the dividends steadily in future years. He saw no reason to revise that estimate now, and he hoped no circumstances would arise which would necessitate a reduction in the estimate, but the directors were anxious to have it understood that during the war and during the strenuous times that would follow after, the distribution of profits should not be looked upon as a thing that could be done without regard to the general situation and the permanent interests of the company. It was quite possible that if the war was prolonged the Government embargo on the issue of new capital might become even more stringent than it already was, and it was quite conceivable that the companies in which they were interested might find it prudent and necessary to employ their cash resources for more pressing needs than the payment of dividends. They fully recognised that the payment of dividends was the ultimate object of all their work, but it was impossible to say what situation this war might produce, and it was only right that he should, without in any way alarming the stockholders, utter that word of warning at a time when they were proposing to reduce the capital and were raising expectations of larger dividends.

Mr. C. Shirreff Hilton seconded the motion which, after a brief discussion, was agreed to.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended May 28th, 1915, amounted to 1,904,829, compared with 1,425,593 units in the corresponding four weeks of 1914.

National Electric Construction Co., Ltd.

The annual meeting was held on June 24th at 3, Laurence Pountney Hill, E.C. Mr. L. B. Schlesinger, who presided, said that the negotiations for the contract in Denmark which had been in hand for some time had been suspended on account of the war, and the contract in connection with the Bagdad scheme was for the time being in what he hoped might be called a state of suspended animation. Owing to the Treasury restrictions, he was afraid that finance during the period of the war would be practically impossible. Provisional Orders granted by the Board of Trade for the electric lighting of districts contained a clause to the effect that the Order was to commence to run from a date to be fixed by the Board of Trade after peace had been declared, and he believed that practically all Acts of Parliament for tramway extensions, etc., prohibited the raising of capital for a period of twelve months after peace had been declared. In consequence, there would be little general contract work to be secured. They were endeavouring to secure construction work from other channels, and he thought their efforts would be successful. They had an arrangement with the operating companies controlled by the Electrical Finance & Securities Co., Ltd., whereby they carried out the construction work and, in addition, supplied the materials so long as they could supply at prices not unfavourable to the company. When the war was over he thought they could look forward to a constant flow of construction work from that company. Proceeding to refer to the various undertakings in which the company was interested, he said the war had affected their progress, with two exceptions. In addition to decreased revenue they had had to face increased expenditure owing to dearer coal and materials, and war bonuses and payments to dependents of the employés who had enlisted and whose positions were promised to be kept open. The revenue of the Rhondda Tramways Co. up to the date the war broke out showed an increase of £2,095 over the corresponding period of 1913, but since then there had been a decrease, so that by the end of the year the increase was reduced to £566. There was a decrease this year up to date of £1,760, as against the corresponding period of last year, the average decrease being £72 per week. That was likely to continue, although probably from August to the end of the year the decrease would not be so noticeable. The railless traction system which was opened in the district towards the end of last year was suspended in March owing to the condition of the roads and was not yet working. He understood, however, that they would be in a position to resume the service shortly, although owing to the decreased population they could not expect to obtain the results which they would get in normal times. The profit earned for 1914 was £8,190, which with £593 brought forward made a total of £8,783. £2,000 had been put to reserve and renewals account, and the balance of £6,783, which was more than sufficient to have paid the full dividend on the preference shares, had been carried forward. The results of the Torquay tramways for the first half of the year appeared to forecast further increases in revenue and profit, but with the outbreak of war all holiday traffic ceased, and during the two months of August and September there was a decrease in the revenue of £3,786 as compared with 1913. It was satisfactory, therefore, that the company should have been able to pay a dividend of 3¼ per cent. on the ordinary shares after providing for reserve and depreciation on the same scale as in prevous years. There was a decrease in receipts to the 20th inst. of £512, as compared with the same period last year, although the estimated decrease in profit was negligible. The directors were, however, inclined to believe that the results for the current year would be worse than those for 1914. In regard to the Dewsbury and Ossett tramways, after providing for sinking fund and interest payments to the local authorities, a profit of £1,188 was earned, a decrease of about £399. For the current year, up to date the receipts showed an increase of £320. In the case of the Mexborough and Swinton Tramways Co., notwithstanding the war, the profits for the year amounted to £6,930, compared with £6,460 in 1913, which permitted of the payment of a dividend of 2¾ per cent., as against 2½ per cent. last year. The new 300-kw. steam turbine set was started working in June, 1914, and during the period it was running there was a very substantial reduction in costs. A breakdown occurred in February last, and owing to the difficulty experienced by the manufacturers in getting the material necessary for the repairs the turbine was still out of service. In the case of the Musselburgh and District Electric Light & Traction Co., there was again a satisfactory increase in the profit, which amounted to £7,547 as compared with £7,169 in 1913, and £5,901 in 1912. The results for the current year, however, had been seriously affected, first, by a strike of the company's employés, which lasted about a month; and secondly, by the war. Musselburgh was on the Firth of Forth, and the lighting restrictions were particularly severe. However, he thought that when the war was over the results for the past two or three years predicted steady progress. The results in the case of the City of Oxford Tramways Co. were very gratifying. For the year 1914, after providing for depreciation on a generous scale, there was a balance sufficient to pay a 4 per cent. dividend. The directors, however, only paid 2 per cent., carrying forward the balance. At Bo'ness, Carnarvon, and Wisbech, the military restrictions as to lighting were very severe, and the undertakings there had suffered severely, although at Bo'ness, owing to the increased demand for power, since the close of the year there had been a substantial improvement, and it looked as if the works would have to be extended. The net result of the year was that there was a balance of £1,675 carried to the credit of profit and loss, as compared with £171 for 1913, and after providing £1,550 for the debenture redemption fund there was a balance of £125 to be carried forward. Had it not been for the war the outlook was distinctly more promising than it had been for some time past, but with all the undertakings in which they were interested, affected as they were, and the financial restrictions imposed by the Treasury, they must be satisfied if they could make both ends meet for the time being.

Mr. J. T. Jervis seconded the motion, and the report was adopted.

Marconi International Marine Communication Co., Ltd.

In their report for 1914 the directors state that during the last five months of the year the company's business suffered considerable disorganisation and some loss, due to the war entailing a great increase of work and strain upon those responsible for the conduct of the business, but, notwithstanding the adverse circumstances, the business had continued to show substantial progress. The net profit was £55,668, after deducting £28,000 for depreciation and debenture interest, compared with a net profit of £37,029 for the preceding year. The revenue from ships' telegrams, subsidies, etc., amounted to £175,021, which was a substantial increase over the amount for 1913, namely, £146,317.

The number of telegraph stations owned and worked by the company as public telegraph stations on the high seas increased from 788 at the end of 1913 to 905 at the end of 1914. Although these figures denote a marked appreciation of the company's organisation, the increase would have been even more satisfactory had normal conditions prevailed. During the current year further progress is being made, the number of steamers fitted to June 19th having increased to 970.

The fact that there are now over 2,000 ships, exclusive of ships of war, fitted with Marconi telegraph stations, and for the most part worked under the direction of this company and its associated companies, has an importance in these times which all shareholders will appreciate.

The Amalgamated Wireless (Australasia), Ltd., in which this company is interested, has paid a dividend of 4 per cent. in respect of the period to June 30th, 1914, and an interim dividend of 2½ per cent. in respect of the half-year ending December 31st, 1914.

The amount to the credit of profit and loss account now stands at £64,856, including £6,068 brought forward. The directors recommend a final dividend for 1914 of 5 per cent., which, with the interim dividend, makes 10 per cent. for the year.

The company has sustained some loss in consequence of the attacks upon our mercantile fleet by enemy submarines, for which it is contemplated compensation will be received. However, the directors think it desirable that £10,000, a sum far in excess of all losses to date, should, in the meantime, be placed to the credit of a special reserve account, and having regard to the prevailing circumstances and the desirability of their holding a strong financial position, with ample cash resources to provide for the continuous increase of telegraph installations on board ships, it is deemed prudent to carry forward £20,747, after allocating £3,500 to the repayment of debenture account.

The option on the 43,916 unissued shares of the company for two years from June 27th, 1913, mentioned in the last report, has not been exercised.

The directors record the death of two of their colleagues, General Albert Thys, of Brussels, and Major Samuel Flood Page.

Annual meeting: July 7th.

Edmundsons' Electricity Corporation, Ltd.

The net profit for the year ended March 31st, 1915, after providing for administration expenses and for mortgage and debenture stock interest and redemption, amounts to £23,240. After adding £2,125 brought forward and deducting the interim half-yearly dividend paid in January last on the cum. pref. shares, the final half-yearly dividend on the cum. pref. shares requires £6,000, and £3,366 is to be carried forward. For the previous year the net profit was £23,125. There was carried to reserve £9,000.

We extract the following particulars from the schedule showing the gross profits of subsidiary and other companies for the years 1913 and 1914:—

	Gross profit (before providing for capital charges and depreciation).		Lamps connected (equiv. 33-watt).	
	1914.	1913.	1914.	1913.
Alderley	£3,118	£2,849	31,390	27,823
Bromley	12,755	13,196	122,671	115,518
Folkestone	19,487	17,994	145,943	139,100
Guernsey	5,830	5,895	135,471	126,774
Isle of Wight	12,946	14,402	145,794	138,809
Ilfracombe	1,151	1,252	22,550	21,159
Lymington	1,899	2,058	21,085	20,394
Melton Mowbray ..	2,727	2,654	25,152	28,206
Newmarket	2,318	2,630	30,749	29,729
North of Scotland ..	6,937	7,075	95,089	87,570
Ramsgate	3,991	3,492	44,459	40,478
Scarboro' Trams ..	298	730	–	–
Salisbury	5,896	5,783	44,576	43,881
Urban Co.	70,329	61,684	836,519	760,319
Wycombe	6,337	6,242	68,336	65,250
Cromer	892	1,109	17,806	16,828
Dorking	2,393	2,643	26,685	24,141
Frome	2,063	1,446	51,820	48,991
Hamilton	4,300	3,640	78,898	67,368
Surbiton	*3,938	*4,254	*49,943	*47,313
	£169,605	£161,028	1,994,936	1,839,651

* Figures for year ended March 31st.

The total capital expenditure increased during 1914 from £3,098,053 to £3,182,877.

Annual meeting: July 8th.

Crompton & Co., Ltd.

In their report to March 31st, the directors state that the reorganisation of the company's business and management continues to show beneficial results, and, with economies in manufacture, accounts for the improvement in the year's working. The gross profit for the year is £57,911. After deducting general charges, depreciation, interest on debentures and other items, there remains, with the sum carried forward, an available balance of £28,649. The directors recommend that there be placed to general reserve fund £6,500, to special depreciation account £3,500, written off preliminary expenses £1,608, that a dividend be paid on the preference shares at the rate of 7 per cent. per annum, requiring £9,349, leaving £7,691 to be carried forward. The company's works continue to be fully employed.

Annual meeting: July 5th.

For the previous year the gross profit was £48,672. There was placed to general reserve £2,500, written off preliminary expenses £1,500, a dividend of 5 per cent. was paid on the preference shares, and £2,189 was carried forward.

J. G. White & Co., Ltd.

The annual meeting was held on Tuesday at the Cannon Street Hotel, E.C. Mr. J. B. White, who presided, said that when they met a year ago, a month before the outbreak of war, emphasis was laid on the depressed financial conditions then existing, and it was pointed out that the resources of the company were less liquid than they would have wished, also that new contracts were not being received as fast as old ones were being completed. The directors, nevertheless, anticipated a moderately good year. The effect of the war had been very serious, but considering the character of the business, and being as they were largely dependent for additional contracts on the development of new enterprises, they were to be congratulated on being able to meet under as favourable conditions for the company as were shown by the accounts. When the war began the necessity of doing everything possible to conserve their resources became at once evident. If the company was to withstand a possible long period of comparative inactivity, to meet promptly its commitments and obligations when, on the other hand, it might not be able to secure the payment of accounts for materials furnished and work done on all contracts in hand, then not only would it be necessary to watch carefully over the liquid resources of the company but also to institute economies wherever possible. It was for this reason that the directors decided not to pay an interim dividend at the end of December last. Economies were as early as August instituted by reducing the fixed salaries of directors and the staff. A considerable number of the staff had enlisted, but were receiving allowances and their places were being, in so far as it was possible, held open for their return. Other economies had been effected so that while the war had been in progress for seven months out of the total year covered by the accounts, yet expenses had been reduced by 32 per cent. of those for the preceding year. The expenses for the current year should show a reduction of about 50 per cent. over the year to February, 1914, and it would not seem wise to make any further reduction at the present time as it was necessary to keep the organisation complete in outline. The work in some branches, especially in the operating department which had charge of the various companies for whom they acted as managers and engineers, had been increased due to the difficulties of transportation, securing supplies, and staff. With regard to the present position, they had made a profit of £19,772, against £70,387 in the preceding year; and they were recommending a dividend of 6 per cent. If their resources had been more liquid they could have made a larger distribution. The item "percentage of profit to staff and directors," which last year absorbed £7,504 had disappeared. This was unfortunate for the directors and staff interested, and showed that they were suffering with the shareholders in the lessened return. Turning to the balance sheet, there were a few changes from a year ago. On the debit side the sundry creditors had been reduced from £220,583 to £158,549. When he told them that £120,000 of this amount represented a loan they would realise that the ordinary creditors were comparatively small representing only current accounts, which had been paid since the date of the balance sheet, although there were now, of course, similar accounts outstanding. On the credit side it would be seen that they had realised some of their investments; that had been done at a profit. The financial stability and strength of the company really depended on the investments. The directors had gone over these most carefully, and in their opinion, the value appearing in the balance sheet was less than they were actually worth to-day, although under present conditions no appreciable amounts could be sold on the market. From this fact they would appreciate that the previous valuations placed upon the securities were conservative. In connection with the sundry debtors, allowance had been made for any doubtful accounts, and while it might not be possible to collect certain of these until the end of the war, yet the directors considered that they were perfectly good and that their collection with interest would only be a matter of time. With regard to the future they believed that the business of the current year would meet all expenses and leave a substantial profit. As to anything beyond that period it was difficult to forecast, but the directors saw no reason why the company should not continue its successful career.

Mr. W. C. Burton seconded the motion which was adopted without discussion.

Austrian Electrical Companies.

The Elektrizitats Gesellschaft Kolben & Co., of Prague, has declared a dividend of 7 per cent. for 1914 on a share capital of £250,000, being the same rate as in 1913.

The Kabelfabrik und Drahtindustrie A.G., of Vienna, earned gross profits of £109,000 in 1914, as compared with £113,000 in 1913, and net profits of £43,000 and £52,000 in the two years respectively. The dividend is at the rate of 10 per cent., as against 12 per cent. in 1913.

The Gesellschaft für Elektrische Industrie, of Vienna, which is closely associated with the Vienna Bank Verein, realised gross profits of £91,000 in 1914, as contrasted with £90,000 in the previous twelve months. After making provision for depreciation and reserve funds, the accounts indicate net profits of £8,900, as against £8,700 in 1913, and the directors recommend the distribution of 5 per cent. on the share capital of £83,000, being the same rate as in the preceding year.

The A.E.G. Union Elektrizitats Gesellschaft, of Vienna, which is a subsidiary of the Berlin A.E.G., reports that the company suffered from the effects of the war, and the difficulty of procuring raw materials, even at the greatly increased prices. The number of the staff and workmen was reduced to 70 per cent. of the normal through the call to the Colours. The production of munitions of war was undertaken in so far as was possible. As compared with the previous year, the gross profits in 1914 experienced a decrease, and the net profits also declined from £58,000 in 1913 to £26,000 last year. It has been decided to pay a dividend of 4 per cent., this rate contrasting with 8 per cent. in 1913.

French Electrical Companies.

The Compagnie Générale de Electro-Chimie de Bozet, which increased its share capital in 1914 for the purpose of doubling the productive capacity of the works, records net profits of £12,000, as against £28,000 in 1913. It is not intended to pay any dividend.

The Compagnie Continentale Edison, whose concession for the supply of one of the districts in Paris expired at the end of 1913, reports gross receipts of £33,000 for 1914, and net profits of £14,000, which sum has been carried forward to the current year.

The Compagnie Centrale d'Energie Electrique records net profits of £23,000 for 1914 on a share capital of £800,000. The profits have been carried forward, this result contrasting with a dividend of £1 per share in 1913.

The Compagnie Parisienne de Distribution d'Electricité, which took over from the several companies the whole of the lighting supply business in Paris at the beginning of 1914, proposes to pay for the first working year a dividend at the rate of 8s. per share on an ordinary share capital of £4,000,000.

The Société d'Energie Electrique du Littoral Mediterranéen, which has a share capital of £1,520,000 and loan capital of £1,420,000, proposes to pay 12s. per share for 1914, as compared with 16s. in 1913. The reduction is due to an exceptional allocation which has been made to the reserve fund.

The Société Parisienne pour l'Industrie des Chemins de Fer et des Tramways Electriques reports net profits of £63,000 for 1914, as contrasted with £132,000 in 1913 on a share capital of £2,000,000. It is not proposed to make any distribution, this result comparing with a dividend of 12s. per share in each of the past seven years.

The Compagnie Havraise d'Energie Electrique, which has a share capital of £360,000, obtained gross receipts of £109,000 in 1914, as against £98,000 in the previous year, the great activity at Havre being responsible for the increase. After deducting the general expenses and interest on loans, the net profits are £54,000, as compared with £47,000 in 1913, and the dividend is at the rate of £1 2s. 4d. per share, as in the preceding year. It is in contemplation to raise the share capital gradually to £600,000, so as to provide for the extensions of plant which are necessary owing to the growth of the business.

The North-South Railway Co., which works the second underground electric railway in Paris, earned gross receipts of £354,000 in 1914, as against £393,000 in the previous year. On the other hand, the working expenses were £169,000, as compared with £196,000, and the profit share of the municipal council was £26,500, or £800 less than in 1913. The interest on the loan capital required a larger sum than in the preceding year. The net profits are returned at £41,000, as contrasted with £78,000 in 1913, the whole of the former amount being placed to a contingency fund.

The Paris Metropolitan Railway Co., whose working results in 1914 were seriously affected by the war, reports gross receipts amounting to £1,861,000, as compared with £2,185,000 in the preceding year. After deducting the receipts from line No. 8 (Auteuil), which was operated for the account of the City Council, there remains the sum of £1,768,000. The working expenses declined from £938,000 in 1913 to £778,000 last year, and the share of the Municipal Council from £701,000 to £572,000 in the two years respectively, but the interest service on the loans required a greater appropriation than in the previous year. The net profits amount to £252,000, as contrasted with £375,000, and the rate of dividend is 11s. 2d. per share, as against 17s. 2¼d. in 1913.

Madras Electric Supply Corporation, Ltd.

Mr. J. Gray presided at the annual meeting, held at 1, Queen Victoria Street, E.C., on June 24th. He first referred to the death of Mr. T. E. Ivens, a director, and said that Mr. K. A. Scott-Moncrieff, who had experience of the working of electric lighting and power companies in India and at home, had been elected to fill the vacancy. The revenue account showed a surplus of only £315, but as this compared with a loss of £5,309 for 1913 they had made some headway in the rearrangement of management and administration, to which this improvement was almost entirely due. However, the results were extremely disappointing. Last year he said they expected to obtain the beneficial use of the new plant during the last four or five months of the year, and this forecast was considered at the time to be fully warranted. It was October, however, before the new generating plant could be handed over by the contractors, and subsequent delays with the transformers and rotary converters prevented them from obtaining any real benefit from the new plant during the whole of 1914. The cause of these delays had been the subject of protracted discussion with the contractors and subcontractors, but a settlement had not yet been reached. Their generating costs since the beginning of this year had been reduced by 50 per cent., and the shareholders would thus appreciate what the delay in starting the new plant had meant to them financially. Applications for current, both for lighting and power, continued to expand, and arrangements had been made for providing a supply for the districts of Adyar and Kilpauk. This side of the business was quite satisfactory, and there was still a large field remaining to develop. Last year he said the board had under consideration a proposal to increase the flat rate of 4 annas for lighting and fans, which was charged to private consumers, and it was resolved to defer a decision until he had visited Madras. This he did in January last, and having very fully discussed the subject with Mr. Simpson (the local director) and managers, a petition was presented to the Government to increase the flat rate from 4 annas to 5 annas per unit. They considered that, whether from the point of view of cost of production in Madras, where fuel was exceptionally dear, or from the charges made by other Indian electricity companies, a strong case had been made out for the increase, and they sincerely hoped Government would grant their application. If so, their revenue would be increased automatically by about £6,000 per annum, which would be of the greatest help to them during the next few years in putting the company on a sound financial basis. While he was in Madras an agreement was entered into with the Corporation for an increased supply of current for street lighting on terms which were mutually satisfactory, and they hoped to see a considerable increase in this item of revenue during the next year or two. The net revenue account, after debiting debenture interest and providing for the sinking fund, showed a debit of £11,710, which had been carried to suspense account. A comparison with 1913 would show that the loss had been apparently increased by £1,185, but he asked them to bear in mind that in 1913 the debenture sinking fund, amounting to £3,906, had not come into operation, and that that year had the benefit of an additional £3,200 for interest upon capital raised for the new installation. The comparison of the net revenue account for the two years was not, therefore, so unfavourable to 1914 as the figures alone might imply. The first four months of this year showed that they had earned sufficient to cover all interest and charges—depreciation excepted—and there was every prospect of a further improvement in the latter part of the year, provided there was no more trouble with the transformers. Additional transformers were now on their way to Madras, and their arrival about the end of next month would remove any further anxiety. Indeed, they already recognised that the concern had "turned the corner," and that they would in future meet under much more favourable auspices than they had yet done; but the hopes of the directors had been so often unfulfilled that he was anxious that they should recognise exactly how they were placed at the moment. In regard to the last three items on the asset side of the balance sheet, viz., "Cost of issue of debentures," "Discount on debentures," and "Suspense account," which aggregated £58,614, this amount could only be liquidated either gradually out of profits (which would indefinitely postpone the payment of dividends either on the preference or ordinary shares) or by writing off the amount from the share capital. In addition, the loss arising from the supersession of part of the old plant would have to be provided for. This had not yet been ascertained, but they expected to be able to appraise the amount at an early date. The board was of opinion that it was desirable to write off the whole of these losses by a reduction of capital, and it was proposed to formulate a scheme for their confirmation at the next annual meeting. While he was in Madras, extensions of the tramways were discussed and the routes were settled with the Corporation. The proposals were submitted to Government for approval, but this had not yet been obtained. He was of opinion that the extensions contemplated would prove remunerative, but there would probably be some delay in proceeding with these, although the tramway company was using every endeavour to obtain the consent of Government. He was pleased to say that he found the tramway undertaking in good condition generally. The reorganisation of the staffs of the two companies in Madras had proved beneficial, and important economies had been effected thereby. The board were indebted to the management in Madras. Mr. Simpson, the local director, notwithstanding his other important duties, took a close interest in both undertakings. The technical and commercial departments were ably supervised by Mr. Jones and Mr. Powell respectively, but a special word of commendation was due to the former and his staff for the manner they had carried on the undertaking under very arduous conditions.

Mr. J. G. B. Stone seconded the motion.

Mr. Mumford criticised the cost of management, and remarked that awful mistakes had been made in the past.

The Chairman replied that the costs compared favourably with those of any other concern of like dimensions that he was acquainted with. He mentioned that so far as the profit-earning side of the business was concerned, the anticipations of the original directors had been fully realised. The losses incurred by the company had arisen entirely from the excessive cost of production. The plant chosen under expert advice had proved by experience to be unsuitable and uneconomical.

The report was adopted.

Stock Exchange Notices.—The Committee has ordered the undermentioned securities to be quoted in the Official List :—

Calcutta Electric Supply Corporation, Ltd.—Further issue of 6,115 ordinary shares of £5 each, fully paid, within Nos. 250,001 to 260,000; and 6,198 5 per cent. cum. pref. shares of £5 each, fully paid, within Nos. 200,001 to 210,000.

Edgar Allen & Co., Ltd.—A dividend on the ordinary shares of 10 per cent. per annum and a bonus of 2½ per cent. for the year ended March, free of tax, are recommended.

Oriental Telephone and Electric Co., Ltd.—The directors of the company are stated to have paid a bonus of 2s. 8d. per share, free of income-tax, on the ordinary shares.

Bombay Electric Supply and Tramways Co., Ltd.—The directors recommend a dividend of 6 per cent. on the ordinary shares, carrying forward £8,327.

STOCKS AND SHARES.

Tuesday Evening.

For the time being, all the markets of the Stock Exchange reflect the influence of the new War Loan. The cheapness of the latter has made existing securities in many cases look over-priced at their current levels, and the result, therefore, is that business in these senior stocks has come to something like a full stop, pending allotment of the War Loan and whatever subsequent consequences will spring therefrom. The easiest way to gain an idea of what the change in values set up by the new loan really means, is to work out the corresponding return which would have to be given, say, by a 4 per cent. debenture stock of some first-class company, the price of which security has hitherto stood in the neighbourhood of 95. To get on to a 4½ per cent. level, the quotation would have to go back to 89; and even then an industrial debenture would scarcely look as attractive as a national stock bearing the guarantee of the Imperial Government. It is too early to realise, even yet, how far-reaching will be the influence of the new War Loan upon existing securities; its immediate effect has been to render many scores of them unsaleable, whether they be protected by minimum prices or not.

The investor in the older stocks, of which the capital value is materially depreciated for the time being by the latest War Loan, must look not to the price of his stock, but to the safety of his interest. With that well secured, he need trouble little; and he will apply for the new security, feeling that 4½ per cent. is an excellent return for a patriotic stock, backed by the greatest security in the world. The new loan can be repaid in ten years' time at 100, and, in any case, must be so redeemed by 1945. Therefore it stands to reason that the price will never go to an extravagant premium; and this terminability of the stock, while offering an extra inducement to the investor of to-day, is a businesslike compensation to holders of existing securities, the prices of which are temporarily depressed by the War Loan, but which, by reason of their longer life, stand in a far better position for improvement in price in the years to come.

The War Loan has altered the whole standard of values, it is true; but too much stress must not be laid upon this, since it may prove to be in the nature only of a temporary depression. There is nothing fantastic in the longer view which looks ahead and sees, after the declaration of peace and the settlement of the new conditions which will follow it in the commercial, labour, and financial worlds, a return to years of profound peace and cheap money, in the course of which the present War Loan, paid off at par, will no longer compete with gilt-edged securities demanded by the investor. Between the prices of that time and those of to-day there may quite probably stretch a long ladder of which the foot rests upon to-day's war markets; and without pursuing the metaphor any farther, let us come back to the point from which we started, namely: that assurance of dividend payments is to-day of far greater value than quotations for the stocks yielding them—these quotations being influenced by factors which in the long run will automatically cease.

We have ventured to discuss this general aspect of the situation because it has a very vital bearing upon the securities with which these notes are mainly concerned. It is not our province to deal with speculative concerns at all; and although in the electrical industry, as in every other, there are stocks and shares of more or less speculative character, they do not invite speculation in the sense of that which goes on in mining shares, for instance, or American railroads.

The necessity for raising such a huge sum, in connection with the war requirements of ourselves and our allies, has produced a War Loan of so much greater magnitude than has ever before appeared that its coming was bound to cause radical alterations to all past and conservative views regarding investment. This alteration has been accompanied by—or, rather, has produced—a great deal of uneasiness, possibly anxiety, in the minds of the great investing classes. The anxiety is superfluous in most cases; and as soon as the subscription lists are closed, the existing prices modified to fall into line with the new standard of values set up by the War Loan, and comparative familiarity with the War Loan has shown how extremely cheap is the stock itself, the nervousness will subside. The boldness of our sons in thronging in their thousands to the Services shall be emulated in its humbler degree by the calmness with which we regard the cutting off slices from our material possessions in the great cause.

From the foregoing, it may be well supposed that the changes on the week will be most marked in the higher-class investments stocks. Up to the present, the ordinary and preference issues have not had time to become adjusted to the fresh standard referred to above, but 4 per cent. debenture stocks are being scaled down drastically. Eastern Extension debenture and Eastern Telegraph debenture are two representative stocks which may be cited, the falls being 5 and 10 respectively. Nor is it possible to say that even at the lower prices would buyers be found. Great Northern Telegraphs stand out brightly, credited with £1 rise. American Marconis rose to 12s. 6d. on New York demand, and Marconi Marines hardened to 1 3/16 on the good report just out.

The Home Railway market has suffered severely, having its especial cause for weakness in the latest demands made by the miners, which have led to their being allowed to remain outside the area controlled by the Munitions Workers' Act, and apparently left to make whatever insatiable demands may please them. The stocks of the Steam companies have already undergone heavy losses, while Underground Electric Incomes are down 4½ points to 69, at which the yield, allowing for the payment of the interest free of tax, comes to nearly 10 per cent. on the money so long as it is maintained.

The Electric Lighting list shows the debenture stocks to have fallen in much the same way as those in the Telegraph department. Declines of 2 to 8 points are marked, and one cannot say that the end of the shrinkage can be limited by the present prices. Losses amongst the ordinary and preference are less drastic, but in these cases we have to add that the levels are once more to a large extent nominal.

Curiosity and interest both were aroused in the Stock Exchange last week by the marking of a bargain in South Metropolitan Electric ordinary shares at 18s. 6d., accompanied by the two symbols which point out the transaction as having been amongst exceptional bargains, and done with, or between, non-members. Seeing that other transactions were marked on the same day at 14s. 9d. and 15s. 3d., and that more shares could probably have been obtained, at any rate at 16s., the price of 18s. 6d. naturally created attention and inquisitive wonder why a buyer should have paid such a price, unless under very exceptional circumstances indeed.

Brazil Tractions have gone back to 50; and the Foreign group, with most of the other Stock Exchange markets, is lower. Mexican Light preferred shed 9 points, Mexico Trams 5 per cent. bonds lost 3, on the latest information from the country, to the effect that chaos is, if anything, worse than ever. A pitiable story was unfolded the other day at the meeting of the Mexican Railway Co., and there seems hardly a gleam of light on the situation, except such as is provided by the hope, so often raised, that the United States Government will endeavour to restore peace—though, when peace comes, there will be a vast amount of reconstruction work to be done in Mexico before ever the dolorous country is likely to return interest to its creditors.

Several reports of interest are out this week. Cromptons have done well, practically doubling the net profit of the previous twelve months and paying 7 per cent. on the preference capital—an increase of 2 per cent. as compared with last year. The Bombay Electric Supply & Tramways Co. issues a decidedly good report. The ordinary dividend, as before noticed, is a repetition of the usual 6 per cent.; but the carry-forward of £8,300 is £4,300 more than it was a year ago. The Oriental Telephone & Electric Co. has declared a bonus of 2s. 8d. per share, free of tax, on its ordinary shares; and the proprietors must hold themselves indeed fortunate in getting such a pleasant solatium at a time like this.

There is not much doing in industrial descriptions. Most of the changes are, of course, in a downward direction. Armament shares have given way, in connection with the Government's Bill for taxing war profits. The rubber market is quiet, its volume of business greatly curtailed by the exclusion of most other things except the War Loan from the minds of investors. Rubber has again hardened to half-a-crown per lb. Amongst the few bright spots, copper shares claim notice, their prices being well maintained, in consequence of the strength of the metal.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend, 1914.	Price June 29, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	8¼	—	£6 1 8
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4	—	6 5 0
do. do. do. 4½ Pref.	4½	4⅛	—	5 9 1
do. do. City Pref.	4½	3⅞ xd	—	5 16 2
do. 4 Deb.	4	82	−8	4 17 7
Chelsea	5	4½	−⅛	5 11 1
do. 4½ Deb.	4½	88 xd	−2	4 17 10
City of London	9	13½	−¼	6 11 0
do. do. 6 per cent. Pref.	6	12	—	5 0 0
do. do. 5 Deb.	5	105 xd	−2½	4 15 8
do. do. 4½ Deb.	4½	90 xd	−4	5 0 0
County of London	7	11	−⅜	6 7 3
do. do. 6 per cent. Pref.	6	11	−½	5 9 1
do. do. 1st Deb.	4½	96 xd	−2	4 13 6
do. do. 2nd Deb.	4½	90	−5	5 0 0
Kensington Ordinary	5	7	—	6 8 7
London Electric	4	1⅜	−⅛	8 8 4
do. do. 6 per cent. Pref.	6	4⅞	−⅛	6 3 1
do. do. 4 Deb.	4	85	−2	4 14 2
Metropolitan	8½	8	—	6 16 8
do. 4½ per cent. Pref.	4½	3¾ xd	—	6 0 0
do. 4½ Deb.	4½	90 xd	−2	5 0 0
do. 3½ Deb.	3½	70 xd	−2	5 0 0
St. James' and Pall Mall	10	7¼	−¼	6 18 0
do. do. do. 7 per cent. Pref.	7	6¼	−⅛	5 12 0
do. do. do. 3½ Deb.	3½	70 xd	−3	5 0 0
South London	5	3	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7	−¼	6 8 7
do. 4½ Pref.	4½	4¾	—	4 14 9

Telegraphs and Telephones.

	Dividend, 1914.	Price June 29, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	103½	−2	5 16 0
do. Def.	1½	22	−½	6 16 4
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8½	—	5 17 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	12	−¾	*6 13 4
do. 4 Deb.	4	82½	−5	4 17 0
Eastern Tel. Ord.	7	130	−1	*6 1 9
do. 3½ Pref.	3½	72	−3½	4 17 3
do. 4 Deb.	4	81	−10	4 18 9
Globe Tel. and T. Ord.	6	10¾ xd	—	*6 7 6
do. Pref.	6	11¼ xd	—	5 6 8
Gt. Northern Tel.	22	34	+1	6 9 [illegible]
Indo-European	65/-	62	−2	6 5 0
Marconi	20	1 13/16	—	11 0 8
New York Tel. 4½	4½	96½	−½	4 13 0
Oriental Telephone Ord.	10	2 xd	—	5 0 0
do. Pref.	6	1 3/16	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 8
United R. Plate Tel.	8	6⅞	−⅛	*7 15 6
do. Pref.	5	5	—	5 0 0
West India and Pan.	1	1⅛	−⅛	8 17 9
Western Telegraph	7	13¼	—	*6 0 9
do. 4 Deb.	4	83	−7	4 16 5

Home Rails.

	Dividend, 1914.	Price June 29, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented	4	74	−1	5 8 1
Metropolitan	1¼	25	−2¼	4 16 2
do. District	Nil	13	−1½	Nil
Underground Electric Ordinary	Nil	1⅛	−⅛	Nil
do. do. "A"	Nil	4 6	—	Nil
do. do. Income	6	69	−4½	*9 18 8

Foreign Trams, &c.

	Dividend, 1914.	Price June 29, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Arg. Trams, First Pref.	5½	4¼ xd	−⅛	6 9 5
do. 2nd Pref.	5½	3⅝ xd	—	7 11 9
do. 4 Deb.	4	80 xd	−3½	5 0 0
do. 4½ Deb.	4½	82 xd	−3	5 9 9
do. 5 Deb.	5	83	−3½	5 15 7
Brazil Tractions	6	50	−1½	12 0 0
Bombay Electric Pref.	6	10¼	−⅛	5 16 10
do. 4½ Deb.	4½	90 xd	—	5 0 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds	—	50	−3	Nil
do. 6 per cent. Bonds	—	30	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	30	−9	Nil
do. 1st Bonds	—	45	−3	—
Adelaide Sup. 6 per cent. Pref.	6	5	−5/16	6 0 0
do. 5 Deb.	5	100	−3	5 0 0

Manufacturing Companies.

	Dividend, 1914.	Price June 29, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	2⅜	−⅛	5 18 0
British Aluminium Ord.	5	22/-	—	4 12 0
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	11	−¼	6 13 4
do. Pref.	6	6⅛	—	5 0 0
British Westinghouse Pref.	7½	1⅞	—	8 0 0
do. 4 Deb.	4	70 xd	—	5 14 [illegible]
do. 6 p. lien	6	101	—	5 [illegible] 0
Callenders	15	11½	−⅜	6 10 5
do. 5 Pref.	5	5	—	5 0 0
do. 4½ Deb.	4½	95	−3	4 14 9
Castner-Kellner	15	8¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/6	−1/-	Nil
do. do. fully paid	Nil	1¼	−⅛	Nil
do. do. 4 Deb.	4	60 xd	−1	6 13 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/6 xd	—	8 17 10
do. do. Pref.	7	1 xd	—	7 0 0
Gen. Elec. Pref.	6	9¾ xd	—	6 3 1
Henley	20	14	−¼	*8 3 3
do. 4½ Pref.	4½	4¾	−¼	4 14 9
do. 4½ Deb.	4½	95	−2	4 14 9
India-Rubber	5	8¾	—	5 14 8
Telegraph Con.	20	86½	−½	6 11 7

* Allowance made for dividends being paid free of income-tax.

Kaministiquia Power Co., Ltd.—The directors have declared a dividend of 1½ per cent., or at the rate of 6 per cent. per annum, on the common stock for the quarter to July 31st.

INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

The Use of Electric Vehicles in Municipal Service.

(*Concluded from Vol.* 76, *page* 906.)

Ambulance Work.

By reason of its smooth and silent running, and uniform and jerkless acceleration, the electric is an ideal vehicle for ambulance work in our towns and cities. It has for some time been employed for this purpose by the City of London Corporation, by the Port of London Authority, and the Metropolitan Asylums Board. The feature of economy should not be forgotten; while the promptitude with which calls may be answered is just as valuable an attribute as in the case of fire brigade service. The simplicity of operation also enables several ordinary attendants to be trained to drive, so that a call may never find the van in want of a driver.

In regard to the City Police ambulances, Captain Sir J. W. Nott-Bower, the Commissioner of Police, informs the Committee as follows:—

"The electric motor ambulance service was commenced in May, 1907, with one electric ambulance. In May, 1909, a second ambulance was obtained, and both have since proved very satisfactory indeed for removing cases of accident or illness in the streets to hospitals.

"The initial cost of the ambulances, with surgical fittings, was, approximately, £569 and £552 respectively, and the total cost of the service is, approximately, £2,000 per annum.

"The cost of working is about 5.1d. per car mile, including expenses such as tires, necessary repairs to cars, charging of batteries, etc., but excluding wages and rent. Tire costs account for about 2½d. in the cost mentioned per mile.

"Another ambulance is now being obtained from the Cedes Electric Traction Co., Ltd., and will be taken into use shortly."

The Secretary of the Port of London Authority states that: "The Authority possesses four electric motor ambulances, and these have been in use since September, 1912. They have been found quite suitable for the conveyance of injured persons to hospital with promptitude and comfort."

Electric appliances are also in use in the United States. The New York Hospital, for example, has seven such vehicles. These vehicles sometimes make long journeys, it being recorded that one of them made a trip of fifty miles there and back to a hospital beyond the city limits on a stormy day, with mud, in some places, nearly up to the hubs, and it is added that only an hour's boosting charge was necessary in order to get the car home. The superintendent of one of the branches of the hospital, where they keep two horse-drawn and one electric ambulances, thus reports as to experience with this type of vehicle: "We find the electric vehicle much more satisfactory than the horse-drawn ones, especially during the hot weather. During one hot day about eighty calls were answered, and the electric ambulance responded to those with the longest radius, answering thirty calls in twenty-four hours."

Fire Brigade Work.

Electric battery vehicles have been in use to a considerable extent for fire brigade work. Notable examples of their use are to be found in London and Liverpool; while, up to the outbreak of war, they were known to be employed in several Continental cities, one having no less than 24 in use. Several towns and cities in the United States employ electrically-propelled fire engines and escapes, and there can be but little doubt that electric battery traction offers special advantages for fire brigade work, which may be summarised as follows:—

Unlike the petrol-driven type, there is no preliminary starting of the engine before the vehicle itself can be got on to the move. All that is necessary with the electrically-driven type is for the driver to get on the seat, throw off his brake, move the controller, and the vehicle is under way. That this feature secures a promptness in answering calls is fully confirmed by the experience of the London Fire Brigade, which possesses a total of 15 electrically propelled vehicles, the oldest having been put into commission in 1911.

At a discussion upon electric vehicles at the Institution of Electrical Engineers on March 19th, 1914, Lieutenant-Commander Sladen, R.N., Chief Officer of the London Fire Brigade, referring to the feature mentioned above, said:—

"Among the advantages of electric vehicles for fire brigade work, we find that they require repairing less frequently, and that the rapidity of turn-out is absolutely unequalled by any other form of traction; it is not uncommon at an electric-motor fire station, under ordinary service conditions, for a turn-out to be effected in 7 or 8 seconds, whereas with other forms of motors a good turn-out is perhaps 15 seconds. That is a very good point with us, especially for the life-saving appliances . . . . the maximum speed is at once obtained, whereas with other forms of traction, namely, steam and petrol, a little time has to elapse before things become quite normal."

The Liverpool Brigade has had 4 electric vehicles in use since 1907. Three of them weigh about 6 tons, while the fourth scales 2½ tons; all four have a speed of 20 miles per hour on the level, and a mileage capacity on one charge of 30. Mr. Alex. W. Weir, the Chief Superintendent of the Brigade, writes in regard to these vehicles:—"They have given every satisfaction, and are inexpensive to run, the cost working out at 2½d. per mile. The main features which commend this class of machine for fire brigade work are the practically instantaneous starting; rareness of failure on the road; the ease with which defects may be remedied in consequence of the fewness of the working parts; the ease with which the vehicle may be driven, and the short time in which a man can be taught to drive."

The mechanism being so simple and the construction so strong, there is much less to get out of order than in any other mechanical system of traction.

The Chief Engineer of the Philadelphia Fire Brigade, which possesses some electrically-driven engines, thus deals with the reliability feature:—"During the winter, and at times when the snow was unusually heavy, and particularly during the time when traffic between the cities of New York and Philadelphia on all the railroads was held up, this apparatus performed its duty without fail, and in one instance it was taken to a fire hydrant, where it was impossible to get with a lighter steamer with horses."

Referring to a couple of electric hose wagons which they possess, he says:—"They were run about the city during last winter's heaviest snowstorms, and fully demonstrated their ability to do all that is claimed for them, *i.e.*, not to be stalled in 12 inches of snow."

He later goes on to say:—"In the heaviest snowstorm of last winter (1913-14), Sunday, Feb. 15th, we had three police patrol petrol cars that had to be abandoned in the streets on that night. They were towed to their respective stations by electric vehicles the next morning, after the failure of two heavy petrol vehicles to move them."

At Baltimore, the Chief of the Fire Brigade affirms that their No. 32 steam fire engine, fitted for electric traction—the only one so far converted—"is the most reliable and economical apparatus in the whole department, and is always to be depended upon."

Speaking upon this point and others, Lieutenant-Commander Sladen at the previously-referred-to discussion in London last year, said:—"In conclusion, I should like to say that after four years' experience I agree with Mr. Ayton as to the advantages of the electric over other power-driven vehicles in regard to its simplicity of construction, its low cost of maintenance, its ease of driving, and its general reliability."

In regard to economy in the cost of operation, the claims of the electric on this score are fully borne out when applied to this special sort of service.

Lieutenant-Commander Sladen, speaking upon this point, stated that, in the London Brigade, the electrically-propelled appliances cost, on the average, about 1s. per mile to maintain, this figure not including drivers' wages, capital charges or depreciation, whereas the similar figure for the brigade's petrol vehicles is 1s. 3d. He also went on to say:—"When one takes into account the first cost and the depreciation, the cost of maintenance of an electric fire-escape and of a petrol fire-escape are about the same, namely, about £150 a year, allowing for interest and depreciation. The annual cost of repairs for an electric escape van that runs about 800 miles per annum is £40, that is, allowing for renewals of batteries and so forth." Viewed from the standpoint of the ordinary user of commercial motor vehicles, the costs per mile given above would be considered very high indeed, but it must be remembered that the total annual mileage run by each vehicle is comparatively small, although the vehicle has to be kept in readiness to go out at any moment.

Further information supplied to the Committee in May of this year shows that the cost of repairs to accumulators for the previous twelve months worked out at an average price of £22 per vehicle, including a complete renewal of one battery and extensive replacements to three others.

As to speed, vehicles for this purpose have been built to run up to 30 miles per hour, and have, of course, a correspondingly smaller radius of action on one charge, usually from 30 to 35 miles. The vehicles of the London Brigade can run up to 27 miles per hour on the level, while up a gradient of 1 in 19 the speed is 15 miles per hour.

Other advantages connected with the employment of electrics for fire apparatus include less room taken up in the station, greater cleanliness, and greatly reduced risk of fire. There is also the point that any ordinary fireman can be taught to drive.

No difficulty has been experienced in converting horse-drawn steam fire engines and other fire-fighting apparatus, the application of the front wheel drive, to which the electric motor so readily lends itself, making the problem quite an easy one. This method of driving is also claimed to have the further advantage of avoiding the risk of skidding to a considerable extent.

Upkeep and Cleaning of Streets.

If the dumping ground for the disposal of road sweepings is some distance from the centre of the town, much time is wasted upon the "to and fro" journeys with the ordinary cart and horse, so that, in many cases, there would appear to be good reason for the employment of self-propelled vehicles of large capacity for this class of work. Since this service entails frequent starting and stopping, the conditions are more or less similar to those appertaining to the collection of house-

Some Views of the Electric Vehicles on the Victoria Embankment.

List of Vehicle Exhibits.

Exhibited by	Type of vehicle.	Carrying capacity.	Speed on smooth level road. M.P.H.	Battery.			Reference letter for method of control.	Transmission and tires.
				Make.	No. of cells.	Capacity in A.H.		
Harrods, Ltd.	Walker covered delivery van	10 cwt.	14	Edison	60	220	B	Spur and idler gear in rear wheels (solid tires)
West Ham Corporation	Open body wagon	20 "	11/12	"	60	225	B	Chain drive (solid)
St. Marylebone Council	"Opel" covered delivery van	10 "	12	Hart, lead	52	120	A	" " (pneumatic)
General Vehicle Co., Ltd.	Covered delivery van	9 "	15	Ironclad-exide	44	133	—	Worm drive live axle (solid)
Edison Accumulators, Ltd.	Patent automatic tipping refuse van	40 "	12/13	Edison	60	300	C	Bevel gear jack shaft and roller chains to rear wheels (solid)
" " "	Type G.M. Edison chassis	20 or 40 cwt.	12/13	"	60	225 or 300	C	" " (solid)
J. Pullar & Sons, Ltd. (Perth)	Covered delivery van	20 cwt.	12	"	60	300	C	" " (solid)
Wolseley Motors, Ltd.	Baker chassis with box van body	20 "	10½	Ironclad-exide	42	157	—	Chain drive (solid)
" " "	Baker chassis	40 "	9	"	42	189	—	" " (solid)
Croydon Corporation	Roadster passenger car	3 people	18/20	Edison	60	150	B	Worm drive live axle (pneumatic)
Poplar Borough Council	"Opel" covered delivery van	10 cwt.	12	E.P.S. Co.	44	125	A	Chain drive (pneumatic)
Heston and Isleworth Council	"Opel" light delivery van	15 "	14	Hart, lead	44	120	A	" " (pneumatic)
Hertford St. Motor Co., Ltd.	Electric landaulette	4 people	15/20	Lead plate	45	150	D	Helical gear (pneumatic)
Krieger Electric Carriage Syndicate	" "	4 "	20	Naylor, lead	46	175	E	Single reduction spur gear (pneumatic)
Heath's Garage, Ltd., Birmingham	"Millburn" coupé	4 "	20	Philadelphia lead	20	204	—	Worm drive live axle (pneumatic)
" " "	"Lang" coupé	4 "	24	Ironclad-exide	41	137 5	—	" " (pneumatic)
Wolseley Motors, Ltd.	Baker electric lorry	70 cwt.	8/9	Ironclad-exide	42	—	—	Chain drive (solid)

(A). Series-parallel arrangement of battery in two sections with resistance steps. (B). As A, but with addition of series-parallel arrangement of field coils. (C). Battery in series with series-parallel arrangement of field coils combined with resistance steps in main circuit and arrangement for shunting field coils. (D). Double-wound armature and two commutators. Battery permanently in series. Series-parallel arrangement of armature windings and field coils combined with resistance steps. (E). 1st step: Two sections of battery in parallel and two compound motors in series; 2nd step: Same as 1st step, but shunt windings cut out, making two series motors in series; 3rd step: Battery in series and two compound motors in series; 4th step: Same as 3rd step, but shunt fields cut out; 5th step: Battery in series and two compound motors in parallel; 6th step: Battery in series, shunt windings cut out.

refuse, and the same arguments in favour of electric vehicles apply.

The electric vehicle is in use on the Continent and in the United States in connection with street cleaning and brushing machines and for watering, one important Continental city having about 30 in use. In the city referred to, each electric watering van waters about 49,000 square yards of road surface per day of eight hours, as against 30,000 yards, the best average of a horse-drawn van. The saving stated to result from employing "electrics" in place of horse-drawn vans for this purpose by the municipality mentioned is about £80 per electric van per year. The electric vehicle is also employed for carrying materials used in the making and repair of roadways, and a 3-ton wagon with tipping body has just been put into service for this purpose by the Corporation of Ipswich. In reality, this wagon will be a "double-purpose machine," since the tipping body is removable, and can give place to a water-tank (which is now being constructed) to enable the vehicle to be used for street watering. The energy consumption is on the average under 0.75 unit per mile.

It has been suggested that an electrically-driven road roller would be an improvement upon the noisy steam roller generally in use. Although, as far as the Committee's knowledge goes, no electrically-propelled rollers have yet been introduced, there appear to be obvious advantages in that method of working and no difficulties in applying it. As weight is an essential requirement, a battery of as large a capacity as necessary could be fitted.

The Tramways Department.

There are now three municipal tramway undertakings making use of the electric battery 'bus as an adjunct to their tramway services, *i.e.*, Southend-on-Sea, South Shields, and York. In all three instances, it is understood that the vehicles are giving satisfaction.

Apart from the features of economy, silent running, general cleanliness and simplicity, a strong argument for the adoption of electric vehicles, as against petrol or steam-driven ones, by a tramway department lies in the fact that their use entails no augmentation of the repair staff by specially experienced men, because the equipment, except the battery, being similar to that upon a tramcar, the ordinary repair staff can quite easily do all repairs needed.

The South Shields Corporation 'buses have accommodation for 22 passengers, the speed being 12 miles per hour on the level and about 6 miles per hour on gradients of between 1 in 8 and 1 in 10. The energy consumption per mile varies with the condition of the roads, being, under the best conditions, about 1.3 units, while the figure runs up to about 2 units per mile when the roads are deep in thick sticky mud. On a fine day, each 'bus will run, if necessary, 50 miles on one charge. A charging station is placed at one terminus, enabling each 'bus to be given a boosting charge several times a day, which enables a fast service to be obtained during the evening without the necessity of charging during the station "peak-load" hours. Up to date, the maintenance cost has been practically nil, and the reliability of the vehicles receives cogent attestation in the statement of the tramways manager:—"One does not have to worry about them any more than one would about an ordinary tramcar."

The 'bus which the Southend Corporation Tramways Department has had in use since June 26th, 1914, is similar to those at West Hartlepool (?Bromwich.—Eds.). The experience at Southend, however, is perhaps a little more valuable for the reason that other 'buses of the petrol and petrol-electric type, and of the most modern make, have also been in use alongside the electric 'bus. In a report presented to his committee at the end of 1914, Mr. Birkett, the engineer and manager of the combined electric supply and tramway undertakings, dealing with the running of all three types, says:—"The electric 'bus is the most reliable and free from breakdowns. This is no doubt owing to the simplicity of the mechanism."

After going on to detail the troubles which have been incidental to the operation of the other two types, he adds:—"The electric 'bus is so free from moving parts, there being only the motor with chain drive and differential, that stoppages due to breakdown of parts are almost negligible. It will be apparent that fewer spare 'buses of the electric type will be needed in a large fleet as compared with petrol 'buses . . . . Providing all necessary plant for re-tiring wheels is available, there will be no reason for possessing a stand-by electric 'bus with a fleet of six 'buses. . . . It follows that the staff at the garage would be affected in favour of the Edison 'bus."

As to cost of operation, after eliminating from the cost ascertained up to date, certain items in connection with each type of 'bus which are incidental to the inception of a 'bus service, Mr. Birkett gives the actual average cost per 'bus mile (including capital charges) for each type as follows:—

Petrol	8.56d.
Petrol-electric	8.31d.
Electric	7.52d.

Mr. Birkett further points out that, in his opinion, the results would be still further in favour of the electric battery 'bus if a fleet consisted entirely of the latter.

The consumption of energy on the hilly route is at the rate of 1.55 units per mile, while on a route which is more or less level, the figure comes down to 1.1. The 'bus receives a short boost while waiting at one terminus, the boosting current being about 300 amperes. The average speed, including stops, is about nine miles per hour. Up to date there have been no repairs needed to the electric vehicle.

Battery 'buses are on order for the West Bromwich Corporation and for a company at Loughborough.

The Ilford Council Tramways Departments employ an electric tower wagon which has now been in service for over twelve months. The special advantages claimed for the electric vehicle for this work are:—

(1) Can be started away without loss of time.

(2) So simple that any workman can easily drive it, in consequence of which several men may be provided with licences, ensuring that whenever the call may come, a driver shall always be available.

(3) More easily manœuvred against poles or under insulators and wires than a petrol or horse wagon.

(4) Hand-lamps on flexibles, for night repair work, may be operated from the battery.

(5) Reduced risk of fire when garaged at the tramway depôt.

(6) Low cost for operation and upkeep.

Although the Ilford wagon weighs some three tons, the energy consumption is only a little over a unit per mile. With the exception of the cost of a little distilled water for the battery, no expenditure has been necessary for maintenance during the time the vehicle has been in commission, and there is stated to be no sign of wear upon the tires.

Similar vehicles are in use by, or on order for, the tramway departments at Derby and Belfast.

Other Uses.

There are still many districts where cesspool emptying has to be done, and, where the health and comfort of the residents is studied, the vacuum tank system has taken the place of the old and crude methods. It is possible to construct an electrically-propelled vacuum tank wagon—the usual capacity required is about 350 gallons—fitted with an electrically-driven air pump. As such a pump will only need some 2 horse-power to drive it, the ordinary size of battery fitted to a 3-ton wagon would easily supply the energy required. Ordinary labourers could work the plant, the cost of working and upkeep would be small, and the plant would operate with absence of noise.

The expenses of conveying the municipal officials about, on their business visits and rounds, aggregate into a fairly large annual sum in any town of size, and this is especially the case where hired vehicles are concerned. It would undoubtedly pay any large municipality to invest in a few electric cars for such service, which could be garaged with the electric supply or tramway departments. The simplicity of control is such that chauffeurs would hardly seem necessary. The figures already quoted in this report indicate how low is the running cost of the passenger "electric," and this feature, as well as the fact that the vehicle is free from all the starting difficulties, the vibration, and the fire risk of the petrol type, should act as a strong incentive towards its adoption for this particular service.

The "Point Five" Association.

On Thursday evening, June 17th, the members of the Point Five Association met at the Tricity Restaurant, Oxford Street. The proceedings, which were prefaced by an excellent little dinner, were quite informal.

Mr. S. E. Fedden (Sheffield), in the chair, expressed the hope that in such a period of stress "they would excuse him for not contemplating such matters as the grilling of chops," and dealt briefly with the general position created by the war, particularly as regards electricity suppliers. The last six months of 1914-15 had shown an output of 29 million units at Sheffield, as compared with 16 million units for the same period of 1913-14. In addition, 10,000 kw. of connections had been applied for or was being connected, and a further 10-15 million units output was in prospect. He estimated next year's output at 65 million units, as against 45 millions last year and 26 millions the year before. The difficulty was to extend the plant and to obtain coal. They would have to pay 10s. per ton more (making 18s.) for their next coal contract, and in all three or four principal items in electricity cost would in their case cost £23,000 extra next year. As regarded electric cooking, they wanted a hot plate that got hot quickly and showed it was hot; pilot lamps were not noticed, and apparatus must be designed for servants' use.

Mr. A. S. Blackman (Sunderland) expressed his satisfaction with the Carron cooker in use; it had fast and slow hot plates and would cook bread, which was a necessity in the North of England. They made a point of regularly inspecting flexibles and had had much success with Thermoid flexible, which was better than anything else so far tried. Their coal was supplied under contract at 1s. per ton less than last year.

Mr. Thos. Roles (Bradford), in the matter of coal, was in a similar position to the last speaker at present (paying 1s. 3d. per ton less), but he expected to pay over 60 per cent. more on the next contracts. He regretted the trend of the discussion which had taken place in the morning on the Point Five Tariff.

Mr. Cooke (Luton) agreed that they must have a red-hot hot plate and one which cooled rapidly. In the last few months their load had grown so quickly that they had placed an order for a 3,000-kw. set for next winter; the only difficulty in regard to coal was the price, which demanded Government action.

Mr. S. E. Britton (Chester) said he had used a Thomas electric cooker for five years with only one failure, and it did not present any difficulty to a servant. He used two red-hot hot plates, one with one heat and the other with three heats, which was most useful in the kitchen. Two years ago they had an exhibition where the Co-operative Society baked bread electrically, and it was the most perfect bread he had seen. The rise in the price of coal meant very little at Chester, where water power supplied a large proportion of the units.

Mr. Hame (York) had used several types of electrical cooker: it was an advantage to get the cooker into a house where it was under the eye of the owner, and not much good in large houses.

Mr. Pickvance (Wrexham) protested that the discussion in the morning missed the real point—the ½d. tariff—and dwelt on the method of arriving at the fixed charge. His experience of electric cooking did not reveal many failures of apparatus; the latest Belling hot plate appeared to be very successful.

Mr. Sauvage (Wrexham) agreed as to the disappointing character of the morning's discussion: the rateable value basis was a detail to be fixed by local conditions, and Mr. Davis (Ilford) urged them to renewed efforts, which would result in the manufacturers producing the right apparatus.

Mr. Shaw (Ilford) had used electric cooking for years, and agreed that apparatus must be constructed with a view to use by servants, and that red-hot hot plates were wanted.

Mr. Hoadley (Maidstone) said he had used electric cooking for a long time, and while the weekly units used by a servant were over 50, his own wife would do the same work with 30 units. He used a red-hot boiling ring.

Mr. Bowden (Poplar) said in their case coal had doubled in price in a year; one trouble was the shortage of trucks, and they had hired 40 and were running them continuously and getting coal at the contract prices fixed in November last. He agreed that the Point Fives were unlucky in the morning's discussion; his only issue with them was the method of assessment. He was convinced that the red-hot hot plate would come to stay.

Mr. Woodhouse (Yorks. Power Co.) said it was clear that in the morning the Point Fives had not stuck to the "point." Both the price of coal and labour would be permanently higher as a result of the war, and this would be all to the advantage of the electricity suppliers. As regards the increased prices asked for coal, it must be remembered that the war bonus to colliery workers represented a loss to the owners on contracts running at old prices.

Mr. Allen (Wolverhampton) said his coal was costing more, but he had arranged a contract for 25,000 tons of cooke breeze at a low figure, which would help things. Comparative tests showed that considerably less units were used with the red-hot than the black hot plate, and he was convinced that it was the type of the future. He used both the bright and black types of oven with a view to finding which was preferable in practice, and, so far, it appeared that each type had its favoured uses. In Wolverhampton, flexible troubles amounted to 2 per cent. per annum; flexible was often too light. His department did all the renewing of irons, etc., and sent inspectors round.

Mr. F. C. Raphael said it was not his experience that flexibles gave much trouble.

Mr. W. R. Cooper supported the Point Five policy, but could not specify the brand of assessment, though he felt up against the inclusion of a garden in the assessment.

Mr. Barham (Watford), in the matter of the apparently greater destructiveness of alternating than direct current to apparatus, suggested that this should be carefully considered by the Association, and the Chairman mentioned the necessity of fitting lock-nuts on stove elements on alternating circuits. He added that it was impossible to bake bread in a little oven.

SUBMARINE SIGNALLING.*

By R. F. BLAKE.

Sound signals produced in air are very erratic in their range and intensity, so much so as to be on many occasions absolutely misleading. Water has many advantages over air for this purpose. It is free from the dangerous zones of silence which occur when the signals are produced in air; the absorption of the sound is much less in water, and consequently the signal is not only absolutely reliable but is transmitted to a distance many times greater than when it is transmitted through air; the sound is not carried away by the wind in stormy weather, as is the case with the siren; it is not affected by atmospheric disturbances, as in the case of wireless. It permits of the accurate determination of the direction from which the sound is proceeding, which is not the case with either the air siren or wireless telegraphy.

Up to the present time the sum of a million dollars has been invested in developing submarine signalling, so far without monetary return.

The first method which was employed for producing the sound was through the striking of a bell, and the method of receipt of the signals was by means of a microphone attached to the skin of the ship. Neither the original bell nor the original microphone attachment was satisfactory, but finally the work of Mundy, Wood, Fay, Williams and others resulted in a completely practical system.

The submarine bell in use on lightships is actuated by compressed air stored in a reservoir. The actuating wheel has projections mounted on it, so that when the wheel revolves a number of strokes follow each other, the different intervals being peculiar to the different signal stations. In order to receive the sounds, it has been found absolutely necessary to suspend the microphone in a tank of water, for this is the only method of cutting out noises which otherwise drown the sound of the bell.

One of these small water tanks, containing a microphone of a special type, is attached to each side of the bow inside of the ship. From each tank wires are run to a device which is called the indicator box, so arranged that by throwing the handle to one side, the starboard microphone is connected to the telephone, and by throwing the handle to the other side, the port microphone is connected.

It will be obvious that once the bell is picked up, the captain has only to turn his vessel until the sound is heard with equal intensity on each side, to know that his ship is then pointing in the direction from which the sound is coming, and in this way he can take compass bearings of the lightship on which the bell is situated.

Even if no further development had been made, the system would be—and is—a complete and practical one. Its universal adoption would greatly minimise if not entirely prevent disasters due to errors of ship position.

If the sound-producing apparatus could be so constructed as to be operated from moving ships by a telegraph key, it would be possible for one ship to signal to another in fog, to communicate its position, its direction, and its speed, and to eliminate all dangers of collision. It would also be possible to signal between submarines or between battleships and submarines, and to communicate between battleships in action without interference from the enemy and though all masts were shot away. If the sound-producing apparatus could be constructed so as to be actuated by telephonic currents, it would be possible to transmit speech through the water.

Serious difficulties had to be overcome before the desired results could be obtained. Since water is almost incompressible, any apparatus which is to transmit sound through water must be capable of exerting very great force, comparable with that produced by the impact of a hammer on an anvil. Some material object must be set in motion to compress the water, and that object must start from rest, reach its highest velocity, and come to rest in one-thousandth part of a second, if a musical note having a pitch of five hundred per second is to be produced. The forces of acceleration thus necessitated are very large.

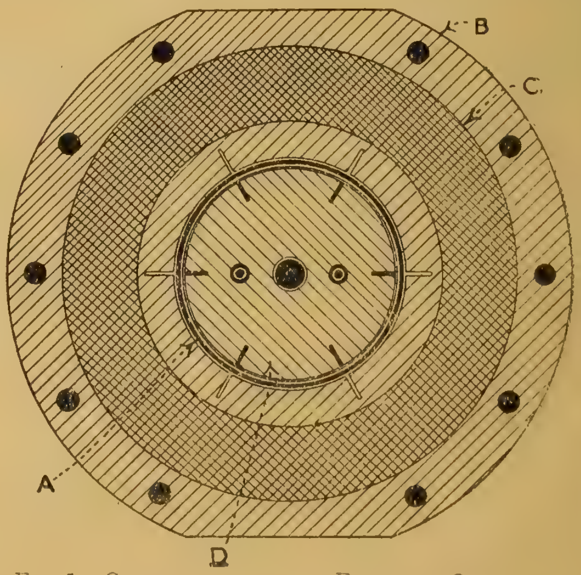

Fig. 1.—Cross-section of the Fessenden Oscillator.

Whatever device is used must be capable of producing at least 100 compressional waves per second, in order to telegraph satisfactorily at the rate of 20 words per minute; to transmit speech through the water, it must be capable of producing several thousand waves per second.

The apparatus, as finally developed by Professor R. A. Fessenden, is termed an oscillator, and its construction is shown in cross-section in fig. 1, in which the iron of the magnetic circuit and the copper tube are shaded. The magnetising coil is cross-hatched. The moving part is the copper tube A. This lies in the air gap of a magnetic field formed by a ring magnet B, built up in two parts, as shown in longitudinal section in fig. 2.

The ring magnet is energised by the coil C, and produces an intense magnetic flux across the air gap containing the copper through the central stationary armature D. This field is very much stronger than that in the ordinary dynamo, there being more than 15,000 lines per cm^2. of cross-section.

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* Abstract of paper read before the American Institute of Electrical Engineers.

Around the armature is wound a fixed winding, which is reversed in direction so that one half of the winding is clockwise and the other counter clockwise. When an alternating current is passed through this armature winding, it induces another alternating current in the copper tube.

Only by this construction has it been possible to obtain the enormous force and rapidity necessary to compress the water and to overcome the inertia of the moving parts of the mechanism.

In order to apply this force to the work of compression, the copper tube is attached to solid disks of steel, which are drawn together on the tube by a one-inch vanadium-steel rod and a right- and left-handed screw thread, and are attached to a steel diaphragm one inch thick, which may be made part of the side of the ship.

Telegraphing is accomplished by means of an ordinary telegraph key placed in the main armature circuit. There is no sparking at the contacts, although a very high frequency is used, five hundred per second, and there is no laminated iron used in the construction of the apparatus. The secret of this lies in the fact that the armature has substantially no self-induction, and no eddy currents are generated in the apparatus; the copper tube forms the short-circuiting secondary of a transformer, of which the armature winding is the primary.

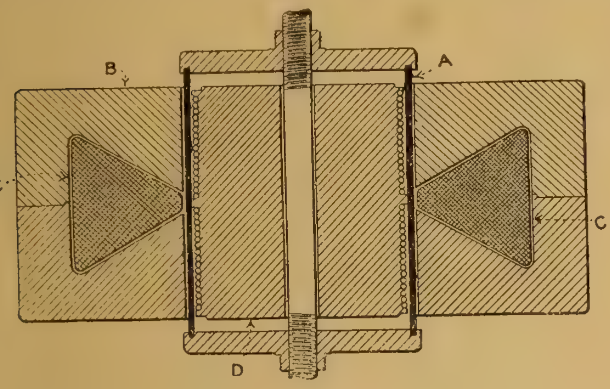

Fig. 2.—Longitudinal Section of Oscillator.

This eliminates the self-induction of the armature winding. In addition the upper and lower portions of the winding are wound in opposite directions, and therefore there is no mutual induction between the field coil circuit and the armature circuit. With this construction, the amount of magnetic leakage in the armature circuit is very small, only a trifle more than if the armature core were of wood, and as there is no alternating magnetic flux in the iron, there are no eddy currents.

The capacity in kilowatts of this apparatus is large; the winding being in grooves in the armature core, so as to withstand the mechanical forces acting upon it, is well cooled.

The copper tube has no insulation to be affected, and on account of its large cooling surface and high permissible temperature of operation, can carry very high currents without injury.

When the oscillator is placed on a vessel or hung overboard from a lightship, a large water-tight diaphragm is attached to the oscillator. This particular type of oscillator was first tested by suspending it in twelve feet of water at the Boston lightship, and the signals were heard plainly with a microphone lowered overboard from a tug at Peaked Hill Bar Buoy, thirty-one miles away. Since that time tests have been made with oscillators installed in the fore peak tank of the *Devereux*, a collier of the Metropolitan Coal Company, and also with an oscillator mounted on a diaphragm made part of the hull of the vessel. The signals have been heard upwards of twenty miles from the *Devereux* running at her regular speed of eight knots. Full power has not been employed on any of the tests, and it is more than probable that much longer distances can be attained in the future.

In addition to the tests already described the oscillator has been temporarily installed on submarine boats, and demonstrated that a flotilla of submarines equipped with oscillators will be able to make a combined attack on an enemy, only one needing to show its periscope in order to direct the others, or all of them can be directed by the mother ship. It therefore makes possible a whole field of submarine manœuvres heretofore out of the question; and perhaps most important, it removes the principal danger these boats have had to face, the risk of being run into.

The signals produced by the oscillator can be received by water-immersed microphones of the usual type. One would perhaps not anticipate the possibility of using the oscillator as a receiver, in view of the fact that the diaphragm is of solid steel, and weighs, with the copper tube and its attachments, considerably over 100 pounds; but the oscillator, like the ordinary electric motor, is also capable of acting as a generator, and on account of its high efficiency as a motor, is a very efficient one.

The same oscillator is therefore used for sending and for receiving, a switch being thrown in one direction when it is desired to telegraph under water, and thrown the other way when it is desired to listen in.

In addition to telegraphing and receiving messages, the oscillator can also be used for telephoning under water. Sentences have been transmitted at 800 yards and conversation at more than 400 yards, and this was accomplished with the use of an ordinary telephone transmitter and six dry cells.

It seems evident, therefore, that with more power much greater distances can be reached. Long distances are not, however, necessary, as even with a distance of one mile it will be readily understood that this method of under-water telephoning will be of great use as a means of communicating between submarines while submerged, and between ships in fog, as the captains of the vessels can talk directly to each other, instead of transmitting and receiving through a telegraph operator.

In April, 1914, some tests were made on the U.S. revenue cutter *Miami* to see whether soundings could be taken by echo from the sea-bottom. The echo was plainly heard not only on the oscillator, but in the wardroom and in the hold of the ship without any instruments whatever. The elapsed time corresponded to the depth shown on the chart, and the proposed method was proved to be feasible.

The chief object of the tests on the *Miami* was, however, to determine whether a reflection from icebergs could be obtained, and this was proved beyond question.

A signal was sent on the oscillator, the echo from the bottom heard, and then the echo from the iceberg came in. To make sure that the second echo was not also from the bottom, the distance from the *Miami* to the iceberg was varied from about 100 yards to 2½ miles. The elapsed time between the signal and the echo from bottom remained the same, but the elapsed time of echo from the iceberg varied with the distance and corresponded very closely to the position of the iceberg determined by the range finder. Moreover, it was found that it made no difference whether the face of the iceberg was normal to the path of the sound or not, thus showing that the echo was due not to specular reflection but to diffraction fringes.

[In a popular article on this subject recently published in the *Strand Magazine*, it was stated that the Fessenden system had been adopted by one of the European nations for use on its submarines.—Eds. Elec. Rev.]

AN ELECTRICALLY-DRIVEN MILL.

An example of the benefits accruing from the electric drive of textile mills is found in a doubling-frame installation carried out by the General Electric Co., Ltd., at the New Bridge Lane Mills of Messrs. Thos. Reynolds, Ltd., of Stockport. In this installation the main "Witton" generator, of 150 KW. capacity, is driven through ropes from a main mill engine, and, running at 385 R.P.M., delivers three-phase power at 500 volts, 25 cycles. On the same shaft is coupled a D.C. generator, which supplies the exciting current for the alternator as well as current for the lighting of the mill. A 120-H.P. "Witton" three-phase slip-ring motor, running at 490 R.P.M., drives about 6,000 spindles from a central point. This motor works in conjunction with two 45-H P. water turbines, which draw their water from the River Mersey. The motor, which is shown in fig. 1, is of sufficient capacity to take the full load of the 6,000 spindles when the water supply fails.

When water-power is available, the arrangement is such that the turbines take as much load as the water supply will permit, and the motor develops the additional power. This is accomplished by means of a special clutch whereby when, through the scarcity of water, the speed of the turbines drops, they are instantly cut out and the motor takes the full load. As soon as the speed of the turbines comes up again, the clutch acts to effect engagement between the turbines and the motor, so that the load is shared as before.

In another part of the mill are installed 10 doubling frames aggregating 4,000 spindles. These frames, which are illustrated in fig. 2, are individually driven by three-phase squirrel-cage "Witton" motors taking power at 500 volts, 25 cycles, and running at a speed of 1,490 R.P.M. Each motor is mounted on a bedplate complete with oil-immersed chain drive in a cast-iron case, which enables the tin roller shaft to be driven at the correct speed through a friction clutch and a flexible coupling. The drive is so arranged that by disconnecting the flexible coupling the whole gearing can be slung over approximately 45°, thus making the frame gearing accessible without in any way interfering with the motor or its gearing.

The motors are run up to speed by star-delta starters of a compact design, which are conveniently situated in proximity to the motors. These starters are simple in operation, and can be left in the control of the workpeople, to whom they present no difficulties

They are provided with devices which prevent the workmen making a mistake in the starting-up operation, and fully protect the motor against damage.

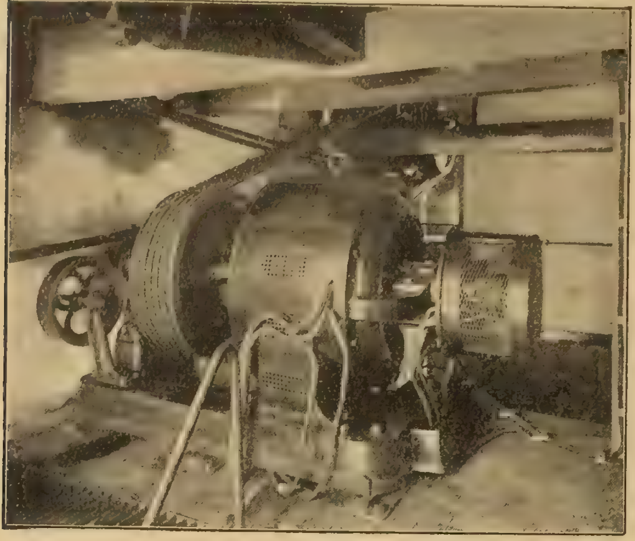

Fig. 1.—120-h.p. "Witton" Motor driving part of the Mill.

The main switches controlling the motors are shown in the background of fig. 2. They are of the standard G.E.C. "Salford" pattern, and are provided with fuses.

This installation has solved for the owners a difficult problem, as the small headroom available would have made the installation of mechanical transmission a perplexing question, which at the best could only have resulted in an inconvenient solution. We understand that the owners are entirely satisfied with the application of electricity for driving their mill.

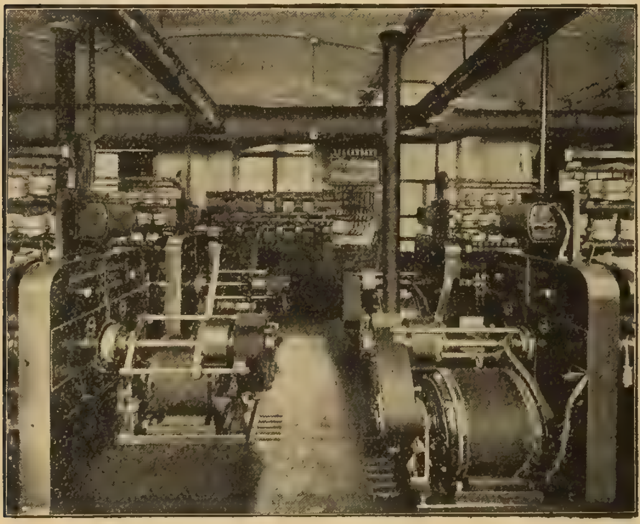

Fig. 2.—Individual-drive "Witton" Motors with Oil-immersed Chain Drive; the Main Switches controlling them are shown in the background.

LEGAL.

Interned German as Plaintiff.

In the City of London Court, on June 25th, before his Honour Judge Rentoul, K.C., the H.N. Battery Co., electricians, 16, Barbican, sued Messrs. Harvey, Taylor & Co., medical and dental electricians, 253, Gladstone Avenue, Wood Green, for £4 15s. for electric lamps supplied. The defendant Taylor said that the plaintiff company was an alien enemy. The real plaintiff was H. Neuberger, and he was trading as the H.N. Battery Co. The goods sued for were sold in July of last year. The Judge: At that time the Germans were our best friends. Defendant said that the money did not become due until after the war began. The Judge did not see why the defendant should not pay. It might be his duty to keep the money in Court to prevent it from going abroad. Plaintiff's representative, named Sim, said that the account was for April and May. The proprietor of the business was Neuberger, who was interned on the previous Tuesday. Witness was looking after the business in the meantime. The Judge: You are winding it up? Mr. Sim: No, keeping it on. He is applying for exemption from internment on certain grounds, and he hopes that he will be successful. The Judge said he must find for the plaintiff, with costs, but the money would stay in Court until after the war.

Osram Lamp Litigation.

In the Chancery Division, on June 22nd, Mr. Justice Joyce commenced the hearing of an action by the Osram Lamp Works, Ltd., of 31, Copthall Avenue, E.C., against Pope's Electric Lamp Co., Ltd., of Hythe Road, Willesden, for an injunction to restrain the defendants from infringing the plaintiffs' Letters Patent 23,899* of 1904, for damages, and for the delivery up of articles or things made in infringement of the said letters patent. The defendants denied that they had infringed the letters patent, and alleged that there was no subject matter for the plaintiffs' patent and a want of novelty.

Mr. A. J. Walter, K.C., Mr. H. A. Colefax, K.C., Mr. J. Hunter Gray, and Mr. Lunge appeared for the plaintiffs; Mr. T. Terrell, K.C., Mr. T. R. Hughes, K.C., and Mr. E. Russell Clarke appeared for the defendants.

Mr. Walter informed his Lordship that this action related to incandescent electric lamps, and more particularly to the filament in such lamps.

After explaining the history of the subject and the state of the art when Just & Hanaman made the invention which was in the Specification 23,899 of 1904, Counsel said that that was a patent for manufacturing a tungsten filament, and these patentees discovered that tungsten if taken in metal form or in the form of its oxides or sulphides, mixed with an agglutinant and formed into a thread, and carbonised so as to form a filament of tungsten and carbon, could be protected by an atmosphere of hydrogen in the further process of burning out the carbon. Dr. Welsbach had discovered that this was the case with osmium and the metals of the platinum group. These inventors discovered that it was also the case with tungsten, and that you could burn out the carbon by means of the oxygen in steam without injury to the metal, which would be protected by the hydrogen.

In a previous action by the Osram Co. against the "Z" Electric Lamp Co., Ltd., this patent had been considered by Mr. Justice Warrington. In that action practically every one of the objections taken to the plaintiffs' patent in this action was taken and overruled. It was suggested in the "Z" action, and it was again suggested here, that there was no subject matter in discovering that tungsten could be protected by hydrogen from the action of oxygen. Mr. Justice Warrington held that there was invention in it, and that there was nothing in chemistry which would have taught a person that because osmium and the metals of the platinum group would be so protected, the metal tungsten could also be protected by hydrogen; in fact, titanium, zirconium, and thorium could not react in this way. According to the defendants' case, Welsbach, when he made his invention, though he was, in fact, treating osmium and the metals of the platinum group, must have known that tungsten, a metal otherwise possessing desirable qualities, would be susceptible to the same treatment. But, until this specification, no one ever suggested that this was the fact. This specification formed the basis for the manufacture of tungsten filaments in this country, and tungsten had substantially replaced carbon filaments for commercial lighting. There had been a subsequent development, and means had now been found for the working of tungsten. That patent had not yet been before the Courts, but it would soon be. The defendants operated by two methods, but they used a carbonaceous binding material, and they took as their raw material a mixture of finely divided tungsten and a small quantity of one of the oxides of tungsten. These were the metals referred to in the specification. They mixed that metal with an organic binding material, and they made threads by a process of squirting. Thus they obtained a thread of tungsten material bound together with carbon. These filaments were dried so as to have some sort of form, and then there were two alternatives in the first process. They had furnaces of iridium, down the walls of which an electric current flowed so as to heat it at the top to a temperature of about 950° C. Lower down the temperature was lower, and the bottom was cooled by a water jacket. Hydrogen was passed into the interior of the furnace, and hydrogen was also brought round the furnace to prevent the possibility of anything but hydrogen getting inside. The filaments, which had been squirted and dried, were put upon a holder from which they hung and passed very gradually from the bottom of the furnace into gradually increasing heat. When they got to the top they remained there a certain time and then passed down again into the cooled part, from which they could be taken out. They were, therefore, in an atmosphere of hydrogen, being first carbonised in the lower and cooler portions of the furnace. When they got to the higher portions the hydrogen acted on the oxygen of the tungsten oxide, steam was formed, and the oxygen in the steam burned out the carbon precisely as indicated in the specification. The same process appeared to be carried out partly not in the iridium furnace, but in a porcelain furnace, which was heated electrically to a temperature of 950° C. The chemistry of the operation which took place in the porcelain furnace was precisely the same as in the other. Whichever method was adopted the makers had now got rid of some of their oxygen, and they wanted to get out more carbon, and they wanted to make more steam. After the cooled filaments were removed from the furnace they were therefore heated in an oven exposed to the air up to a temperature of about 220°. By this means some tungsten was oxidised. Then the filaments were passed into another iridium furnace into which hydrogen was flowing at the top, where the maximum heat was 1,850° C. As in the previous case, the furnace was cooled at the bottom, and the filaments were gradually raised through the increasing heat, and in the same way vapour was formed. This operation was, therefore, also carried out in an atmosphere of steam and hydrogen, and the carbon was oxidised while the tungsten was protected. Electricity played no part in the process other than heating, and it was much the same as if current had been run through the filaments themselves in a prepared atmosphere in the manner described in Just & Hanaman's specification. The second of the two processes to which he had referred was carried out by means of quartz or silica tubes about 2 ft. 6 in. long and about 2 in. in diameter. These were sealed at one end and were fitted at the other end with a cover by which they could be connected to an exhaust pump. The filaments were put on to a holder and put inside the tube. The vessel was then closed and the air pump put to work. The quartz tube was put into an electrical furnace and heated up to 950° C., the exhaust pump continuously working. Hydrogen with steam and carbonic oxide were the gases that came out of the tube, so this process was essentially the same as the others. The tube was taken out of the furnace in due course and allowed to cool. When cool it was put into an exposed oven heated up to 220° C. More tungsten oxide having been formed in this way, the filament was again put into the quartz tube and the process was repeated in a final furnace heated up to 1,850°. Thus the one method of treating the filaments was carried out in a vacuum, the other in a stream of hydrogen, but in both the atmosphere was that described in the plaintiffs' specification.

Dr. Francis Wm. Passmore, a consulting chemist, said in evidence that for the purposes of this case he had studied the specification sued upon and the prior documents which were urged against its validity. On several occasions he had attended when the defendants afforded inspection of their process. He had also carried out a large series of experiments. Taken through the plaintiffs' specification by Mr. Colefax the witness agreed that, following out the invention as described in this specification, filaments of pure tungsten or substantially so were obtained which did not possess the defects of those where tungsten had been applied as a coating. The directions given were, in his opinion, sufficient to enable one to carry out what had been described. He did not find disclosed in any of the documents that were pleaded against this patent the idea of using a filament of pure tungsten, except in the case of drawn wire, No. 20,277 of 1904, the patent granted to Abel on a communication from Siemens & Halske, and the German patent of Just & Hanaman, No. 154,262. In none of those documents did he find any suggestion that for the purpose of obtaining a tungsten filament substantially pure one could use the process described in the plaintiffs' patent. The two patents mentioned, 20,277 of 1904 and the German patent 154,262, were referred to in the disclaiming clause of the specification. He considered the Just & Hanaman an epoch-making invention. At the date of Just & Hanaman's specification no means were known by which one could obtain a drawn-wire filament. With regard to the suggestion of Just & Hanaman in their German specification No. 154,262, one could make a tungsten filament following that process, but it was not pure. It was known that a stream of hydrogen would remove carbon from the admixture with tungsten, but whether or not it would leave the tungsten filament intact no one knew. Welsbach's specification 1,535 of 1898 referred entirely to osmium or a metal of the platinum group. He did not think Welsbach's specification would have told anyone in 1904 of the possibility of making a built-up filament by the Just & Hanaman process. Nor did he think that any assistance ould have been got from the specification of Gulcher, which mainly related to iridium, which Gulcher proposed to sinter. Bottone dealt with tungsten, but his object was merely to produce carbon filaments strengthened by tungsten, and there was no suggestion in Bottone's specification of a paste of tungsten or a compound of tungsten and a binding material from which the carbon could subsequently be eliminated and the tungsten retained. Similarly the two Lodyguine specifications related not to a paste process, but to claims for a body containing a fillet without any process for getting rid of the fillet. He found in the specification of Just sufficient directions to enable him to put the invention into practice.

His Lordship: I apprehend the greatest possible difficulty as to whether the process which the defendants are operating is the patented process. The other questions as to the validity of the patent, and so on, one can understand, but I suppose defendants are going to say it is not the process patented. Your witnesses will have to explain this to me clearly. It is an issue I don't look forward to with any pleasure.

Mr. Terrell: It seemed to me that for the purpose of enabling your Lordship to deal with this particular issue, it would be desirable that you should see the process at work.

His Lordship: I don't think I am going to do that. In these cases I bear in mind that I am not bound to be an expert. I have no doubt that scientific witnesses will be called, and I shall have to do the best I can.

Dr. Passmore then proceeded to describe the defendants' processes, which were explained by Mr. Walter in opening.

He said that in the vacuum process the filaments were, after the first furnacing up to 950°, put into an exposed oven heated up to 220°. In the next stage the filaments were transferred to the furnace and the first operation was repeated. Finally the filaments were transferred to a platinum-iridium furnace in which a stream of hydrogen passed downwards, and which was heated to 1,850°. Analyses of samples taken at the defendants' works were produced by the witness. From one of these it appeared that a filament, after squirting and drying, contained 2·32 per cent. carbon and 93·04 per cent. tungsten; the balance was made up of oxygen, hydrogen and nitrogen. At that stage carbonisation had not commenced. In another sample analysed, witness said the records showed that the carbon had dropped to 0·013 per cent., and the tungsten had risen to 99·95 per cent., after heating to 1,850°. At the very last stage the tungsten was brought up practically to 100 per cent.

Mr. Terrell then cross-examined the witness on behalf of the defendants.

Is the total result of your view, said Counsel, that with regard to this patent for the use of an atmosphere of gas, steam and hydrogen, however much they might try to avoid infringing it they cannot help doing it?—Witness: No. I think a pure tungsten filament can be made without using it.

But can a pure tungsten filament be made by means of the building-up process—that is the point?—Yes, without using this process.

Using a binder?—Yes.

And not using this process?—Yes.

Was there any usual practice of making filaments for lamps at the date of this patent other than the process for making carbon filaments?—Yes.

Where was it carried out?—That I cannot say. But I say from the literature it is quite evident there must have been.

Was there any furnace known in which you could raise a filament, or anything, to a temperature of 1,850°, and at the same time keep it in a gas such as hydrogen?—Certainly, I should think.

You knew that this specification of Just & Hanaman prescribes heating by an electric current?—Yes.

You knew perfectly well that the heating adopted by the defendants is in a furnace at which a temperature of 1,850° is reached in an atmosphere of hydrogen?—But the other temperatures are in an atmosphere of hydrogen.

You knew perfectly well that that was one of the issues in this action?—No, it never occurred to me that there was any distinction between heating in a furnace up to 1,850°, the furnace being warmed by electric current, and in the other case the filament.

Later Mr. Terrell said that some part of the process it had been desired to keep secret; but keeping this secret would, he found, hamper his cross-examination: and as the importance of keeping it secret had gone, he would abandon the idea of trying to do so. The binder that was used by defendants was composed of 20 parts of binder and 100 parts of metallic tungsten.—Witness said that was only right in respect of some filaments.

It is nearly always five to one, is it not?—It is always four to one for thin filaments and five to one for thicker filaments.

As to the composition of the binder, it is 68·8 per cent. amyl acetate?—I don't know that. What I have here is "Mix 243 grammes amyl acetate and 30 grammes castor oil; dissolve therein 30 grammes of camphor; then add 50 grammes nitro-cellulose; heat up to 130° C. in an oil bath for about half an hour. Filter through asbestos."

In the defendants' process they do not denitrate?—Not in the size of filament I saw.

Now consider Welsbach's second method. "The principle of this method is to take a carbonaceous filament and to cover it, or saturate it, with an osmium compound; and then by electrically heating the conductor so formed in a suitable protective atmosphere to burn out the carbonaceous matter, and thus to leave a coherent filament of osmium." Do you understand that he is going to pass an electric current through it?—Yes.

And by means of a protective gas he is going to oxidise the carbon while keeping the osmium in a reduced condition?—Yes.

Then he says: "Instead of a carbonaceous filament being taken I may use the equivalent method of a carbonaceous binding material." What do you understand by that?—He is going to take a powder of some osmium metal or a compound and mix it with a carbonaceous binding material such as collodion and make a paste and squirt a filament.

Then he goes on to describe what he does in detail. Later, he speaks of carbonising the organic matter by destructive distillation and getting rid of the carbon. The success of this operation of Welsbach's depends upon the knowledge that hydrogen will reduce osmium?—Yes, that is one of the necessary items of knowledge, but you must know a great deal more than that.

And he says: "As has been already stated, it is not necessary that the basis of the filaments should be organic fibres. They may be made from any convenient carbonaceous material which can be burnt off by the above process. Thus, the method used for the production of artificial silk may be employed." What does Welsbach tell you when he tells you that?—He means squirting a solution of cellulose into a setting bath.

If you read "metal tungsten" there wherever the word osmium occurs, is there any difference in the process described there and the process described in the specification sued upon?—There are two processes dealt with there, one with steam and hydrogen, and that would work.

He says: "A mixture of finely divided osmium and osmium compounds, such as sulphide and tetra-hydroxide, is mixed with the collodion, so as to render the mixture viscous and to keep the osmium from separating out by reason of its greater density. The magma is now formed into the desired shape as, for instance, by squirting it through a die. The collodion is then denitrated."

Is there any difference between the process there described and the process described by Just & Hanaman?—No.

It says: "The collodion is then denitrated and subjected to the process described above to burn off the carbon," and the process described above is: "When it is fixed it is gradually raised to a high temperature in a reducing atmosphere containing water vapour or hydrogen preferably of the kind before referred to which is obtained from the Bunsen flame; but mixtures of steam and hydrogen or of carbonic monoxide, carbonic dioxide and hydrogen can also be used"?—Yes, it is one of the processes described.

Do you say any one of the atmospheres described in Welsbach for osmium will not work quite well with tungsten?—I can't say; it depends on the composition of the mixture.

Do you say now that you are unable to say whether all these atmospheres mentioned by Welsbach for osmium will not also equally well work for tungsten?—I should certainly think not. It may be that they do, but reading this specification would not convey to my mind that they do, because my experience has been that even with a small amount of hydrocarbon, if tungsten is heated in an atmosphere of that kind there is carbon deposited. But it may be that you might discover some conditions under which it would work.

At any rate you are not prepared to say that experiments which show that they all work perfectly well with tungsten, as well as with osmium, are erronous?—Certainly. They will not work as well with tungsten as with osmium.

Why not?—Because of the different nature of the metals. It is a matter of proportion.

Proceeding, Mr. Terrell read a portion of Mr. Justice Warrington's judgment in the "Z" case, in which the Judge said that Welsbach's process of decarbonising in steam and hydrogen had been tried by Dr. Lieman upon uranium, which is in the same group as tungsten, but without success. What is the reason, inquired Counsel, that uranium will not succeed in this process described by Welsbach?

Witness: I presume it oxidises.

You have tried several metals of the tungsten group yourself? Yes; tantalum, titanium, zirconium and thorium. All of those failed in the process of removing carbon in an atmosphere of steam and hydrogen.

It was a matter of text-book knowledge in 1904, was it not, that tungsten is reduced from its oxide by hydrogen?—Yes, that was one way of doing it.

Therefore would not everyone in 1904 know perfectly well that this process of Welsbach, so far as the steam and hydrogen part of it was concerned, would work?—No.

What other knowledge would you want to enable you to predict that it would succeed than the fact that it was reduced by hydrogen?—I should want to know what oxide was produced, at what temperatures, where reduction commenced, where oxidation commenced, before I could form any idea.

All that you would have been told by the common knowledge of the day?—No.

Are you in a position to say that tungsten was not one of the metals referred to in Siemens & Halske in 1904 as having been suggested for filaments made with the use of agglutinants?—I don't know about suggestions. I daresay it had been suggested that tungsten would make a very good filament. The question was how.

By the aid of agglutinants?—No, I don't think it had been suggested before.

(To be continued.)

Attwell v. West Ham Corporation.

Last week, at the Bow County Court, the hearing of this case was resumed. Plaintiff claimed damages for injuries sustained due to an electric shock received while cleaning out a transformer station. Further evidence having been given by plaintiff, and by Mr. T. W. Baker, consulting electrical engineer, the hearing was again adjourned.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

8,726. "Self-acting electric fire alarm." A. P. Symons. June 14th.

8,736. "Combined electric switches and connecting plugs." R. Moore. June 14th.

8,739. "Electric apparatus for driving clocks and similar mechanism." H. E. Warren & Warren Clock Co. June 14th. (Complete.)

8,748. "Regulating mechanism for dynamo-electric machines." J. Martin and British Thomson-Houston Co., Ltd. June 14th.

8,770. "Electro-magnetic make-and-break devices." Soc. Anon. des Etablissements L. Bleriot. June 14th. (Divided application on 16,080/14. Convention date, July 7th, 1913, Belgium.) (Complete.)

8,773. "Electro-deposition of metals." L. Wirtz. June 15th.

8,806. "Electrical incandescent lamps." British Thomson-Houston Co., Ltd. June 15th. (General Electric Co., United States.)

8,813. "Cell, battery, or refill for use in connection with portable electric lamps, and for other purposes." L. Wahl. June 15th. (Addition to 7,213/15.)

8,826. "Method of telephonic transmission without return wire." C. Bardeloni. June 15th. (Complete.)

8,829. "Electric heating and resistance devices." A. F. Berry. June 15th.

8,850. "Electric meter." R. S. Xenaky & F. Gilman. June 16th. (Complete.)

8,860. "Electrical resistances." A. H. Railing, C. C. Garrard & F. Greenhalgh. June 16th.

8,881. "Micro-telephones for portable instruments." F. Kirkby. June 16th.

8,891. "Automatic and semi-automatic telephone systems." Relay Automatic Telephone Co., Ltd., & W. Aitken. June 16th.

8,895. "Arrangements for protecting telephone, telegraph, and the like instruments against lightning or excessive electric potentials." A. E. Beattie. June 16th.

8,903. "Electrical relays." V. Tedeschi & A. G. Rossi. June 16th. (Complete.)

8,907. "Anodes for the electrolysis of solutions of metallic salts." P. C. C. Isherwood. June 16th. (Complete.)

8,923. "Method for the production of an electric discharge of high-frequency by means of sparks." R. J. Bourgeois. June 17th.

8,926. "Wireless telegraph receivers." Marconi's Wireless Telegraph Co., Ltd., & G. M. Wright. June 17th.

8,927. "Wireless telegraph receivers." Marconi's Wireless Telegraph Co., Ltd., & G. M. Wright. June 17th.

8,928. "Wireless telegraphy." Marconi's Wireless Telegraph Co., Ltd., and G. M. Wright. June 17th.

8,946. "Metallic lead-in wires for electric lamps, scientific apparatus and the like." J. F. Duke. June 17th.

8,961. "Apparatus for detecting the presence of electric conductors." A. W. Sharman. June 17th.

8,980. "Insulating covering for telegraph and like wires." J. D. Brunton. June 18th.

9,003. "Miners' electric safety lamps." J. G. Patterson. June 18th.

9,012. "Secondary battery plates." Electrical Power Storage Co., Ltd., and W. Schofield. June 18th.

9,015. "Motor-actuated electric switches." Landis & Gyr Akt. Ges. June 18th. (Convention date, July 14th, 1914, Germany.) (Complete.)

9,021. "Electro-magnetic apparatus." W. F. Jones. June 19th.

9,023. "Ammeters and voltmeters." Walsall Electrical Co., Ltd., & V. Delebecque. June 19th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1914.

3,701. Rotary Electric Switches. M. K. Ownbey. February 12th.

5,040. Electric Ignition Apparatus for Internal-combustion Engines. R. Varley. February 26th.

5,841. Circuit Arrangements for Semi-automatic Telephone Systems. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). March 7th.

7,746. Combined Dynamo-electric Generator and Electric Motor. W. Fox. March 27th.

8,683. Method of Repairing Electric Incandescent Lamps. Electric Utility Co. & R. W. Long. April 6th.

10,930. Electrical Liquid Heater. A. Howard. May 4th. (July 11th, 1914.)

13,022. Dynamo-electric Machines, particularly applicable for Engine-starting Systems. C. F. Kettering & W. A. Chryst. May 27th. (July 14th, 1913.)

13,022. Dynamo-electric Machines, particularly applicable for Engine-starting Systems. C. F. Kettering & W. A. Chryst. May 27th. (September 13th, 1913. Addition to 13,022/14.)

13,076. Manufacture of Tungsten. British Thomson-Houston Co. May 27th. (General Electric Co.)

13,173. Automatic Telephone Exchange Connections. Relay Automatic Telephone Co., formerly known as Betulander Automatic Telephone Co., G. H. Bryant & M. Ward. May 28th.

13,231. Systems of Control for Electric Motors. British Thomson-Houston Co. (General Electric Co., United States). May 29th.

13,232. Liquid Rheostats. British Thomson-Houston Co. (General Electric Co., United States.) May 29th.

13,310: System of Electric Signals for Main and Tail Haulage in Mines and like places. G. B. Burrows. May 30th.

13,410. Telephone Systems. M. S. Conner and R. E. Robinson. June 2nd.

13,549. Manufacture of Metal Wire. British Thomson-Houston Co. (General Electric Co., United States). June 3rd.

13,709. Starting Apparatus for Alternating-current Motors of the Slipping Induction Type. W. E. M. Ayres. June 5th.

13,715. Electro-magnetic Locking Devices. L. Cadenel. June 5th. (June 10th, 1913.)

13,854. Means for Telephonic Communication between Moving Trains and Railway Stations or other stationary places. T. G. Thornblad, R. H. Warfvinge & V. G. Werner. June 8th. (Convention date not granted.)

14,156. Sparking Plugs for Internal-combustion Engines. W. V. Williams. June 12th.

14,229. Shaping Filaments for Electric Lamps and the like. British Thomson-Houston Co. (General Electric Co., United States.) June 12th.

15,464. Electric Starting Devices for Internal-combustion Engines. L. Renault. June 27th. (July 12th, 1913.)

17,345. Electric Heaters. H. Wilson & Co., Ltd., and W. R. Fairbairn. July 22nd.

17,732. Automatic Electric Fire Alarms. H. Dixon. July 27th.

18,677. Telegraphy. E. C. R. Marks (Delany Foreign Co.). August 4th.

19,598. Electric Switches. F. B. Holt. September 9th.

20,671. Electrodes for Secondary Batteries. A. Connell & H. S. Hohne. October 7th.

24,046. Manufacture of Electrical and other Heaters. J. A. Chell. December 14th.

1915.

1,600. Electric Couplings. W. C. Lea. February 1st.

2,387. Electric Liquid Heater of the Water-flow Service Supply Type. A. Howard. February 15th. (Divided application on 10,930/14, July 11th.)

3,003. Electric Switches for Motor-car and like Horns. A. H. Midgley and C. A. Vandervell. February 24th.

Fires.—Early on Wednesday, June 23rd, a fire occurred at the Peel-Conner Telephone Works, Adelphi, Salford. The outbreak was discovered in the grinding room on the ground floor, and by the time the fire brigade had arrived the roof of the building had fallen in. After about half an hour's work the brigade got the upper hand, and prevented the fire from spreading to the main building.

A fire also occurred last week among some large packing cases at the works of Switchgear & Cowans, Ltd., Springfield Road, Salford. It was quickly extinguished, the damage being very slight.

THE

ELECTRICAL REVIEW.

VOL. LXXVII. JULY 9, 1915. No. 1,963.

ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: July 9, 1915. [No. 1,963.

	Page
The Scientific Organisation of Science	33
The National Register	34
Electricity "also ran"	34
The Lead Position	34
Electrical Imports during the War	35
Our Future	35
Sheathed-Wire Heating Units, by C. P. Randolph (*illus.*) ...	37
New Russian Customs Tariff (*continued*)	38
War Items	39
Our Electrical Imports during the War Period	39
Legal	40
Correspondence— Reserve Officers' Training Corps	42
Business Notes	42
Scientific Organisation of War Material Supplies in Germany and Incidental—Robbery, by L. A. Staylaers	48
Notes	49
City Notes	52
Stocks and Shares	55
Share List of Electrical Companies	56
Market Quotations	56
Metal Market—Fluctuations in June	57
A New British Industry	57
Incorporated Municipal Electrical Association— Annual Report	58
The Work of the National Physical Laboratory in 1914-15 (*concluded*)	61
New Electrical Devices, Fittings and Plant (*illus.*)	62
New Patents Applied for, 1915	64
Abstracts of Published Specifications	64
Contractors' Column ... ... Advertisement page	xx

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THE SCIENTIFIC ORGANISATION OF SCIENCE.

WE have recently drawn attention to the imperative necessity of making use of all our resources to prosecute the war to a successful conclusion, and consequently the importance of utilising the intellectual reserves at our disposal; we urged the Government to take immediate steps to this end, and cordially welcomed the sympathetic attitude of the late President of the Board of Education towards the deputation of scientific men which he received shortly before he left office. Mr. Pease in the House of Commons outlined a scheme for carrying out the policy of enlisting the services of our scientists, and his successor declared his intention of putting it in force. All that was weeks ago—and yet no apparent progress has been made towards the fulfilment of the promises that were made, and in the meantime men are enlisting in the ranks who ought to be entrusted with leading posts in the scientific branches of our organisation, whilst others who cannot adopt that course are standing idle when they would gladly throw themselves heart and soul into the battle of the laboratory and workshop.

It is true that Mr. Lloyd George, in answer to a question in the House of Commons, recently stated that he was in communication with the War Office on the subject of employing scientific advice, and still more recently the Council of the Chemical Society, apparently despairing of Government action, has constituted itself a consultative body to consider and utilise suggestions that may be communicated to it by members of the Society, and others; and on Monday it was announced that Lord Fisher had been appointed chairman of a new "Inventions Board," to assist the Admiralty in co-ordinating and encouraging scientific effort in relation to the Navy. But these sporadic attempts to meet our urgent requirements are mere nibbles at the greater problem, and are entirely lacking in evidence of any definite and matured policy on the part of the nation. The formation of an Inventions Board —when it takes place, for the *personnel* is not yet organised, if, indeed, it has been chosen—is certainly commendable, but why should its operations be confined to naval matters? There is plenty to be done in connection with the Army, the aerial services, the commissariat, the medical service, and surely it would be preferable to co-ordinate all these branches by forming one advisory body with subdivisions, to avoid overlapping and waste of labour. That Lord Fisher, with his vast experience in naval engineering and architecture, will make an efficient chairman to the Board can hardly be doubted; yet we would have preferred to see a younger man appointed to this post, for the older a man is the more conservative are his tendencies, and it needs a young man with the gift of imagination in full vigour to grasp and visualise the possibilities of an apparently crude and impracticable idea. We saw this in the case of Mr. Marconi, for example, who alone gathered together the threads which had been spun by his elders and, endowed with splendid imagination, wove them into the design which has become one of the landmarks of history.

As for Mr. George's movement, he spoke three weeks ago, and we have heard no more of the matter; and Mr. Henderson shows no sign of fulfilling his intention to carry out Mr. Pease's scheme. But not only inventions need consideration—there is abundant scope for scientific work in many other ways; methods which are in vogue may be faulty or detrimental and need correction; materials in use may be inferior to others that our scientists can indicate; substitutes may be required for substances that are scarce, new ways of preserving food and ministering to the comfort of our sailors and soldiers can be devised, and even the psychologist will find useful occupation for his knowledge in the trenches, and on board ship. We have the men, able and willing to devote their ability to the nation's service; why, in the name of all that is mysterious, do we not instantly avail ourselves of these invaluable resources, as the Germans have done from the beginning, and as our French and Belgian Allies have already done? Those who scan the pages of our French contemporaries will find that for the preparation of foods special processes and machines have been developed; similar attention has been given to the soldiers' clothing, and in many other ways advantage has been taken of the knowledge ready to hand, but in our case unutilised. Why do we wait?

We note that on June 19th, Mr. F. Creedy, a well-known electrical engineer, in the *Times* proposed that a voluntary organisation should be formed to do the work, in the absence of Government action; the Chemical Society has already taken steps in that direction, and on June 21st Prof. Armstrong called upon the Royal Society to organise itself for the service of the State or forfeit its claim to the peerage of science. All such efforts are laudable, but, as we have said, sporadic and unorganised—in fact, unscientific; what we want is the scientific organisation of science to aid us in the war, and we want it *now*.

The National Register.

THE National Registration Bill passed its second reading in the House of Commons on Tuesday. The opposition, both numerically and in respect of forceful argument, was, like the alleged German air raid on Landguard Fort, "hardly worth notice." We need not waste space in condemning such obstructive and anti-national efforts—the nation may be trusted to recognise its friends. In our opinion national registration is one of the imperative necessities arising out of our present national emergency, and if it is inquisitorial it is no more so than the periodical census and the National Insurance Act. In place of the private inquisitorial attentions of ladies and others, it will afford every man and woman an opportunity for self-examination, and will enable them conscientiously, we hope, to decide whether they are or are not aiding their country in her hour of need. That will be something gained. Not less important, however, is it that at such a time the nation should have at command complete information, from which it may be possible accurately to judge the extent and character of our available resources. Further, it may enable us to avail ourselves with greater efficiency and facility of particular classes of labour, knowledge and experience, and to prevent further enlistment for the Forces of men who ought to be in the factory or the colliery, or keeping the trade wheels turning. Lord Kitchener is stated to hold that Mr. Long's Bill will enable him to avoid taking men who ought not to be taken. At present without such a Bill we are getting mechanics back from the training camp, and in some cases from the trenches, but the Registration Bill will give us organisation which will prevent future enlistment of men in the wrong armies. Mr. Long says that the Bill is essential if we are to organise the nation as it ought to be organised. It will enable us to effect the mobilisation of necessary forces with a measure of discrimination suited to our present needs. Mr. Long asserts that while supporting those splendid fellows who are fighting heroically on sea or on land, it is no less our duty to see that everything possible is done to support our agriculture and our trade generally, and certainly our export trade, which means so much to the income of the nation. With reference to these trade matters, he is constantly being asked: "Can you find me so many men? I can employ them if I can get them." Also: "Do you think I am justified in carrying on my own industry? I do not know that it can properly be described as connected with the war." When the machinery contemplated by this Bill has been got to work it will be possible more satisfactorily to answer such questions. Manufacturers and workers, too, will then be able to see their way more clearly than they can do now.

Electrical men do not need to be reminded of the completeness and efficiency of the German system of organisation—some of them have been surprised in peacetime at the method of some of the bigger companies who have pigeon-holed all the particulars they could secure of Britishers whom they considered "good men" technically or industrially, and likely at some time or other to be useful to them.

Events have proved that we have been sadly lacking in respect of national organisation in the past. We believe that the present Bill will be welcomed by the vast majority of the people because it enables us to do something tangible toward remedying that defect.

Electricity Outclassed.

To those who have burnt the midnight filament in attempts to provide ways and means for supplying the British workman with electricity for lighting purposes, and have, moreover, satisfied themselves that it can be done, we commend the following:—

In October last, the Finchley Council decided to adopt electricity for lighting the whole of the workmen's dwellings on an estate, and lately, in order to obtain some idea as to the cost of supply, tenders were invited for the installation work on the first 100 houses.

Of 29 tenders received the lowest, that of a local firm, was for £686 or £720, for w. or s.d. tubing, and in addition the electricity department's service charge would be £19. This is equivalent to from £7 to £7 10s. per house, entailing, for a 15 years' loan, annual repayments of about 13s. per house. So much for electricity: on the other side we have the local gas company offering to lay the connections and carcass all the first 100 houses *free of charge* in the event of the Council deciding to install gas there, but with the condition that if the Council supplies electricity to any of these dwellings within 5 years, it shall pay the gas company 10s. for each house so lighted.

Naturally, the responsible Committee decided in favour of gas, while our last information goes to show that the Council was "considering" the report in camera. Some thoughts will not bear publication.

The Lead Position.

THE lead market has been very much under the influence of speculation, and the sharp reaction which followed the upward movement to £30 a ton for September deliveries about the middle of last month was succeeded by a substantial downward movement, which carried prices to about £24. The market has been undoubtedly controlled by mere speculation, and in America at all events, determined efforts have been made to drive up prices in much the same way as that witnessed in connection with spelter. The manipulators, however, have a less easy task before them in attempting to deal in this way with lead than they had with spelter, for the entire basis of their manipulation of the latter metal rested upon the fact that Germany and Belgium between them were responsible for fully 50 per cent. of the world's production. This naturally laid bare almost unlimited possibilities for market manipulation, particularly in view of the fact that spelter would be required in enormous quantities for the production of war munitions. With lead, however, the position is vastly different, Germany and Belgium between them contributing less than one-fifth of the world's production. Great Britain can draw about 120,000 tons from Australia, if needs be, while the Spanish production exceeds 200,000 tons a year, and that of the United States will this year exceed half a million tons. These considerations must be taken into the clearest calculation when attempting to rig the lead market, but may not have much effect upon the Teutonic-American interests, backed with unlimited capital and engaged across the Atlantic in making things as hot as possible for the Entente Powers.

The suspicions entertained regarding the *bona fides* of the last big upward movement have proved themselves abundantly justified by the subsequent course of events. Considerable suspicions were aroused in high quarters by the persistence of the demand met with for lead in the open market, buying being of the most vigorous character, and orders being carried out with a freedom which gave rise to the belief that the price paid was really a secondary consideration. It is no wonder that, under these circumstances, suspicions should have been engendered in high quarters, and the announcement which was made at the close of last week that the Government had decided to prohibit all exports of lead, therefore created little surprise in some of the best informed quarters.

It must not be forgotten, however, that a complete embargo upon shipments from this country would inevitably prove a source of considerable embarrassment to our Allies, Russia and France, and it is inconceivable that this could form any part of the British policy at this juncture. It is probable, therefore, that no hindrances will be placed in the way of really legitimate dealings with the countries named, both of which are forced to supply a considerable portion of their needs from the London market, and it is regarded as pretty well assured, therefore, that under due safeguards shipments will be permitted.

At the present time, the London market stands well below the level of New York. The latter market has been greatly influenced by gambling operations, and it is probable, therefore, that the prices ruling across the Atlantic represent a sentimental rather than an intrinsic value. Any operation initiated with the intention of cornering the market would have in all probability to be started in America, since the export regulations on this side have dashed the hopes of the bull party. The greatly increased and still increasing output in North America is bound sooner or later to tell upon the situation, and there is plenty of lead in sight in Europe.

Electrical Imports during the War.

Elsewhere in this issue we give interesting tables showing the values of electrical imports into the United Kingdom since the outbreak of war. The figures for the corresponding months of the previous year are also given. Little comment is needed; the figures speak eloquently for themselves, and will enable the reader to see at a glance the changes that have been taking place. The most noteworthy feature is the big increase in our purchases of electrical requirements from the United States, whose total for the period is in the neighbourhood of that for the business previously done with Germany. The imports from Holland and Spain are quadrupled in value; those from Switzerland are more than doubled; while those from Italy and Canada also show very considerable rises.

OUR FUTURE.

Each succeeding month the unenviable record of our enemies grows worse, and the judgment of the civilised world in condemnation takes more definite shape until there seems to be not the slightest room for doubt as to what the ultimate issue *must* be if following generations are to be permitted to enjoy what we have latterly looked upon as the common heritage—the right to live in freedom. We may not be able to see very far ahead just now, but it is unthinkable that there can be permitted to remain any "Kultured" Force to dominate Europe; in the end the policy of frightfulness and terror must bring about its own undoing. It is that policy that has arrayed such a combination of nations in one common cause against the Central Empires, and apart altogether from the financial weakness that seems to be inevitable for those Empires for many years to come, there can be nothing short of dethronement of Emperors and Sultan and the absolute crushing of those who with them have in less than a year mangled the life of practically the whole of Europe beyond recognition. That we are a long way from securing that absolute victory which is essential, if such is to be the issue, we all recognise. The Forces which stand for Freedom are, however, now fully awake, and are daily strengthening their resources; we shall do well to ignore all talk of peace suggestions and consider anything in the nature of a sudden collapse of the enemy as quite out of the question. There can be no collapse on the side of the Allies—we have got to see the thing through or we are lost.

Assuming that in the foregoing we have correctly stated the position, what bearing has our observation upon the future of industry? We, of course, admit that we tread on very uncertain ground, and that there is little light to guide us; pages of speculative writing might be indulged in with the aid of a little imagination, but such an effort would be wasted. Yet there are some things which seem to stand out so clearly that we do well to take a note of them even at this early date. First, we must recognise that though enemy connections with the outer world are nearly all cut off, German manufacturing ability and German population, save for war depletions, remain. The financial fabric of the German Empire may collapse when defeat comes, with, as some predict, such a shock as the world has never before heard, and the people may be crippled. The nation's goodwill throughout most of the world may be gone. Her reputation for barbarism may render her an outcast among the nations of the earth. But she will still have intact many vast industrial works and organisations which, so far as we can tell at present, will have to be reckoned with. We sometimes positively assert that British money must not in future be employed to keep German factories going, and if we were able to secure that that determined war-time resolution should be carried into effect as a definite imperial policy throughout these islands and in our Colonies, we should be able to handle the business because we have a sufficient manufacturing capacity therefor. But, much as we may desire it, the indications are not as favourable as they might be that such a principle would be unanimously adhered to after a short time—even in the midst of this terrible war are there not dissentients?—and apart from that consideration, when we have put the sword into its sheath and have resumed operations more congenial than shell-making, and are making up the arrears that Treasury restrictions have rightly imposed upon us, shall we be able to tackle the business that will be offered us by our present Allies? It seems to us to come down to this: the world has and will have great need for electrical and engineering requirements. We cannot expect to meet these requirements from the British Isles as our manufacturing facilities and organisation stand at present. The Colonies want us to do so. Our Allies want us to do so. Are we prepared or preparing to undertake the task? Is it possible to do so to any particular extent under the prevailing conditions? These questions, and others akin to them, must occur to us as we stand at this moment faced with the unquestionable fact that Germany's industrial strength is immense, and her organisation both scientific and complete. Mr. Lloyd George's speeches about munitions and the needs of the Allies in respect thereof have shown that the Government has now a full appreciation of the manufacturing resources of German engineering and allied works and industries. It is the whole force of these industries that is being hurled east, west, and south, against her enemies. This circumstance alone has revealed the manufacturing deficiency of these islands. We have magnificent works in many parts of the country doing splendid business all over the world, but some of our engineers have long been impressed with the huge works idea, and the vast scale on which some Continental and American electrical organisations have been conducted has produced advocates of the huge works policy for ourselves in order that we may manufacture at more competitive prices. We are trying to meet a large part of our Allies' war requirements as well as our own, to conduct an essential home and export business, and are putting down new works in various parts of the country. We are even making plans for utilising in some way every available piece of suitable factory accommodation in gas and electrical and other works in the metropolitan area. Scattered and extravagant operations, it is true, but seemingly necessary to help us to accumulate that vast reserve of shells, &c., that our fighting men must have.

Is it to be anticipated that when we come to settle down to manufacturing the electrical requirements of peace for ourselves and our friends, our capacity, even taking into account all the new factories that we are now equipping, will be sufficient, or so organised that we shall be able to meet those needs, and meet them at competitive prices? In all probability there will be no works deficiency in Germany and Austria, unless establishments there meet the same fate as has broken up those in Belgium and Northern France. As we have already stated, Belgium shrinks back aghast at the very thought that if nobody else can supply her needs, she may be driven into the arms of her worst enemies for re-establishing her industries and rebuilding her cities and towns. Russia, too, on sentimental grounds, will be equally averse to resuming the old trading relations. Italy, as criticisms recently received from that country go to prove, is fearful of German industrial domination, and her traders suggest that we had better drop altogether our talk about capturing German trade in Italy unless we are going to do something more than talk. Yet it will be the manufacturing capacity that will go far to settle these questions when markets reopen. We should like to see a statement showing the actual manufacturing capacity of the British electrical and engineering industries, prepared by reliable authorities, placed side by side with the probable requirements of all these lands of our Allies. No doubt manufacturers will feel that there is reason for satisfaction if they can be assured that the after-the-war business of the United Kingdom will be sufficient to fully and profitably occupy existing works accommodation. British and Colonial requirements alone, if they are on only the same scale as in pre-war days, will mean a greatly increased demand if all are executed here; India will continue to give us the great bulk of her electrical business, no doubt; there will be large neutral markets more or less open to us; and at home we shall have to make up arrears of work which will have accumulated owing to the Government embargo on issues of new capital. Where, then, shall we be placed in respect to the question of manufacturing capacity? For the time being America has an excellent opportunity, and is rightly availing herself of it to the full extent of her ability restricted as even that is by the manufacture of munitions of war. Probably the States, as well as Sweden and Switzerland, will continue for some years after the war to fill a more important *rôle* in supplying those who cannot be served from England and will not be served from Central Europe. But the fact will still remain that Germany's electrical and engineering manufacturing capacity and organisation will not be taken away so long as she has several scores of millions of population from which to draw the necessary workers. Germany and Austria have been losing millions of men by death and disablement; large numbers have been withdrawn from skilled trades such as our own. France has been losing heavily in the same way, though probably by nature of the country and her occupations the loss to engineering skilled labour has not been in anything like the same proportion to her total losses. In this country we have been losing on a much smaller scale because the bulk of our men are still in training, and our loss of engineering workers may be reduced somewhat by calling back those whom we need now for the manufacture of munitions, and whom we shall need in the days to come in connection with our industries. The ability to meet future requirements in all the markets in which we are interested must be affected in a considerable measure by this skilled labour question. But the killing off of skilled labour, assuming that Germany is suffering in this connection worse than any of those with whom she is at war, will not kill off her factories, their effective systems of organisation, their technical educational and other training facilities for the younger generation. Defeat may bring the financial crisis, which will hinder the immediate renewal of her world-wide commercial efforts, and in other ways, which one can only conjecture, her plans for meting out complete commercial defeat of her rivals may go wrong. But it would be unwise to pretend that the excess manufacturing ability, the existence of a vast industrial people, and the necessity for those people accepting very low wages, will not have to be reckoned with. Their opportunity will come just as soon as it is proved to the satisfaction of possible buyers in present enemy lands that friendly and neutral nations are unequal to meeting their needs at satisfactory prices. We may be assured that Germany will be prepared to go such lengths as never before in underselling her foreign competitors; she will resort to all sorts of devices in order to sell her goods so disguised that they shall be considered British—there is evidence of this already. Where then do we stand to-day as an electrical manufacturing people in regard to preparations for the future? Are we to rest contented with the truism that the state of trade after the war will be largely controlled by economic conditions? Can we make no plans—even on paper—for preparing for those days so that we may be able to stand up against the poisonous gases of German commercial machination backed up by industrial organisation and manufacturing efficiency? Russia is short of munitions—why? She was not in days before the war an engineering nation, and she depended too largely upon Germany for her requirements. England has been short of munitions—why? We may have the full answer in due course, but may now at least ask: Should we have had to go about London finding every spare piece of available factory accommodation if, instead of buying so much machinery and apparatus, &c., from Germany, and thereby strengthening her engineering ability, we had added to our own factories and met our own requirements?

The British nation is organising itself at last for securing victory in the war. Necessity has driven us to it, and we shall win, but at a later date and with a far greater loss of life than if our organisation had been different. What about the organisation of our electrical industry? We believe that it has improved in recent years, but have we no advisers who can tell us what should be in course of preparation in these days in the industry itself, in readiness for the time when Germany is freed from the pressure of the British Navy, and is able to export again? Or are we to be contented with just a little more British and Colonial preference for British manufactures and a few additional orders from our present Allies? It would go far to guide us in our discussions of German trade capturing if we could tell just what our capacity was, and what the world was likely to require from us. It is to be assumed that by increasing our capacity, and, perhaps, by certain processes of reorganisation, we could produce some lines competitively that we have not so produced recently. We have quoted in our pages at different times the remarkable output figures of the—to us—colossal electrical works of Berlin and of the States, and bigger works in this country might be justified if we were assured of the necessary skilled labour without extravagant demands for its compensation; but these are questions which have to be settled by manufacturers of broad view and financiers of wide knowledge and large resources. We trust that we have such men amongst us who are weighing up these important questions and their possible effect upon the future of British electrical industry. All of us desire that that industry in the days that are to come shall be free from the defects which have given rise to so much controversy in the past. Unless we are prepared to take some measures appropriate to so great an occasion, can we expect that that desired state of things will follow through our receiving the crumbs that fall from the rich man's table, while Berlin again takes a large part of the loaf ?

As we have referred above to the necessity for the guidance that comes from big men and from experienced experts we may be permitted to bring these notes to a conclusion by divulging a conversation that we had with a most estimable German gentleman of wide experience several years ago. Mr. J. Stöttner, who, we believe, built up the great business of the Electrical Co., Ltd., in these islands from the very smallest beginnings, and was responsible for the placing of millions of pounds' worth of contracts with the Allgemeine Electricitäts Gesellschaft, in Berlin, was discussing with us shortly before his death the position of the electrical industry in this country. That matter was just then, as it had periodically been, one of the main themes of conversation among electrical men in London and in industrial districts, and was being much written about in the Press. Mr. Stöttner was no longer the representative of the concern to which for years he had devoted himself heart and soul. He appeared to speak with all sincerity, and what he said carried conviction. He deprecated our scattered and entangled manufacturing operations ; decried the habit of attempting to manufacture "everything electrical" in a comparatively small factory ; advocated the closing or else the complete reorganisation of many of our small factories which he considered could not hope to manufacture competitively when they devoted themselves to scores and hundreds of more or less dissimilar productions ; he would, by a process of arrangement between different firms or companies, concentrate the manufacture of particular lines of machinery or apparatus in specialised factories run on a large scale, in several selected districts—motors here, switchgear there, engines and turbines somewhere else, and so on. This, in brief, was the course advocated by Mr. Stöttner, who knew the reasons for German success in Germany, and for his own success as a competitor here. He positively affirmed that if Britain, as an electrical manufacturing country, was ever to stand up effectively against Germany there was no other way in which it was to be brought about. We give his views for what they are worth. They were confidential, and were those of a German—though a highly respected one amongst us—and we do not think that at this important juncture of our national history we do wrong in quoting them. Since that date we have witnessed the carrying out of the idea on a small scale in connection with some sections of the industry in England, and it has been our privilege to visit works whose owners have had reason for feeling gratified with the measure of success which had attended their efforts at more or less strict specialisation. At times the best concerted schemes "gang aft a-gley," and the many interests requiring reconciliation, and needing to be called upon to make sacrifices and effect compromises, make Mr. Stöttner's proposition one of great complexity and difficulty, but we do not consider that any time spent considering such questions can be wasted in view of the vast changes that lie ahead internationally.

We are not afraid of future German competition—far from it, but we should like to see British electrical industry availing itself of the present opportunity to the full.

The future is hidden ; there may be surprises ; we have a long way yet to go before we celebrate the defeat of the forces which have broken the heart of Europe. Our calculations may be upset, but we do well to make them.

Arranging Nails by Magnetism.—A machine for arranging nails parallel to one another has been described in the *Iron Age*. The nails are fed into a shaking hopper, in loads of about half a ton, which delivers them into a spout of which the two lateral walls form the poles of an electromagnet. The nails are thus brought into order with their length parallel to the magnetic field, and are pushed by a lever into a receiver, the same action cutting off the excitation of the magnet. The machine is driven by a motor of ½-H.P., which keeps the hopper in vibration. The magnet consumes only half a kilowatt-hour per day

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SHEATHED-WIRE HEATING UNITS.*

By C. P. RANDOLPH.

The ordinary construction of heating units utilises a metal or alloy resister, with mica, glass enamel, porcelain, moulded compound, or air as electrical insulation. A large number of the so-called electrical insulators become fairly good conductors at the temperatures reached by heating units, so that the field of available materials is narrow.

The general equation expressing the variation of electrical resistivity with temperature is $\log R = a/\theta + b$, where R = electrical resistivity, θ = absolute temperature, and a and b are constants, depending on the material.

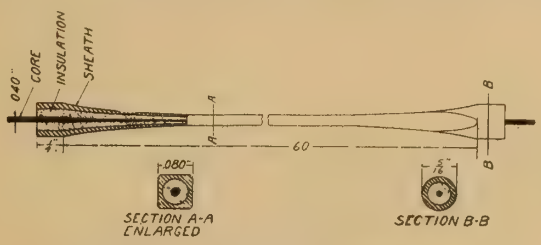

Fig. 1.—Sheathed Wire.

Such materials as mica, porcelain, the silicates, lime, magnesia, &c., follow this equation closely between 0° C. and 800° C.

The General Electric Co., U.S.A., has developed in the last few years an entirely new method of constructing electric heating units. Fig. 1 shows the construction and dimensions of a typical unit. The core, or electrical resister, is made of a metal or alloy, chosen according to the resistivity desired. Air cannot penetrate the walls of the sheathing, so the ease of oxidation of the core is not important.

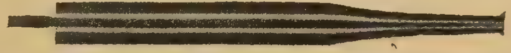

Fig. 2.—Cross-Section of Sheathed-Wire Terminal.

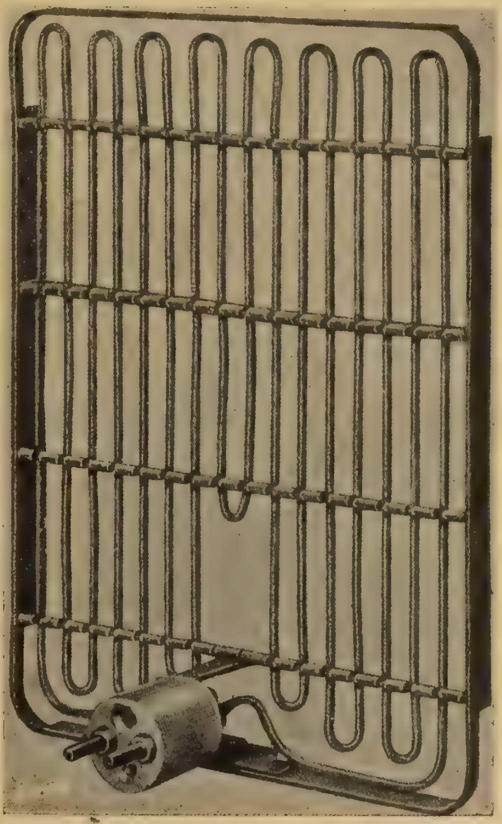

Fig. 3.—Open-Coil Sheathed-Wire Heating Unit.

The operating temperature of the core may be 800° to 1,000° C. The insulation is a heat-resisting material, so tightly packed that it is as hard as ordinary moulded compounds. The sheath may be steel, copper, or other metal or alloy, depending on the properties desired. The sheathed wire is enlarged at the ends or terminals so that the core is cool where it enters the air, although, as mentioned above, the temperature may be 1,000° C. over the small section. Fig. 2 is from a photograph of a section of a terminal. In the small cross-sections (see A A, fig. 1) the core may be 0·006 in. diameter, or larger. It is evident that the dimensions of the sheathed wire can be varied to suit the requirements of each heating unit. For example, a length of wire for a large boiler may have a terminal 1 in. outside diameter, the core where it enters the air may be $\frac{1}{8}$ in. diameter; the outside dimension on A A (fig. 1) may be $\frac{1}{4}$ in.; and the total length 15 ft. Or, a unit for a large japan or bake oven may have a terminal $\frac{5}{8}$ in. outside diameter, the core in the terminal may be $\frac{1}{16}$ in. diameter, the outside dimension on A A $\frac{3}{32}$ in. and the length 25 ft., and so on.

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* From the *General Electric Review*

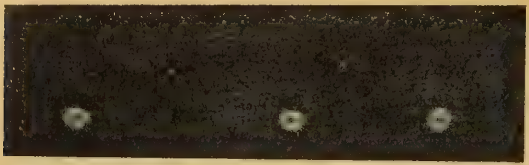
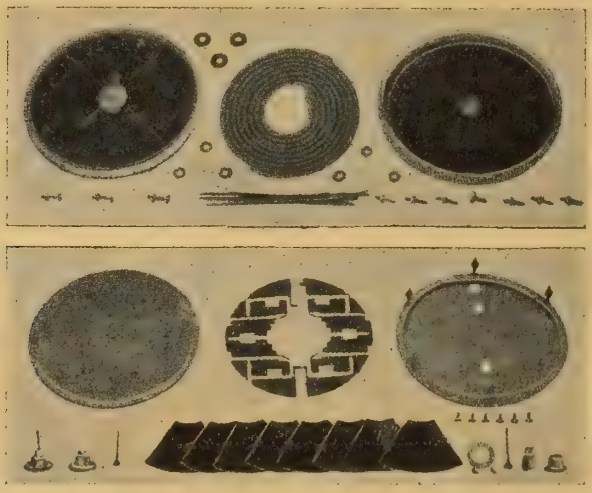


Fig. 4.—Section of Cast-In Hot-Plate, Showing Sheathed Wire Embedded in the Casting.

The piece of sheathed wire is formed into any required shape. Fig. 3 shows an "open coil" unit. In this type the coils are directly exposed to the air, and this is the correct design for heating ovens, &c., where it is important that most of the heat be transmitted from the unit by convection or air circulation. When the operating temperature of the steel sheath is above 400° C., the unit and frame are "calorised"* to prevent oxidation. Except at the terminals there are no porcelains, mica pieces, or other insulators to be easily broken, as the sheathed wire can be supported directly on metal. The construction is just as rugged and simple as though the electrical resister did not have to be insulated.



Figs. 5 and 6.—Parts of Early Types of Hot-Plate.

Fig. 4 shows in cross-section another method of applying the sheathed wire in heating unit construction. A hot-plate is made by pouring molten cast-iron directly around a coil of sheathed wire. As a result, we have a hot-plate which is as strong and rugged as the old-time stove-lid; in fact, it is even more rugged, as the casting is reinforced with the wire; it does not warp or crack.

Figs. 5 and 6 show the number of parts used in constructing early types of 8½-in. diameter hot-plates. Compare these with fig. 7, showing a cast-in hot-plate.

The advantages of sheathed-wire heating units over other constructions may be summarised as follows:—(1) No fragile porcelain or mica is required to insulate the hot resister from ground. This allows a simple, rugged construction with minimum number of parts. (2) The open-coil unit is insulated and the operator cannot get a shock. (3) The resister cannot be displaced and thus grounded, &c. (4) The core temperature is definite, depending only on the thermal resistance of the electrical insulation in the wire and on the temperature of the sheath. Therefore the design of sheathed-wire heating units is based on scientific calculations. This is not possible with other types of units.

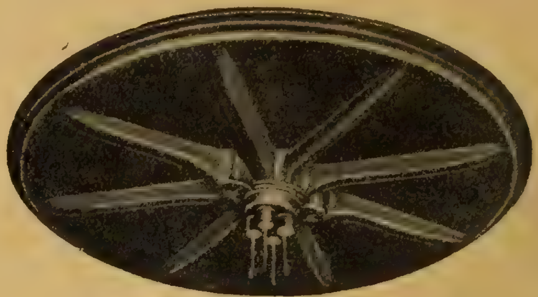


Fig. 7.—Sheathed-Wire Hot-Plate.

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* This process consists in forming a coating of aluminium steel alloy on the surface of the sheath.

NEW RUSSIAN CUSTOMS TARIFF.

(*Continued from page* 6.)

Poud = 40 funts = 36 lb.

* Imported by sea. † Imported over European land frontier.

	Old rate. Roubles.	New rate. Roubles.
Manufactures of copper, of copper alloys, or of other metals or metal alloys:—		
2. Articles not ornamented in relief, nor engraved, and stamped articles, even though in combination with wood, iron, tin-plate, leather, or other common materials:—	Per poud.	Per poud.
(*a*) Weighing over 6 funts each ...	8·00	9·90* 11·88†
(*b*) Weighing 5 funts or less each	9·00	15·07* 18·08⅖†
3. Articles ornamented in relief or engraved (except stamped articles), finished or unfinished, and whether put together or in parts; also ornaments, caryatides, medallions, busts, statues	21 00	27·83* 33·39⅗†
4. The articles enumerated in subdivisions (2) and (3) of the present No.; also articles, not specially mentioned, of non-precious metal — when gilt, silvered, or in combination with other costly materials, except the articles which fall under fancy and toilet articles.		
(*a*) Weighing more than 1 funt each; also (irrespective of weight) gilt or silvered metal in sheets or wire (except those falling under No. 148), or in the form of powder	Per funt. 1·10	Per funt. 1·21* 1·45⅕†
(*b*) Weighing 1 funt each or less ...	2·20	2·42* 2·90⅗†

Note.—In determining the duty on articles imported in separate parts (*i.e.*, taken to pieces) the duty is calculated according to the weight of each of the parts taken separately.

Wire:—		
1. Of iron or steel:—		
(*a*) Of a width or diameter of from 6¼ mm. down to 1 mm. inclusive	Per poud. 1·80	Per poud. 1·98* 2·37⅗†
(*b*) Less than 1 mm. down to 0·5 mm. inclusive in thickness ...	2·30	2·53* 3·03⅗†
(*c*) Less than 0·5 mm. down to 0·3 mm. in thickness inclusive ...	3·30	3·63* 4·35⅗†
(*d*) Less than 0·3 mm. in thickness	4·70	5·17* 6·20⅖†
2. Of copper or copper alloys or of any of the metals or metal alloys specified in No. 143:—		

	Old rate. Roubles. Per poud.	New rate. Roubles. Per poud.
(*a*) Of a width or diameter from 12·5 mm. down to 0·5 mm., inclusive	7·35	8·08½* 9·70⅕†
(*b*) Less than 0·5 mm. down to 0·2 mm. inclusive	10·35	11·38½* 13·66⅕†
(*c*) Less than 0·2 mm. in thickness...	11·85	13·03½* 15·64⅕†

Note.—All wire coated with tin, zinc or other common metal pays 50 per cent. additional to the duty for which it is liable, according to the category under which it falls in the classification adopted in the present No.

Wire manufactures :—

	Per poud.	Per poud.
1. Of iron and steel :—		
(*a*) Of all kinds, not specially mentioned	6·00	6·60* 7·92†
(*c*) Iron and steel wire (even though coated with tin or zinc) covered with textile materials or gutta-percha, wire cables and hawsers of iron or steel :—		
(*a*) Not containing wire of less than 1 mm. in thickness	5·60	6·16* 7·39⅕†
(*β*) Containing wire of less than 1 mm. in thickness	7·00	7·70* 9·24†
2. Of copper, of copper alloys, or of similar metals or metal alloys :—		
(*a*) Of all kinds not specially mentioned	11·25	12·37½* 14·85†
(*b*) Wire tissues prepared from wire having a diameter of :—		
(*a*) From 1 down to 0·2 mm. inclusive	16·20	17·82* 21·38⅖†
(*β*) Of a diameter of less than 0·2 mm.	17·70	19·47* 23·36⅖†
(*c*) Wire (even in the form of a bunch or cable) covered with textile materials, gutta-percha, caoutchouc, or other common materials, the diameter of the separate wires being :—		
(*a*) 0·2 mm. or more...	16·20	17·82* 21·38⅖†
(*β*) Less than 0·2 mm.	17·70	19·47* 23·36⅖†

Note.—Metal wire of all kinds, and also all manufactures of metal wire, covered with silk, whether such silk be mixed with other textile substances or not, pay the respective duties specified in the present number increased by 50 per cent.

	Per poud.	Per poud.
3. Electrical cables of all kinds ...	6·70	7·37* 8·84⅖†

Note.—Under the old tariff metals and metal manufactures mentioned paid duty under these numbers, even if they were coated by any process (by galvanising, by the application of a layer of molten metal, by passing between rollers or in any other way) with common metals; provided that the superimposed coating did not exceed 25 per cent. of the total weight in the case of the metals and metal manufactures mentioned. In cases where the superimposed coating of metal exceeded the limit of 25 per cent., the metals and manufactures enumerated paid the duties or surtaxes fixed by the tariff for the superimposed metals.

(*To be continued.*)

WAR ITEMS.

British Insulated and Helsby Cables, Ltd.—An announcement has been issued by the secretary (Mr. S. Kerfoot) that the company is about to invest a large sum in the War Loan, but at present the directors do not propose to divulge the amount. At the present time the company is busily engaged on manufacturing power feeder cable, and some orders have been transferred to the United States. In view of the shortage of male labour due to the large number of men enlisting from the works, the company is, as far as practicable, introducing female labour, and numbers of girls are being trained systematically for work on light machines. A new building which has recently been erected has been set apart for female labour, and light machines for the main works installed there. Although skilled workmen are difficult to obtain, a system of day and night shifts has been established with very satisfactory results.

Openings in Italy.—We have received from the British Chamber of Commerce in Italy lists Nos. 20 and 21 of openings for British articles in Italian markets, from which we extract the following. Many of the firms inquiring formerly did business with German and Austrian houses and now seek British connections:—

No. 836.—Agent at Campobasso requires agencies for sundries for electric light installations.—C.L.A.

No. 845.—Firm at Rome wish to represent manufacturer of industrial machinery, tools, ironmongery, brass-ware.—F.

No. 874.—Engineer at Rome wishes to represent British firm supplying electro-mechanical machinery.—R.A.P.

No. 880.—Firm at Turin seek agencies for sundries for motors cars, electric lamps and material.—T.B.B.

No. 885.—Engineers at Genoa wish to take up, on commission, agencies for electrical material, and especially for steamers.—G.O.B.

No. 894.—Old-established firm at Genoa wish to take up agencies for oil, gas, and benzine motors, lubricants, oils, machine tools, machinery.—G.R.T.

No. 908.—Engineer at Rome seeks agencies for Italy for electric machinery and machine tools.—R.A.R.

Petrograd Electricity Works.—Having come to a decision on the purchase of the concessions of the electric lighting enterprises, the Petrograd authorities are inquiring into the methods of lighting adopted in other towns. With this object in view, inquiries have been addressed to all the large towns of America, Europe, and Australia. The Petrograd Council is desirous of profiting by the experience of other towns for the purpose of improving both its electric and gas lighting systems.

OUR ELECTRICAL IMPORTS DURING THE WAR PERIOD.

1913-4.

From	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apl.	May.	Totals.
Russia, etc. ...	£12,034	£16,019	£14,199	£13,404	£27,156	£18,943	£22,783	£16,021	£12,609	£21,992	£175,160
Germany ...	122,562	133,908	148,409	134,883	146,858	133,110	159,634	181,521	159,821	167,730	1,488,436
Holland ...	1,123	2,328	2,322	6,218	2,799	1,742	1,211	4,475	1,170	1,089	24,477
Belgium ...	20,685	20,394	15,232	13,185	26,968	15,732	15,671	21,028	12,002	15,476	176,373
France ...	7,963	11,849	21,095	13,122	12,857	12,790	17,608	12,322	11,196	12,172	132,974
Switzerland ...	3,379	3,669	6,596	5,111	9,683	6,440	4,296	7,892	2,394	6,542	56,005
Italy ...	3,201	4,591	3,771	13,862	7,015	4,934	4,367	5,538	7,362	4,306	58,947
Austria ...	2,029	1,848	2,548	3,383	1,956	1,121	1,518	1,761	1,437	1,636	19,237
Spain ...	550	99	442	415	566	686	662	788	410	144	4,762
U.S.A. ...	42,595	57,885	51,242	54,954	58,433	62,462	42,944	40,797	64,521	59,564	535,397
Canada, etc. ...	180	151	360	400	550	215	250	416	283	227	3,032
Total ...	£216,301	£252,741	£266,216	£258,937	£294,844	£258,175	£270,944	£292,559	£273,205	£290,878	£2,674,800

1914-5.

From	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apl.	May.	Totals.
Russia, etc. ...	£4,337	£7,429	£11,075	£20,237	£9,532	£11,946	£6,932	£16,881	£5,490	£13,382	£107,241
Germany ...	24,953	—	—	—	—	—	—	—	—	—	24,953
Holland ...	7,736	9,424	12,342	8,704	8,964	8,605	18,137	13,438	7,570	6,912	101,832
Belgium ...	3,755	18,700	4,398	495	10	88	—	—	—	—	27,446
France ...	3,208	3,250	8,320	10,845	6,974	5,363	6,850	9,423	10,368	13,720	78,321
Switzerland ...	1,030	3,574	9,542	7,064	13,016	7,503	6,479	28,787	9,274	36,539	117,808
Italy ...	1,624	4,102	5,036	2,922	36,808	4,738	2,483	9,072	9,874	10,053	86,712
Austria ...	665	—	—	—	—	—	—	—	—	—	665
Spain ...	52	1,213	684	2,180	2,264	1,995	4,351	867	3,584	3,850	21,040
U.S.A. ...	39,426	63,441	116,482	148,757	163,867	198,596	171,696	129,381	184,202	184,319	1,400,167
Canada, etc. ...	245	41	552	365	19,868	293	582	910	390	63	23,309
Total ...	£87,031	£111,174	£168,431	£201,569	£261,303	£239,127	£217,510	£203,759	£230,752	£268,838	£1,989,494

Electricity Workers and War Badges.—In the House of Commons on Friday, Mr. Touche asked the Under-Secretary of State for War whether he was aware that the manager of the Heston and Isleworth Electricity Works, in response to an application for war badges for certain skilled employés on his staff, made on June 4th, and containing names of firms engaged on Government work to which power was being supplied by his works, was informed that the issue of official badges could not be authorised on the ground that no power was being supplied to any factory manufacturing munitions of war; that his application was made as the result of a communication from the War Office to the Secretary of the Associated Municipal Electrical Engineers (Greater London), of which association he was a member, in which it was stated that a system had been instituted by which badges for skilled employés of suitable age, and willing to enlist if called upon to do so, could be obtained on application to the War Office; and that the application of this system was suggested by the military authorities to the Associated Municipal Electrical Engineers (Greater London) as a means of retaining their skilled employés? Was he aware that the attitude of the War Office towards applications for badges did not seem in accord with the official statement to the effect that several electrical companies had been offered such badges for issue to men of recruitable age who would be willing to enlist in the event of an emergency would he say why there was an inequality of treatment in regard to the issue of badges to skilled employés of electrical services; and, if it represented a change of attitude, would he consider the advisability of its modification, with a view to granting badges to skilled employés of the Heston and Isleworth Electricity Works and to the employés of other companies similarly situated?—Mr. H. W. Forster: There has, as yet, been no change in the procedure as regards the issue of badges to employés at electricity power stations. The position is as stated in the first part of the question of the hon. member, but the power stations must be supplying power for the manufacture of munitions of war.

Another question was asked in the House of Commons on Monday. Mr. Touche asked why the issue of war badges to employés at electric power stations was limited to stations supplying power for the manufacture of munitions of war, and was refused to other power stations, although many of them were supplying power to private firms engaged on Government work and, even when not doing so, had been asked by the military authorities to prevent skilled employés from enlisting, and so to preserve the efficiency of electric services? Was it now desired to preserve efficiency only in cases where the stations supplied power for the manufacture of munitions, or was it the wish of the Government to have all power stations sufficiently manned? Why did the military authorities ask them to retain their skilled men, while refusing to issue badges to make it easier for them to do so, even where the men were willing to give an undertaking to enlist if called upon? Was any change in this procedure contemplated?—Mr. Forster, in reply, said he had nothing to add to the answer which he gave last week, except that under the new Munitions of War Act the making of regulations with regard to the issue of war badges to persons engaged on munitions or other war work had now been transferred to the Ministry of Munitions.

Scottish Electrical Contractors and Munitions.—In the course of a circular on munitions of war, issued by the Edinburgh Branch of the Electrical Contractors' Association of Scotland to their employés, it is explained that, at a meeting of the Association it was unanimously agreed to endeavour to get representation on the Committee which will be entrusted with the duty of carrying out the Government scheme in connection with munitions of war for Edinburgh district. "If acceptable," the circular proceeds, "we propose to offer to divide our own personal time between the conduct of our own business and any assistance we can give in furthering this work. Personally, we would like to have an expression of opinion from each individual employé in our employment if he would be agreeable to assist in this duty to our country. As a first proposal, we would suggest that, say, twelve hours a day be a working day, half of which would be given to our own work and half to munitions of war; some spare time on Saturday and Sunday could also be devoted to this work." In the event of the employé being willing to offer assistance through the firm he is asked to return a slip, which is annexed, duly signed, so that the Association can bring the matter before the proper authorities. There is, of course, nothing binding in this meantime. The slip is in the following terms:—"I am willing to co-operate in such scheme of work as may be arranged for the electrical trade." The idea is that, if the authorities approve, the masters and men in the electrical trade may put in six hours' work per day at munitions in three or four different shifts at a central workshop in Edinburgh. It is also thought to be desirable that arrangements should be made to furnish those who are willing to do munition work with work in the city, and so prevent them going to other centres.

Restricted Lighting Prosecution.—The "Times" reports that on July 2nd, at the Thames Police Court, Ernest A. Millbank, butcher, Commercial Road, E., was fined £20 for having a brilliant light in his shop, contrary to the provisions of the Lighting Order. It was stated that on the night of June 10th the defendant had a powerful electric light just inside his shop, which threw a sheet of light on the footway and a beam right across the roadway. In the shop were four other electric lights of the same power.

Munition Volunteers.—It is announced that the total number of war munition volunteers enrolled up to and including Sunday last was 67,650, and it is anticipated that, as only skilled men in employment in certain occupations were to be accepted, the great bulk of these will prove efficient. Mr. Lloyd George says that a certain proportion of them cannot be moved from their present occupations without detriment to the national interest.

The Eastern Telegraph Co. and the War Loan.—It is reported that the Eastern Telegraph Co., entirely without charge, cabled the text of the War Loan terms throughout the world, and the result should be to secure a large volume of support. To have sent such a message privately would have cost an enormous sum of money. The company's action was entirely voluntary.

After the War Trade Policy.—Mr. Asquith stated in the House of Commons on Monday that he was not yet in a position to make any statement concerning the appointment of a committee to consider the question of promoting and safeguarding British trade in other countries after the war.

LEGAL.

Osram Lamp Litigation.

(Continued from page 32.)

Dr. Passmore was further cross-examined by Mr. Terrell.—The defendants' filaments are made by grinding together metallic tungsten and what has been called a binding material?—Yes.

You say that the binding material when it is destroyed by heat leaves a substantial quantity of carbon in the form of coke?—Yes.

What is left behind is coke with the metal mixed up with it and held together by it?—Yes.

That is the plaintiffs' case?—Yes.

And you say we get it held together in both the plaintiffs' process and our process by means of occluding it in a mass of coke. Is that right?—Yes, wrapped up, as it were.

Our case is that the quantity of what has been called binding material that we use is so small that the residue of coke is not sufficient to bind the particles together. Do you appreciate that? Yes.

You deny it?—Yes.

The plaintiffs' specification says that to get rid of the carbon, and at the same time not to convert your metal into oxide, you use a mixture of steam and hydrogen?—Yes.

You admit that the hydrogen defendants use is free from vapour at the time they use it?—Yes, when it comes in at the top, before it reaches the filament.

The case for the plaintiffs is: This hydrogen, although it is perfectly dry when it comes in, forms water vapour, and the water vapour acts in the way of the plaintiffs' specification?—Yes.

Now let me put defendants' case. Defendants say: We have got in our filament not free carbon, but carbide of tungsten, at the stage in which it is going to be submitted to the current of hydrogen?—Yes.

They say we have also got oxide of tungsten?—Yes.

And they say: What happens is this: when the carbide of tungsten is made red-hot in contact with the oxide of tungsten, the reaction that takes place is that the carbon of the carbide combines with the oxygen of the oxide and produces carbonic acid, or carbonic oxide?—Yes.

Carbonic acid, or carbonic oxide, is the result of both what the plaintiffs say happens and what the defendants say happens?—Yes.

But plaintiffs' case is the formation of a vapour first and the vapour acting upon the carbon that way?—Yes.

Defendants' case is no formation of vapour, but the carbon acting upon the oxide directly and forming carbonic oxide?—Yes.

Of course there are other larger issues as to whether, even if you are right on that, we are within the specification, but on the point we are now fighting that is the difference?—Yes, I understand.

There is another process in which we use a vacuum instead of hydrogen?—Yes.

We say in that vacuum the carbon of the carbide of tungsten or carbon, as it may be, combines direct with the oxide of tungsten and forms carbonic oxide or carbonic acid?—Yes.

You say No, there is this binding material which starts being destructively distilled?—Yes.

You say there is moisture given off, and that the moisture acts upon the carbon exactly as it did in the other case that I put to you?—Yes, but I do not say that the whole of the moisture comes from the destructive distillation. It is present in the tube. It probably comes from the wall of the tube. The tube is full of air which is laden with moisture. You pump the greater part of that air out and you pump the greater part of the moisture out, but you still leave some in.

But experimentally you do not prove that?—No.

Then what we are fighting about at present is: (1) What is the real reaction that takes place in both the hydrogen-flowing furnace and the vacuum furnace; and (2) if there is any water vapour, where does it come from, and what does it do?—Yes.

Mr. Walter: Do I understand that you suggest further that your binding material does not leave any carbon?

Mr. Terrell: No, I have not said that. All I have said is that there is carbon, but it is in the form of carbide formed in the first furnace.

Dr. Passmore (proceeding) said the invention in Just and Hanaman's German specification 154,262 was the same as that which was in the struck-out part of the plaintiffs' specification.

It is a process for getting the carbon out chemically?—Yes.

And whatever carbon is removed, that carbon is removed by being converted into carbonic acid or carbonic oxide or both?—I have never examined which it is, but carbonic oxide is what is given in the reaction.

Just and Hanaman says: The reaction that takes places in my specification is that the carbon takes the oxygen direct from the tungsten compound?—Yes.

Now come back to the plaintiffs' specification. There an equation is given for removing residuary carbon by presenting it to an atmosphere of tungsten oxychloride, which provides the oxygen?—Yes.

And the carbon is removed by that oxygen in the form of carbonic oxide without first forming water vapour?—Yes.

Proceeding, Counsel dealt with Bottome's specification, and suggested that the patentee described a process by which he got carbon and metallic tungsten mixed together very intimately, which Bottome said was to be treated with steam and hydrogen.

Witness admitted that the steam would remove the carbon, or some of it, and that the hydrogen acted as a protective atmosphere to the tungsten.

The result is a metallic tungsten filament?—Bottome tells you the result is a carbon filament strengthened with tungsten. He had no idea that all the carbon should be removed, apparently.

Except that the result of Bottome is a filament which is partly composed of carbon and partly composed of tungsten, is there any difference in the process used by Bottome and the process used by the plaintiffs' specification as regards decarbonisation?—You start off with cotton fibres, but apart from that, no.

Then so far as the action of steam upon the carbon in the presence of tungsten goes, it being preserved by an atmosphere of hydrogen, it is the same?—Yes.

Lodyguine gives you all the reasons why a metal filament is a desirable thing to get?—Yes.

And if it required invention to distinguish the metals that will form a filament from those that will not, he has done it, has he not?—He makes a statement there which I do not accept as correct.

You have told me when I have been dealing with prior specifications that they did not give you enough information?—In the specification sued upon there is enough information for any man to make a filament with.

But I suggest to you that there is plenty of information in plaintiffs' specification by which a man would not make a filament at all?—Not as used by a practical man, I think.

In the "Z" case it was contended by the plaintiffs that the hydrogen was moist when it was used?—So it was.

And the Judge found that it was?—Yes.

Sir Jas. Dewar, F.R.S., also gave evidence. He said he had nothing to add to Dr. Passmore's description of the defendants' process.

Having seen the process and having carried out experiments on that process afterwards, will you tell my Lord, pursued Mr. Colefax, whether or not carbon is removed chemically?—Certainly.

In what form is the carbon removed, that is to say, what is the chemical compound or compounds of carbon found as it is removed?—The only chemical compounds could be some oxidised form of carbon.

I understand it is suggested that in the defendants' process, in the first stage of heating to 950° C., the carbon enters into combination with the tungsten, and I think it is suggested to form carbide of tungsten. Would such a formation of carbide of tungsten be in accord with what is known with reference to the nature of carbide of tungsten?—Certainly not. I was well acquainted with Prof. Moissan, who was the first to produce carbide of tungsten, but that was produced in the electric furnace, the temperature being at 2,000°. There he got a definite molecule, composed of two atoms of tungsten and one of carbon, but any form of so-called tungsten containing carbon was always produced at the highest temperature of the furnace where the tungstic oxide was reduced directly with carbon or coke.

So far as chemical knowledge and literature goes, I take it you know of no justification for the suggestion that at a temperature of 950° C., any carbide of tungsten is formed by the interaction of carbon and tungsten or carbide and tungsten?—It is quite impossible. From knowledge of tungsten compounds, I say all these carbides that have been revealed are high-temperature electric-furnace products.

Dr. Otto Oberlander said in evidence that he had been practising in England as a consulting chemist since 1906. He was approached by Mr. Hirst, chairman of the General Electric Co., who were now sole selling agents under the Just & Hanaman patent, with a view to making inquiries to enable them to make filaments similar to the filaments known in the Osram lamps. At that time the General Electric Co. had no interest in the Just and Hanaman specification. In 1907 he put the Just & Hanaman specification into practice, and made filaments from it. It was not necessary to submit them to any equalising process, because they were sufficiently uniform when made.

Mr. Hughes, in opening the defence, said there was nothing novel in the mixture of a finely-divided metal with an organic binding material when Just and Hanaman published their specification in 1904. That idea was quite well known in connection with osmium filaments. Of the mixture of tungsten and binding material, Just and Hanaman said that filaments were to be formed "in the usual manner." On that a question would also arise. In defendants' view, the usual manner in 1904 was what was called by way of distinction the soft-paste process, a process by which a relatively small quantity of metal mixed with a relatively large quantity of binder was squirted through a die at a pressure of a few pounds to the sq. inch. The process by which a paste, so hard that it was to the touch almost like metal, was squirted through a die of less than $\frac{1}{250}$th of an inch at a pressure of 20 tons to the sq. inch was subsequent to 1904. Again, for the purpose of carbonising the filament, Just and Hanaman prescribed that electric current should be passed through it. That was an essential part of the specification. In fact, the only way of heating the filament for this purpose known at that time was by the passage of current through it. It was said on behalf of the plaintiffs that the only object of passing the current through the filament was to raise it to a high temperature. But the language of the specification would indicate that it must be done in this way. At any rate, no one could tell in 1904, and he doubted if anyone could tell now, whether the results of passing a current of electricity through the filament and the results of external heating would be the same. It was obvious that the results might be totally different.

His Lordship: I should say no one could tell.

Mr. Hughes: No one knew at that date. But, my Lord, the patentee is in this position. He has said: Do it by the passage of current. If he knew at that time it could be done in another way, he was bound to say so. If he did not know, and a new process has arisen since then, it is not within the patent. Proceeding, counsel submitted that if the patentee knew that this process could be carried out by external heating, he had carefully excluded it from the patent. At any rate, he knew that if he claimed that it could be done by external heating, and it turned out that it could not, the validity of the patent would be jeopardised. Moreover, the passage of current through the filament was essential to the equalising process, necessary when dealing with the soft-paste filaments of 1904, but unnecessary when dealing with the harder filaments it was now possible to turn out. Such as it was, the patentee had obtained the advantage of limiting the patent. With that he must also take the disadvantages. The defendants did not use the passage of current through the filaments at all. The filaments were taken in bundles of some hundreds at a time and heated in a furnace. True, the furnace was electrically heated; but that was a mere method of getting the heat and was immaterial. The defendants used a furnace heat instead of heating by current; and the practical difference there was enormous. For one thing it saved the direct handling of each of these minute filaments. But, in truth, the two systems were hardly capable of being compared. On this point he submitted there was clearly no infringement. The next point to be considered was one to which most of the evidence had been directed. That was the atmosphere in which the removal of the carbonised binder was to be carried out. On that point Just and Hanaman were clear. According to the specification sued upon, that was to be done in an atmosphere of hydrogen and water vapour introduced for the purpose. Plaintiffs now said it did not mean that at all; but that if hydrogen were introduced and if in the process water was formed that was using an atmosphere of steam and hydrogen. In his submission that was an entirely extravagant proposition.

His Lordship: I am sure there is a case in which somethiug was recommended to be done, and it was found that some part of the process did that itself.

Mr. Hughes: A very well-known case in which the alleged infringer was held not to have infringed on account of that.

Mr. Walter dissented.

Mr. Hughes (proceeding): Said that according to this specification at any rate no one could doubt that steam was meant to be introduced. If plaintiffs' view were right and sufficient moisture were necessarily generated in the process, why was steam mentioned at all? It would have been sufficient to say: do it in an atmosphere of hydrogen which, in the course of the process, will produce water, and that will perform the process of oxidation. But the specification did not say that. Nor, if the "Z" case showed anything, had it been the view of the plaintiffs hitherto. Presumably the writ was issued without knowing how defendants' filaments were made. But by inspection granted in August, 1914, plaintiffs discovered:—

1. That defendants did not produce their result by the passage of an electric current through the filaments, but by external heating.

2. That the hydrogen defendants used was dry, and, therefore, plaintiffs' preconceived ideas were knocked on the head at once.

3. That the defendants had an alternative process, which was carried out in a vacuum with substantially the same result. That must also have been a great surprise to them. Proceeding, counsel said that, in fact, they found that the production was carried out without any of the things on which plaintiffs had relied throughout as constituting the invention. Thereupon they set about to evolve a new theory which was now enunciated as the production of some water in the process. How that could be described as the use of an atmosphere of steam and hydrogen he failed to see. Moreover, the hydrogen defendants used was not only dry, but it was used in a rapid stream which immediately removed whatever products were formed in the process. So that instead of using this water vapour, if, in fact, it were produced, that water vapour was being carried away as rapidly as possible. It was not wanted for the alleged reaction. What defendants said happened was

this: There was some oxygen in the filament in the form of oxide of tungsten, and that combined direct with the carbon or carbide and passed off in the form of carbonic oxide. Doubtless it was difficult to say with any certainty what really happened. Scientists appeared to differ considerably. But as the onus was on the plaintiffs, it might not be necessary to decide that point absolutely. The plaintiffs' theory that in the vacuum process hydrogen and water were produced, although the process was commenced without either steam or hydrogen, was more extravagant still. But whether they were right or wrong, one cardinal fact remained. The process was not carried out in an atmosphere of steam and hydrogen, but in a vacuum. Therefore, in the process of carbonisation to be performed by direct current, according to Just & Hanaman, there was no infringement by the defendants; and in the removal of the carbon there was no infringement. The third essential in the process described by Just & Hanaman was the equalising process, which modern developments had rendered unnecessary, and in that respect also there had been no infringement. On the issues of anticipation and want of subject-matter, it was clear that the idea of using tungsten for electric lamp filaments was not new at the date of the specification sued upon. It was mentioned in Just & Hanaman's own German specification as nothing new. It was also referred to by Bottome, by Lodyguine, and in Siemens & Halske. The only point was how it was to be used. The process of building up a filament by taking metals or carbon and mixing them with an agglutinant, squirting the mixture through an orifice, and burning away the binder, was also well known. In fact, it was described by Welsbach in 1898 with reference to osmium and other metals of the platinum group. It was also well known that tungsten was a most suitable metal for filaments, and perhaps the most suitable. All Just and Hanaman did was to say: Try a known process suitable to some metals with other metals, or, rather, another metal which is the most suitable for the purpose for which you want it. There was very, very little invention, if any, in that.

His Lordship: There was no reason to suppose it would not work.

Mr Hughes: Apparently not, and when it was applied it was found it would work. Proceeding, Counsel said that everything else in the specification was known. The only thing which could possibly be described as novel was the direction: Try tungsten. No one had thought it worth while to put "Try tungsten" into a specification, possibly because most people would have thought there was no subject matter in it.

Besides, this specification did not contain a satisfactory method of carrying out the process.

(*To be continued.*)

Re Grosse, Ltd.

In the matter of the Companies' Acts and Allen *v.* Grosse, Ltd., an application was made before Mr. Justice Barton, in the Irish High Court, and granted, for the dismissal of a petition for the winding up of Grosse, Ltd., carrying on business as electrical and automobile engineers and agents at 35, Queen Street, Belfast. The applicants were the petitioners, Messrs. Pritchetts & Gold, Ltd., London, who were creditors for £172, and who stated that since Mr. W. G. Kennedy had been appointed liquidator an arrangement had been made by which all the estate of the company had been sold to Mr. Geo. Allen, who had been manager, and a term of the agreement was that Mr. Allen and his wife should release certain claims against the company. The result, it was considered, would be that the creditors would receive 6s. 8d. in the £, whereas if liquidation was proceeded with, it was likely that nothing would be left for the creditors.

Re G. H. Turner & Co., Ltd.

A petition by Siemens Bros. Dynamo Works, Ltd., for the winding up of G. H. Turner & Co., Ltd., was before Mr. Justice Neville, sitting for the disposal of company business on Tuesday, July 6th. Counsel for the petitioners stated that an arrangement had been come to, and he now asked for leave to withdraw the petition, without costs. His Lordship sanctioned the withdrawal of the petition accordingly.

Oppenheim *v.* Grewing.

In the Chancery Division, on Friday, Mr. Justice Eve granted the application of Mr. Harry James Oppenheim for the appointment of a Receiver of £15,000 worth of the plaintiff's shares in the Oriental Telephone and Electric Co., Ltd. The defendant was Mr. Henry Grewing, a former director of the company, who, it was alleged, held the shares. His Lordship also ordered that the Receiver should collect the dividends of the shares pending the action.

Thor Cotton Spinning Co. *v.* Siemens Bros. Dynamo Works, Ltd.

This action was mentioned to the Lord Chief Justice, in the King's Bench Division, on Monday. It was stated that the claim was for about £15,000.

Mr. McCardie asked for a postponement of the hearing of the action, because a material witness of the defendants was an alien in Germany.

Mr. Langdon, K.C. (for the other side), said it was not suggested that the witness could not return by licence of the Crown.

His Lordship: Do you think the licence would be granted?

Mr. Langdon said he did not think the case would be heard before the Long Vacation, and eventually his Lordship said it could be mentioned again in October, when the Courts would sit again.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Reserve Officers' Training Corps.

On examining the daily casualty lists one can but realise, considering the enormous loss of officers during the period of *defensive*, which is now occurring in our Forces, that when the great *offensive* is taken the casualties will largely increase in the percentage of officers placed out of action either through being killed or wounded.

There is no doubt that there is a large number of professional men of military age, ranging from 30 to 45, holding responsible positions in the profession, who are not engaged directly in supervising the manufacture of shells and other armaments, but who are employed in railway, gas, electricity and other engineering branches, and who, by virtue of their positions, are men who are used to the organisation of labour and the carrying out of routine work, and who have throughout the course of their theoretical training acquired facility in taking notes at lectures, and who would be available (provided they put themselves in training at once) as reserve officers in branches in which military strategy and tactics are not required so much as the organisation of labour and engineering knowledge, and I venture to put forward the suggestion that the Institutions should endeavour to see whether such Reserve Officers' Training Corps should not be formed, having branches in London, Manchester, Newcastle, and other centres, with the object (should it be necessary) that the members of such corps might be drafted into the Army Service Corps, Army Service Corps (Labour Section), the Royal Engineers, and, if necessary, the Artillery.

It is quite evident that men with such experience would be far more valuable than many of the young subalterns who are taken straight from college, and who have neither experience in the handling of men nor initiative in dealing with difficult problems which require immediate action.

It is, of course, understood that the first thing to do would be to ascertain how many men were physically fit, and also to make it understood that enrolment made it compulsory to attend at lectures either in the afternoon or the evening, with a view to becoming efficient; whilst there is also to be considered the fact that difficulty might arise over such reserve officers being released from their present employment, seeing that their employment might be a public necessity or that they might be on war service.

Station Engineer.

BUSINESS NOTES.

Trade Announcements.—The business of Messrs. J. F. and G. Harris has been turned into a limited company under the title of J. F. & G. Harris, Ltd. The company has been registered with a capital of £16,000, divided into 13,000 cumulative 3 per cent. preference shares of £1 each, and 24,000 ordinary share of 2s. 6d. each, to purchase the goodwill, stocks and book debts, and to take a tenancy of the leasehold premises in Wilson Street, Finsbury, and Bevenden Saw Mills, Hoxton, and the company has entered into possession and discharged the purchase consideration. The directors of the company are Messrs. P. L. Mott, of Browning and Co., Cannon Street, E.C.; H. G. Nutman, of Nutman & Son, Gracechurch Street, E.C.; and W. Goff, of Messers, Ltd., Gracechurch Street, E.C. Mr. Edward Harris has been appointed manager of the company.

The title of the General Cable Manufacturing Co. is now the General Cable Manufacturing Co., Ltd., and its address is Imperial House, Kingsway, London, W.C.

The Westinghouse Brake Co., Ltd., chain department, London, N., have notified their customers in Leeds and district that they have decided to close the Leeds office until the end of the war. All communications are to be sent to the London head office in York Road, King's Cross.

Dissolutions and Liquidations.—Aluminium Patent Non-Flux Solder, Ltd.—This company is winding up voluntarily, with Mr. C. Waterhouse, of 10, Camomile Street, E.C., as liquidator.

Smethwick Boiler Covering Co., Smethwick.—Messrs. H. E., A. D. & C. W. Jones have dissolved partnership. Debts will be attended to by the last two of these gentlemen.

Kay & Co., electrical and mechanical engineers, Ecclesfield Works, Ecclesfield.—Messrs. A. A. Kay, G. H. Sykes Carter, and C. E. Carter have dissolved partnership. Mr. A. A. Kay will continue the business under the same title.

Portable Tools.—The Westminster Tool and Electric Co., of Suffolk House, E.C., inform us that they have discontinued the use of the name "Vulcan" in connection with their electric tools. In future these portable electric drills, blowers, and lifting magnets will be known by the registered trade-mark—"Westool."

Book Notices.—*Journal* of the Institution of Electrical Engineers. Vol. 53, No. 250. June 15th, 1915. London: E. and F. N. Spon, Ltd. Price 3s. 6d. Also the index to Vol. 53.—This issue, the last until next session, contains papers on the "Magnetic Behaviour of Iron under Alternating Magnetisation," by N. W. McLachlan; "Incremental Armature Copper Losses at No-Load and Armature Teeth Eddy-Current Losses," by A. Press; "Notes on the Cooling of Condensing Water," by C. S. Jeffrey; "Good Lighting," by V. H. Mackinney and E. Stroud; "The Utilisation of Waste Heat for the Generation of Electrical Energy," by H. Hobson; "Modern Power House Condensing Plant," by A. Arnold; "Notes on Modern Methods of Electric Welding," by H. S. Marquand; and the fourth list of members on military service. The pass list for the Associate Membership examination held in April contains the names of five successful candidates.

The Slide Rule. By C. N. Pickworth. Manchester: Emmott and Co., Ltd. Price 2s. net.—This, being the thirteenth edition of a standard work, needs no recommendation. The contents have been revised, and descriptions of various new slide rules and calculators have been added, as well as a note on the extraction of fifth roots.

International Correspondence Schools, Ltd., has sent us an advance proof of a pamphlet on "Electrical Industries"—one of a series intended to cover the principal industries under the general title of "The Recapture and Expansion of British Trade," which will be sent to the I.C.S. students. Copies of these papers may be had on application.

We have received an advance copy of a new prospectus that is being issued by the Wholesale Hardware Club, Ltd. (14, Finsbury Square, E.C.). The President (Mr. F. A. B. Lord) calls for an increase of membership from 300 to 500 during the current year.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXXI, part 3. June, 1915. Newcastle-upon-Tyne: The Institution. Price 5s.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIV, No. 7. July, 1915. New York: The Institute. Price $1.

Circular of the Bureau of Standards, No. 20, "Electrical Measuring Instruments." Washington: Government Printing Office.

"*Transactions* of the Illuminating Engineering Society." Vol. X, No. 4. June 10th, 1915. New York: The Society. Price 75 c.

"The Near-Eastern Problem and the Pan-German Peril." By Vladimir Yovanovitch. London: Watts & Co. 6d. net.

City and Guilds of London Institute: Report of the Council for 1915, and Programme of the Technical College, Finsbury. London: The Institute.

Catalogues and Lists.—Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—No. 2 of the new series of *Installation News* contains, in addition to some opening editorial notes and some "remarks at random," illustrated articles on the correct illumination of shop windows, the illumination of factories, English manufacturers and American guarantees, an account of the company's new premises at Liverpool, and matter relating to the Simplex ironclad distribution boards, the Brilliant cleaner, and Simplex lighting fittings. Copies will be sent on application.

The Edison & Swan United Electric Light Co., Ltd., Ponder's End.—No. 2 (Vol. 1) of *Ediswan Electric Service* contains notes on the development of lamp manufacture (continued from No. 1), and illustrated particulars of the Ediswan Dimmer switch, electric fans, the Pygmy heater, the "Ediswan Imperial" vacuum cleaner, and artistic fittings, also a view of the company's showrooms and extracts from a letter from the firing line, accompanied by a photographic reproduction of a shrapnel-riddled motor headlight and "Royal Ediswan" lamp—the latter, of course, intact.

The Wholesale Electrical Co., Ltd., 54-56, Oxford Street, W.—Fully illustrated price list of electrical accessories, including many patterns of lampholder, with and without key switches, adapters, tumbler switches of various types and sizes, switch plates, button switches, plugs, ceiling roses, cut-outs, &c., also ironclad switches, distribution boards, electric radiators, and ornamental lighting fittings. A series of views of the firm's workshops in London are included.

Messrs. Landis & Gyr, Ltd., Willesden, N.W.—16-page illustrated price list of ampere-hour meters with friction compensating device.

Messrs. Austin Walters & Son, 57, Lower Mosley Street, Manchester.—20-page catalogue containing illustrations and prices of various designs of electrical advertising signs for restaurants, shops, garages, &c., also window signs, theatre signs, gilt wood letter signs, electric sign flashers, and time switches. A second publication, of eight pages, describes and gives tabulated prices of arc lamp resistances, cinema theatre dimmers, sliding contact resistances, and liquid resistances for A.C. and D.C.

For Sale.—Gloucester Corporation has for disposal a quantity of hard drawn copper trolley wire, scrap copper cable, brass, and other metals. Particulars are given in our advertisement pages.

Patent Application.—Application for restoration of Patent No. 10,676 of 1910, for "Improvements in reinforced concrete telegraph poles and the like," has been made by Ricardo Esparza.

Bankruptcy Proceedings. — Boult, J., & Bolt, J. H. (firm, John Boult, electricians, Grosvenor Street, Chester.—Receiving order granted on debtor's petition, June 28th. First meeting July 14th, public examination July 27th—both at Chester.

LIGHTING and POWER NOTES.

Aldershot.—L.G.B. Inquiry.—An inquiry was held on July 1st into the application of the U.D.C. for an urgent loan of £8,500 for new plant for the electricity works.

Batley.—Year's Working, &c.—There was a profit of £634 on the Council's electricity undertaking for the year ended March 31st, 1915. In the previous year there was a loss of £116. The price of energy supplied for lighting is to be increased 7½ per cent., and for motive power 15 per cent., with a minimum charge of 1d. per unit for supplies to motors of 5 E.H.P. (demanded) and under.

Belgian Congo.—At Elizabethville, Katanga, the Union Minière du Haut Katanga has a 745-KW., three-phase, 60-cycle, 550-volt plant in operation at its smelting works, and another 425-KW. plant of the same type is to be erected towards the end of the year. At the same company's copper mines at Etoile du Congo and Kambore, 180 and 60-KW., three-phase, 60 cycle plants are also in use. Several small lighting plants are in use in Elizabethville, for the railway station, cinema, offices, &c.

Bitterne.—The Southampton Gas Light and Coke Co. has petitioned against the Bill of the Southampton T.C. to confirm the prov. order for supplying electricity to Bitterne, and the T.C. is taking steps to support the Bill and prov. order.

Bristol.—L.G.B. Inquiry.—Last week an inquiry was held into the application of the T.C. for sanction to borrow £27,295 for the purchase of a 6,000-KW. turbo-alternator, piping switchgear, &c., and to cover £1,398 excess expenditure. It was pointed out that the normal capacity of the power plant was 9,900 KW., and that it carried a load of 4,947 KW. on March 25th last, but since that date contracts for further supplies had been entered into, making a total of 7,185 KW., and leaving a margin of only 2,715 KW., or less than the capacity of one of the largest units of plant, viz., 3,000 KW. It was pointed out that amongst the firms supplied were many engaged in Government contracts. Some opposition was shown to the proposed loan, Mr. Elvey Robb appearing for the Ratepayers' Association, while several speakers appeared to doubt the real need for the extension. The question of the availability of the Temple Back plant was raised, and Mr. Robb suggested that the L.G.B. should investigate the exact position of the plant, stating, however, that his clients would not oppose the application if a real necessity for the plant were shown.

Burnley.—Price Increase, &c.—The following increases in the price of energy are being recommended for adoption:—Lighting, heating and domestic purposes, ¼d. per unit; power, 5 per cent.; traction, ·05d. per unit.

The E.L. Committee has informed the Burnley Paper Works Co., which is a possible consumer of over 100,000 units per annum, that it cannot reduce its price below ·7d. per unit.

Canada.—The Electric Power Co., which has absorbed 27 electrical undertakings between Toronto and Kingston, has contracted with the Dominion Government for all power developed on the Trent Valley Canal. The transmission system in use is 44,000 volts, three-phase, 60 cycles, and it is estimated that up to 75,000 H.P. can be developed.

Chester.—Hydro-Electric Works Results.—During the past 12 months 1,459,500 units were generated at the Corporation hydro-electric works of which 15,679 were used for pumping sewage, 1,659 for lighting the works, 63,232 by excitation and feeder booster, 117,209 in the distribution cables, and 1,261,721 were sold to consumers. The cost of operating these works in producing the above quantity of electrical energy was as follows:—Oil and stores, £39; wages, £249; repairs and maintenance, £22; rent, £100; rates, £136; insurance, £1; part general establishment charges, £100. Total works charges, £647, *i.e.*, ·123d. per unit sold. The capital charges were interest on loans, £460; sinking fund charges, £484; total capital charges, £944, *i.e.*, ·179d. per unit sold, making in all ·302d. per unit sold. Taking the income per unit sold at 1d., as in the original estimates, the undertaking shows a surplus of £3,665 on the year's working.

Colne.—Price Increase.—In view of the increased price of coal, the Corporation has increased the charge for energy for power purposes by ¼d. per unit.

Coventry.—Year's Working.—The returns of the Corporation electricity undertaking indicate, as usual, striking progress during the last financial year, when over 20¼ million units were sold, as compared with 16,300,000 in the previous 12 months. It is interesting to note that of the above, some 18,430,000 units were sold at an average price of ·72d. per unit, the total average for all supplies being ·92d. per unit. That such prices are justified in Coventry can be gathered from the fact that the total revenue amounted to £77,913, as compared with £71,207 in 1913-14; the total works costs amounted to £29,688 (·35d. per unit); capital charges to £21,941 (·26d. per unit); special charges to £3,192 (·038d. per unit); and public lamps, £262 (·003d. per unit); making a total commercial cost of £55,083 (or ·652d. per unit). Thus the net profit for the year was £22,830, and with a small surplus brought forward, made £23,148, which was carried forward. The previous year's carry forward was £21,943. The reserve fund balance amounted to £9,005, £13,250 having been transferred for capital purposes during the year; the E.L. Committee recommended that the balance in hand, £23,148, should be disposed of as to £17,148 to the reserve fund, to be expended on capital account, and £6,000 to the general district fund. The maximum load for the year was 10,584 KW.; and the connected load included 1,160 motors, of 15,345 H.P.; the load factor was 21·8; and 2·95 lb. of coal was burnt per unit sold, the fuel cost amounting to ·185d., inclusive of destructor steam. The average revenue per 8-C.P. lamp was 2s. 9d., and the number of consumers 3,889.

Continental Notes.—Russia.—Whilst the Petrograd Town Council is thinking over the question of turning the Finnish waterfalls to account for the production of electric power, an English company, says the *Novoie Vremya*, has acquired the right over the Imatra Falls. The company inquired of the chief of the town on what terms and conditions the town would use current generated by the falls named, for lighting and for industrial purposes; "but, just having become free of concessionaires, there is no reason to put on the manacles of concession again."

German "War Wire."—Owing to the scarcity of copper, the German Government regulations with regard to electrical installations have been so far relaxed as to admit the use of conductors of zinc in place of copper in low-pressure installations.

Dalkeith.—Price Increase.—The Electric Supply Corporation, Ltd., is raising the price of energy for lighting to 5½d. per unit, and for domestic heating and motive power to 2d. per unit.

Darwen.—The Electricity Committee has decided that the following clause be endorsed on all statements of accounts for the electricity department:—"The Corporation will not supply or fix internal fittings, except meter and main fuse, on consumers' premises, and at the meter their responsibility ends. The responsibility for all wiring, fittings and apparatus on the consumer's side of the Corporation main fuse, whether tested or not by the Corporation, rests solely with him."

Edinburgh.—The City electrical engineer has reported to his Committee as to the impracticability of further reducing his staff for war services. While mains laying could be delayed, it would hinder the development of the undertaking. The greater part of the work involved in supplying the extended area, including Cramond, Corstorphine, Liberton and Newton has been completed.

Erith.—Proposed Loan.—The U.D.C. has decided to apply to the L.G.B. for sanction to a loan for the provision of additional plant at the electricity works. The full scheme is estimated to cost £20,000, but it is intended to limit present expenditure to £15,300.

Finchley.—Year's Working.—The accounts of the electrical undertaking for the year ended March 31st last show that the income was £23,976, and the working expenses £12,025, leaving a balance of £11,951, which, after the repayment of interest on loans, &c., left a clear balance of £7,902.

At the meeting of the Council, last week, it was agreed that the price for current for private lighting and street lighting be increased by 10 per cent. It was pointed out that next year it was estimated that there would be a deficit of £2,000, and only about £1,300 to meet it with.

Guiseley.—E.L. Scheme.—The U.D.C. has been informed by the Electrical Distribution of Yorkshire, Ltd., that it intends making application for powers to supply electricity in the Guiseley Urban District. The company states that it believes it can offer a supply more cheaply than could otherwise be obtained. The matter has been referred to the Committee considering the joint electricity scheme for the district.

Halifax.—Proposed Loan.—The Tramways and Electricity Committee is asking the T.C. for permission to make application to the L.G.B. for sanction to borrow £24,000 for additional plant, consisting of one 5,000-KW. turbo-alternator, surface condenser, cooling towers, and water-tube boiler, in connection with the electricity undertaking, and for power to accept tenders for the work.

The present charges for electrical energy for motive power purposes are to be increased by 12½ per cent.

Hendon.—Electrical Demonstration.—The Hendon Electric Supply Co., Ltd., has held a series of demonstrations at Golder's Green. The lines adopted were somewhat novel, the hall being invitingly laid out with small tables provided with electric kettles, teaball teapots and toasters, at which during the interval the guests made their own tea. Various useful domestic appliances were also displayed on the tables for inspection, and as the guests arrived the use of them was explained by the company's staff in attendance. Mrs. Lewis gave practical cookery lectures, and prepared the bread, cakes, pastries, &c., for afternoon tea. Mrs. Maud Lancaster explained the use of various domestic electrical apparatus, and lectured on the comfort of an electric home. The demonstrations were organised by the engineer, Mr. B. G. Drummond, the cookers being supplied by the General Electric Co., Ltd., the Brompton and Kensington Accessories Co., Ltd., Messrs. Ferranti, Ltd., and the Bastian Co., Ltd.

India.—Overhead Wires.—The Government of Bombay recently appointed a Committee to inquire into the accidents that have occurred in Bombay through broken telephone wires coming into contact with tramway and other wires carrying high-pressure electric currents. The Committee consisted of Mr. H. P. Gibbs, chief engineer, Tata Hydro-Electric Power Supply Co.; Mr. E. L. Bagshawe, superintendent of telegraphs; and Mr. F. W. Wilson, officiating electrical engineer, Electrical District. Since overhead mains were introduced into Bombay four fatal accidents have occurred. The Committee has made certain recommendations, which the Bombay Electric Supply and Tramway Co. and the Bombay Telephone Co. have been requested to give effect to, with the view of such accidents in the future being reduced to a minimum.—*Times of India.*

Kirkcaldy.—Year's Working.—For the year to May 15th last, the total income of the Council's electricity undertaking was £12,295, and the gross profit £4,866, while, after meeting financial charges, a surplus of £524 remained, as against an estimated net profit of £1,245, which it is thought would have been realised but for the war. The coal consumed was 9·92 lb. per unit sold (costing ·320d.), as against 12·18 lb. (costing ·460d.) the year before, and this would have been lower had the turbine plant been available all the year. The maximum load was 950 KW., load factor 22·5 per cent., units sold 1,880,193, and B.H.P. of motors connected 1,688. Owing to the abnormal price of coal, a deficit of £2,928 is estimated for the present year.

Leeds.—During a severe thunderstorm last week considerable trouble was caused at three electricity sub-stations owing to flooding, and consumers on the mains connected with these sub-stations were deprived of current for a time.

London.—L.C.C. and Loan Sanctions.—The Finance Committee, with the approval of the Treasury, has agreed to the borrowing of £500 by the Shoreditch B.C. for electricity meters, but has asked to be furnished with a list of the consumers and their trades to be supplied by the meters under the sanction, it being understood that the meters are required for war services. H.M. Treasury has now agreed to a suggestion by the L.C.C. that it should sanction loans for electricity mains, house services and meters, without applying to the Treasury beforehand, provided that such loans appear to be reasonable and required in connection with work for the War Office and Admiralty. The Metropolitan Borough Councils have been informed of this arrangement.

Woolwich.—The B.C. is to apply to the L.C.C. for sanction to the borrowing of £1,450 for mains; £1,027 for transformers; £965 for switchgear; and £180 for hire rentals. The loans are to cover expenditure incurred, or to which the Council is committed.

The Finance Committee has considered the question of linking up with the South Metropolitan E.L. and Power Co. in order to give certain urgent supplies, and recommends that application be made to the L.C.C. for sanction to borrow £4,700 for cable and transformers required; in the event of refusal by the L.C.C. to sanction the borrowing of £2,172 for wiring certain Government houses, an appeal is to be made to the L.G.B.

Bermondsey.—The Electricity Committee reports the receipt of a notice of objection to the quinquennial assessment of the electricity undertaking. The present valuation of the undertaking is £9,090 gross and £3,030 rateable, and the undertaking has been put in the new valuation list at the same figures. The County Council contends that the new figures should be £11,000 gross and £4,000 rateable.

Luton.—Year's Working.—During the last financial year the Corporation Electricity Department sold 8,381,000 units, including some 304,000 for traction. The maximum load was 3,189 KW., and the connected load included 5,996 H.P. of motors and 1,465 KW. of heating apparatus. The total income was £32,822 and the gross profit £13,773, as compared with £11,668 in the previous year, representing 10·65 and 11·42 per cent. respectively on the capital expended. The net profit, £4,430, which compares with £4,793 in the previous year, was carried to the appropriation account, and the latter, after deductions for house services, meters, balancer replacement, bonus, &c., stands at £6,803; in addition, the department has a reserve fund amounting to £6,401.

The T.C. proposes to apply to the L.G.B. for permission to borrow £4,000, being the balance of a loan of £24,000 sanctioned for electricity purposes in 1913.

Lytham.—Bulk Supply.—In connection with the proposed scheme for taking a bulk supply of electricity from St. Annes, it has been decided that the agreement shall run for 10 years from the date of the L.G.B. sanction to the loan.

Maidenhead.—The T.C. has decided to invest in the new War Loan £1,000 of the E.L. reserve fund, and £300 of the E.L. insurance fund.

Year's Working.—The gross profit on the electricity undertaking for last year was £4,705, and the net profit £637, both items being an improvement on the previous year. The bulk of the output was generated by the Diesel plant, but oil fuel cost 68s. per ton, as against 47s. in the previous year.

Manchester.—Year's Working.—The annual report of the Manchester Electricity Committee shows a net surplus of £34,926, compared with £36,006 in 1914. The sum of £30,000 has been devoted to the relief of the rates, and the balance to capital outlays for which no borrowing powers exist. The surplus was reduced by reason of war service allowances, amounting to £6,015, and additional income-tax of £3,283.

The total revenue for the year amounted to £543,546, as compared with £513,589 in 1914, while working expenditure, exclusive of depreciation, amounted to £298,444, leaving a gross balance of £248,102, as against £237,105 in the previous year. Interest and sinking fund payments called for £180,453 ; loan instalment to P.W. Commissioners amounted to £7,105 ; £25,618 was transferred to renewals suspense account, and the net surplus of £34,926 dealt with as stated previously. The renewals account balance now amounts to £185,974, and the reserve fund to £11,515.

The total units generated were 162,699,530, of which about 98,000,000 were sold for lighting and power—the latter taking well over 80,000,000 ; 29,000,000 units were sold for traction, and the total units sold were 127,750,000. Nearly 12 000,000 units were used on the works, and distribution losses, &c., accounted for 23,000,000. The maximum load was 50,460 KW., of which traction accounted for only 10,440 KW.

The L.G.B. sanction for the borrowing of £424,220 for the establishment of the electricity generating station at Barton, provides the following periods for repayments :—£121,770, repayable within 30 years ; £49,500, within 20 years ; £126,850, within 17 years ; £105,780, within 15 years ; £15,480, within 10 years ; and £4,840, within 7 years.

The Tramways Committee has granted permission to the Electricity Committee to utilise tramway poles in connection with the electric lighting of Oldham Street, one of the principal central shopping thoroughfares in the city.

Maidstone.—LOAN SANCTION.—The T.C. has received sanction to a loan of £4,800 for new plant, this representing the estimated cost, less £2,150 received from the sale of three small generating sets, and £500 to be transferred from the revenue account.

Nottingham.—PRICE INCREASE.—The Electricity Committee proposes to increase its charges for energy by 12½ per cent.

Oldham.—YEAR'S WORKING.—The electricity accounts for the past year show that the gross revenue was £52,580, and net profit £3,549. The output for private lighting during the year was 2,018,603 units, an increase of 134,377 ; for power, 2,779,150 units, an increase of 924,554 ; and for traction 3,158,753 units, a decrease of 132,855.

Plymouth.—PRICE INCREASE.—The T.C. has decided to increase the price of electric current for lighting by a farthing per unit after September.

Reigate.—YEAR'S WORKING.—Referring to the annual balance-sheet of the electricity undertaking, the chairman recently pointed out that a profit of £206 was shown, being £85 more than estimated. They had lost a good deal of revenue by the war, but the output was 28,000 units higher. Both coal and oil fuel were increasing in price, but the Committee was reluctant to increase the price of electricity. The reserve fund stands at £2,824 on a capital of £35,612.

Ripon.—E.L. SCHEME.—The City Council has decided, after consideration of a communication from its Parliamentary Agents, not to make any order in respect of an electric lighting scheme for the city.

Rochdale.—LOAN SANCTION.—The T.C. has received a letter from the L.G.B. sanctioning loans for £20,171 for the electricity undertaking, and stating that the Board does not see its way to approve any loans at the present time in respect of the expenditure on electricity mains.

The Electricity Committee recommends an increase in the price of electricity by 10 per cent. for lighting and 15 per cent. for other purposes as from the inspection of meters now proceeding.

Runcorn.—The B. of G. has decided to ask the borough electrical engineer of Warrington to report upon the condition and adequacy, or otherwise, of the electric lighting plant at the Children's Homes.

Shipley.—The Electricity Committee has decided, owing to the largely increased price of steam coal, not to enter into contracts at the present prices, and that arrangements be made to purchase coal according to requirements.

The Council has decided to consent to the Bradford Corporation supplying electricity to Dumb Mill on condition that the Corporation enters into an agreement authorising the Council to continue its supply of electricity in the Bradford area.

Spenborough.—During a thunderstorm last week—which affected the whole of the West Riding of Yorkshire—damage was done to one of the dynamos at the electricity works of the Council ; there was, however, no shut down in the supply.

Spennymoor.—RESTRICTED LIGHTING.—On account of the suspension of public lighting, the Electricity Supply Co. has reduced the public lighting account of the U.D.C. by £78.

Stalybridge.—YEAR'S WORKING.—The accounts of the Joint Board's electricity department for the past year show a revenue of £49,071, and expenditure of £22,934, leaving a gross profit of £26,137. After paying £10,234 for interest and special payments and £11,641 to sinking fund, there was a surplus on the year's working of £4,170, as against £8,257 in the previous year. During the past year 22,683,680 units were generated, of which 1,850,354 units were used on the tramways, 6,582 for public lighting, 813,152 for private consumers' lighting, 16,004,499, for private consumers' power, and 1,134,184 were used on works, making the total quantity accounted for, 19,809,771.

Sunderland.—YEAR'S WORKING.—The annual report of Mr. A. S. Blackman, borough electrical engineer, states that there was a decrease of 2¼ per cent. in the units sold as compared with the previous year, the sales being 14,499,124 units. During the year five new sub-stations were completed. The total revenue was £73,517 ; in the sales department work executed and goods supplied totalled £5,775. The total working expenses amounted to £32,880, and the surplus, £33,550, was dealt with as to £10,277 for interest, and £16,640 for the repayment of loans, and after meeting other smaller liabilities, £4,653 was carried to the depreciation and renewals account.

Torpoint.—The Electric Supply Co., Ltd., having completed the lighting arrangements for the town, has asked the U.D.C. to consider the return of £100 deducted from its account owing to delay in completing the contracts, with such deductions as will fully reimburse the Council for all the special outlays it has incurred.

West Bromwich.—The Electricity Committee recommends an agreement being entered into with the Wellington Tube Co., Ltd., for a supply of electricity of a minimum quantity of 80,000 units per annum, for a period of five years.

TRAMWAY and RAILWAY NOTES.

Belfast.—FEMALE LABOUR, &c.—At the monthly meeting of the Corporation last week it was decided, if necessary, to engage women as tram conductors to replace men who had joined the Colours ; it was further decided not to employ in the tramway department any fit man of military age. It was intimated that it was found necessary to increase the rate of electrical charges by ¼d. per power unit, and ½d. per lighting unit, owing to the increased cost of production. The staff of the tramway department has already given a good many of its members to the Ulster Division.

Bournemouth.—YEAR'S WORKING.—For the year ended March 31st last, the revenue of the Corporation tramways undertaking amounted to £102,346, and the total gross balance to £48,235. Interest, sinking fund, rent of leased lines, &c., amounted to £38,101, leaving a net profit of £10,134, or deducting loss on motor-'buses, £8,947. During the year nearly 17 million passengers were carried, and 1,815,632 car-miles were run. The percentage of working expenses to receipts was 53·8 ; and the track mileage of the undertaking 31½.

Burnley.—The T.C. has referred back a proposal to remove all restrictions as to the time at which discount tickets are available on the cars on all days except Sundays.

Doncaster.—FEMALE LABOUR.—The Corporation has decided to employ female conductors on the Avenue Road and Hexthorpe and Hyde Park routes, in replacement of some 30 men who have left the tramway department and enlisted in the Forces. The new conductors must be 25 years of age or over, and it is understood that preference will be given to wives of soldiers serving at the Front.

Dundee.—TRAMWAY ARBITRATION AWARD.—Mr. W. Allan Carter, C.E., Edinburgh, the arbiter in the case between the Corporation and the Dundee, Broughty Ferry and District Tramway Co., regarding the price to be paid by the T.C. for about a mile of the company's line, has issued his award. The formal claim of the company was for £14,500, and the Council offered £8,500. Mr. Carter proposes to award £9,255, with expenses against the town.

Kirkcaldy.—YEAR'S WORKING.—The Corporation tramway undertaking during the year ending May 15th carried 5,492,120 passengers, as against 5,781,895 in the previous 12 months. The total income was £16,977 ; the gross profit £5,525, and the credit balance, after meeting financial charges, contributions to depreciation, cost of 1910 Act, &c., was £33, as against an estimate of £1,040, the reduced figure being accounted for by the falling off of receipts due to the war. Based on present earnings, the undertaking should show a surplus of £70 for the present year, but if the price of energy is increased, as suggested, a deficit of £424 is expected.

Leyton.—ELECTRIC DUST VAN.—The District Council has had its attention called to the trials recently made by the Barnes District Council of an electrically-propelled dust van, and a Sub-Committee has been appointed to consider the matter and report.

Manchester.—WAR BONUSES.—The Tramways Committee has decided to offer to submit the application of a war bonus for certain classes of workers to arbitration by the B. of T.

Northampton.—In view of abuses in the use of military passes, the Tramways Committee proposes to cancel, as from July 1st, all free passes granted for military purposes, except those relating to nursing staffs.

London.—L.C.C.—Discussing the possibility of reducing redundant passenger services on the streets and releasing men, &c., for Government service, the chairman of the Highways Committee recently stated that the duplication of the Council's services by private enterprise would, he hoped, be the subject of an early report. 'Buses competed with the Council's tramways along 100 miles of route, and required 1,500 men to operate them, while the additional men required by the tramways to give the same service would be only 460.

City and S. London Railway.—Owing to the fusing of a cable, the traffic was dislocated for an hour on Saturday morning last, single-line working being, however, possible.

Fire Brigade Vehicles.—According to the annual report of the L.F.B., in addition to 15 petrol vehicles, there were added to the equipment during the past year two electrically-driven chassis, upon which have been mounted turntable ladders, and two electrically-driven motor escape vans.

Ramsbottom.—Railless Cars.—The second of the new cars for the railless traction system was put into service on the 1st inst., and the first of the old cars has been sent to Leeds to be fitted with new body, wheels and springs.

Rowley Regis.—The U.D.C. has decided to take no action regarding the expiration next month of the Quarry Bank, Brierley Hill, and Rowley Regis Light Railway Order, it being considered that, as the motor-'buses were serving the district adequately, it was doubtful if the tramway scheme could be carried out successfully.

Stalybridge.—Year's Working.—The accounts of the Joint Board's tramway undertaking for the past year show on revenue account an income of £37,620, and expenditure £32,049, leaving a gross profit of £5,571. Interest and special payments absorbed £8,282, and £7,785 was transferred to sinking fund, leaving a deficit on the year of £10,497, compared with a deficit on the previous year of £5,870. Car-mileage was 1,116,936, compared with 1,157,163 in 1913-14; and the passengers carried numbered 8,406,915, against 9,900,591. The average fare per passenger was 1·060d., against ·977d. last year; and the average number of passengers per car-mile was 7·706, against 8·556 in the previous year.

TELEGRAPH and TELEPHONE NOTES.

Canada.—In the course of a recent debate on the Marine and Fisheries Department Estimates in the Canadian House of Commons, the Minister of Marine announced that during the coming season the first wireless station will be placed on the Hudson Strait. This station will be able to work with those at Port Nelson and Le Bas.—*Wireless World.*

Postal Servants.—In the House of Commons, on Tuesday, Mr. Herbert Samuel stated that about 36,000 of the Post Office staff were serving in the Army and Navy, and arrangements had been made to release many more. General facilities to enlist could not be given to telegraphists, linemen, and other skilled workmen on the engineering staff, because many thousands of those classes were required at home for military and naval work. Every effort would be made to provide employment for disabled soldiers and sailors, and no more boys would be taken on as telegraph messengers where disabled men could be employed; the latter would also be given first consideration for employment as night telephone operators.

Russia.—The Russian authorities have decided to erect and equip a radio-telegraphic station at Nicolaieff, in the Odessa district, for the purpose of receiving time-signals from the Eiffel Tower, Paris.—*Wireless World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—Aug. 11th. One 1,000-KW. D.C. generator complete, liquid starter, &c., for the City Council. See "Official Notices" June 4th.

July 27th. A.C. and D.C. meters and maximum-demand indicators, for the City Council. See "Official Notices" June 25th.

August 11th. Victorian Railway Commissioners, Spencer Street, Melbourne. Twenty miles of vulcanised-rubber-covered electric light wire (Contract No. 28,925). Local representation. Deposit, ½ per cent. of amount of tender.*

Adelaide.—August 18th. Magneto and trembling bells, for P.M.G.'s Department. See "Official Notices" July 2nd.

August 18th. Battery material, for the P.M.G. See "Official Notices" to-day.

August 25th. Dry cells, earth clips, recording counters, and various other instruments and apparatus, for the P.M.G.'s Department. See "Official Notices" to-day.

Perth.—August 11th. Bolts and nuts, tubular brackets, side brackets for tubular iron poles, &c., Cordeaux and other insulators, copper wire, &c., for the P.M.G.'s Department. See "Official Notices" July 2nd.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

Barking Town.—July 16th. U.D.C. 1,000-KW. turbo-alternator with condensing plant; cooling tower and pipework; chain-grate stoker, boiler pipe work, &c.; economiser; rotary converter; H.T. switchgear; H.T. mains. See "Official Notices" July 2nd.

Dublin.—July 12th. Corporation. 122,000 carbons. See "Official Notices" July 2nd.

Eccles.—July 19th. 4,000 tons of slack coal for the electricity works. Borough Electrical Engineer, Cawdor Street, Patricroft.

Edinburgh.—July 12th. Corporation. One 1,000-KW. motor-converter and transformer. See "Official Notices" June 25th.

July 14th. Corporation. Electric lighting installation at public wash-house, McLeod Street. Mr. F. A. Newington, Engineer, Dewar Place.

Erith.—July 19th. U.D.C. One 2,000-KW. turbo-alternator, with condensing plant, switchgear, and all accessories. See "Official Notices" June 18th.

Hull.—July 22nd. Machinery oils for the Corporation Electricity Works.

Kingston-upon-Hull.—July 22nd. Corporation. One 5,000-KW. turbo-alternator with exciter; one condenser outfit complete. See "Official Notices" July 2nd.

Morecambe.—July 24th. Corporation Electricity Department. 2,000 tons of coal or slack. See "Official Notices" July 2nd.

Salford.—July 12th. Steel and concrete foundations for 5,000-KW. turbo-alternator. Borough Electrical Engineer, Pendleton.

South Africa.—Beaufort West (Cape).—September 14th. Municipality. Suction gas engines, dynamo, booster, switchboard, battery, &c.; also poles, copper, insulators, street lamps, service connections, meters, &c. Specifications, on deposit of five guineas (returnable), from Chas. G. Trevett, A.M.I.E.E., 70, Fletcher's Chambers, Cape Town. Tenders to Town Clerk, Beaufort West.

Spain.—The municipal authorities of Villanueva de los Castillejos (Province of Huelva) have just invited tenders for the concession for the electric lighting of the town during a period of 20 years.

CLOSED.

Aberdeen.—The Corporation Tramways Committee has accepted the tender of the Tudor Accumulator Co. to make 300 new welded joints.

Batley.—The Electricity Committee has accepted the following tenders:—Crawshaw & Warburton, 1,500 tons coal; White Lee Colliery Co., 500 tons coal.

Bury.—The Corporation has entered into the following contracts for the electricity works:—

John Heaton and J. E. Southern & Co.—Coal.
Underfeed Stoker Co., Ltd.—Mechanical stoker.

Derby.—The Corporation Electric Lighting Committee has accepted the tender of Marshall & Plumtree, of London, for 10,000 carbons at £25 15s. per 1,000; and those of the Hall Colliery Co., Ltd., Derby Coal Co, Ltd., Mr. T. Walker, Brookhouse, Johnson, Ltd., Parr & Sons, and Hill & Poyser for coal.

Eccles.—The T.C. Electricity Committee has recommended the acceptance of the tender of Messrs. Joseph Chapman and Sons for the construction of a coal bunker at the electricity works.

Hebden Bridge.—The Waterworks, Electricity and Watch Committee has accepted the tender of the Anglo-American Oil Co., Ltd., for the supply of fuel oil for the Diesel engine at the electricity works until December 31st, 1915.

Kendal.—The tender of the Wigan Coal and Iron Co., Ltd., has been accepted by the Electricity Committee for coal during 12 months:—Arley nuts, 23s. 6d. per ton; John nuts, 21s. 9d. per ton; Hewlett unscreened nuts, 22s. 2d. per ton.

Liverpool.—The Electric Power and Lighting Committee has accepted the tender of Messrs. J. G. Nicholls, Ltd., for the supply of glass for a period of three months.

London.—L.C.C.—The Asylums and Mental Deficiency Committee has accepted the undermentioned tenders for a period of four months from July 1st, 1915 :—

Electric sundries, Schedule 64.—A. F. Goodwin & Co. ; General Electric Co., Ltd. ; Veritys, Ltd. ; W. Geipel & Co. ; Cox-Walkers, Ltd. ; G. MacLellan & Co. ; Falk, Stadelmann and Co., Ltd.

Electric lamps, Schedule 64*a*.—Pope's Electric Lamp Co., Ltd.

Bermondsey.—The Electricity Committee has accepted the tenders of the Glenboig Union Fireclay Co., Ltd., for 1,650 fire bricks, and 1½ tons fireclay for £15 17s. 6d., and Babcock & Wilcox, Ltd., for arch plates, rails, driving links, noses, &c , for £15 16s. 6d.

Poplar.—The B.C. has been recommended to accept the tender of Messrs. Economisers, Ltd., at £360, including the cost of erection, for renewing the tubes of the economiser at the refuse destructor.

Maidenhead.—The T.C. has accepted the tender of the Crynant Colliery Co., Ltd., for coal for the electricity works for a year, at 13s. 4d. per ton.

Manchester.—The Electricity Committee has decided that Messrs. Ed. Bennis & Co., Ltd., shall carry out the work in connection with the supply, delivery and erection of four chain grate stokers for boilers Nos. 45 and 46, at Stuart Street generating station.

The contract of the Street Mains and Lighting Sub-Committee with the British Electric Transformer Co., Ltd., for air-cooled transformers has been extended to June 30th, 1916, with the addition of an extra size.

The Electricity Committee has accepted the following tenders :—

Cables.—B.I. & Helsby Cables, Ltd., and W. T. Glover & Co., Ltd.
Oil immersed transformers, 250 and 500 K.V.A —Ferranti, Ltd.
Service boxes.—J. Stubbs, Ltd., and Hardy & Padmore, Ltd.
Tail end boxes.—B I. & Helsby Cables, Ltd.
Carbon, metal-filament and Mazda lamps.—British Thomson-Houston Co., Ltd.
Radiator lamps.—General Electric Co., Ltd.
Radiator lamps (Dowsing).—Dowsing Radiant Heat Co., Ltd.
Rubber-insulated service cables.—Callender's Cable and Construction Co., Ltd.

Manchester.—The Education Committee has accepted the following tenders for work at the Baguley Sanatorium :—

Installation of electric light.—Bertram Thomas.
Metal-filament lamps.—Siemens Bros. Dynamo Works, Ltd.
Extensions to accumulator house, &c.—Robert Carlyle.

New Zealand.—Wellington.—The Public Service Stores Tender Board has received the following tenders :—

60 Miles Rubber-insulated Twin Twisted Wire.

P. R. Baillie & Co.	(accepted)	£733
Turnbull & Jones		780
Lawrence & Hanson Electrical Co.		844
Richardson, McCabe & Co.		915
A. D. Riley & Co., Ltd.		1,028

8 Miles Lead-Covered Cable, 26 Pairs.

Lawrence & Hanson Electrical Co.,	(accepted)	£1,168
Richardson, McCabe & Co.		1,184
A. D. Riley & Co., Ltd.		1,192
P. R. Baillie & Co.		1,200
Turnbull & Jones, Ltd.		1,200
A. & T. Burt, Ltd.		1,240

6 Miles Lead-Covered Cable, 39 Pairs.

Lawrence & Hanson Electrical Co.	(accepted)	£1,134
Richardson, McCabe & Co., Ltd		1,146
A. D. Riley & Co.		1,146
P. R. Baillie & Co.		1,170
Turnbull & Jones, Ltd.		1,176
A. & T. Burt, Ltd.		1,254

7 Miles Lead-Covered Cable, 52 Pairs.

Turnbull & Jones, Ltd.	(accepted)	£1 694
Richardson, McCabe & Co.		1,724
A. D. Riley & Co., Ltd.		1.729
A. & T. Burt, Ltd.		1.785
P. R. Baillie & Co.		1.753
Lawrence & Hanson Electrical Co.		1,834

1½ Miles Lead-Covered Cable, 104 Pairs.

P. R. Baillie & Co.	(accepted)	£623
Richardson, McCabe & Co., Ltd.		6 0
A. D. Riley & Co., Ltd.		638
Turnbull & Jones, Ltd.		645
A. & T. Burt, Ltd.		658
Lawrence & Hanson Electrical Co		675

7 Miles 128 Yards Lead-Covered Cable, 208 Pairs.

P. R. Baillie & Co.	(accepted)	£5,516
Richardson, McCabe & Co.		5,587
A. D. Riley & Co., Ltd.		5,601
Turnbull & Jones, Ltd.		5,658
A. & T. Burt, Ltd.		5.799
Lawrence & Hanson Electrical Co.		5,976

6 Miles 644 Yards Lead-Covered Cable, 312 Pairs.

Richardson, McCabe & Co., Ltd.	(accepted)	£6,493
P. R. Baillie & Co.		6,556
A. D. Riley & Co.		6,569
Turnbull & Jones, Ltd.		6,684
A. & T. Burt, Ltd.		6,824
Lawrence & Hanson Electrical Co.		7,002

6 Miles 1,100 Yards Lead-Covered Cable, 416 Pairs.

A. D. Riley & Co., Ltd.	(accepted)	£7,042
Richardson, McCabe & Co.		7,221
Turnbull & Jones, Ltd.		7,287
P. R. Baillie & Co.		7,948
Lawrence & Hanson Electrical Co.		7.618
A. & T. Burt, Ltd.		7,923

6¼ Miles Lead-Covered Cable, 520 Pairs.

A. D. Riley & Co., Ltd.	(accepted)	£8,125
P. R. Baillie & Co.		8,418
Richardson, McCabe & Co., Ltd.		8,487
Turnbull & Jones, Ltd.		8,487
Lawrence & Hanson Electrical Co.		8,812
A. & T. Burt, Ltd.		9,293

7 Miles Lead-Covered Cable, 624 Pairs.

P. R. Baillie & Co.	(accepted)	£10,641
A. D. Riley & Co., Ltd.		10,752
Turnbull & Jones, Ltd.		11,025
Lawrence & Hanson Electrical Co.		11,550
A. & T. Burt, Ltd.		12,012

2 Miles Lead-Covered Armoured Cable, 104 Pairs.

P. R. Baillie & Co.	(accepted)	£1,182
Richardson, McCabe & Co.		1,190
A. D. Riley & Co., Ltd.		1,202
Turnbull & Jones, Ltd		1,240
A. & T. Burt, Ltd.		1,254
Lawrence & Hanson Electrical Co.		1,280

9 Miles Lead-Covered Armoured Cable, 312 Pairs.

Turnbull & Jones, Ltd.	(accepted)	£11,790
Richardson, McCabe & Co., Ltd.		11,970
P. R Baillie & Co.		12,064
A. D. Riley & Co., Ltd.		12,240
A. & T. Burt, Ltd.		12,402
Lawrence & Hanson Electrical Co.		12,780

1 Mile Silk and Cotton-Insulated Switchboard Cable, 312 Pairs.

A. D. Riley & Co., Ltd.	(accepted)	£1,335
Turnbull & Jones, Ltd.		1,400
P. R. Baillie & Co.		1,460
A. & T. Burt, Ltd.		1,881

1 Mile Silk and Cotton-Insulated Switchboard Cable, 624 Pairs.

Turnbull & Jones, Ltd.	(accepted)	£2,617
A. D. Riley & Co., Ltd.		2,648
P. R. Baillie & Co.		2,855
A. & T. Burt, Ltd.		3,649

6,000,000 Lead Seals, ⅜-in. Disk.

Canterbury Engineering Co., Ltd.	(accepted)	£1,739
Hughes & Cossar		1 687
R. W. Cameron & Co.		1 737
P. R. Baillie & Co.		1,776
J. L. Lennard		1,818
W. H. Simms & Sons		1,912
J. McIlwraith & Co. Propy.		1,950
Millar & Young		2,275

100,000 Cups Insulator, "Sinclair."

P. R. Baillie & Co.	(accepted)	£3,174*
A. M. Holmes		1,262
A. & T. Burt, Ltd.		1,814
Richardson, McCabe & Co.		1,866
Turnbull & Jones, Ltd.		1,896
A. D. Riley & Co , Ltd.		1,926
Butcher, Reed & Co., Ltd.		2,100

* Including volts.

100,000 Bolts, Insulator, "Sinclair."

P. R. Baillie & Co.	(accepted)	£3,174*
Turnbull & Jones		1,486
A. & T. Burt, Ltd.		1,496
Richardson, McCabe & Co., Ltd.		1,533
Lawrence & Hanson Electrical Co.		1,537
Butcher, Reed & Co., Ltd.		1,750
A. D. Riley & Co., Ltd.		1,787

* Including cups.

—*New Zealand Shipping and Commerce.*

The Christchurch City Council has accepted the tender of Messrs. Lawrence & Hanson Electrical Co. for the supply of aerial cables for two years.

The Wellington City Council has accepted the following tenders :—

Insulated cable—P. R. Baillie & Co.
Gear wheels—Richardson, McCabe & Co.
Overhead material—P. R. Baillie & Co.

—*New Zealand Shipping and Commerce.*

Salford.—The Tramways Committee has accepted the tender of the Tudor Accumulator Co., Ltd., for welding about 550 tramway rail joints, at 27s. 6d. per joint. The offer of Messrs. W. T. Glover & Co., Ltd., to purchase low-tension cable has been accepted by the Electricity Committee as follows :—1·0 sq. in. cable, £845 15s. 6d. per mile ; 1·2 sq. in. cable, £1,010 per mile.

Southampton.—The T.C. has accepted an offer from Messrs. Bradbury, Son & Co., for 3,500 tons of Tamworth coal for the electricity works, at £1 2s. 10d. per ton.

Spenborough.—The Electricity Committee has accepted the tenders of Messrs. Wm Bennett & Sons and Messrs. W. H. Sharp and Sons for coal for the electricity and destructor works for one year.

Watford.—The U.D.C. E.L. Committee has accepted the offer of Messrs. Parsons to repair the rotor of an alternator, for £116 ; the Council has agreed to pay £40 towards the cost. The offer of Messrs. Cory & Co. to supply, during the next 12 months, 1,000 tons of Griff Peas, at 22s. per ton, has been also accepted. The Committee has accepted the prices of Messrs. W. T. Henley's Telegraph Works, Ltd., for the supply of cable. The British Westinghouse Co. has asked the Council to pay an increased price for the transformers recently ordered. The matter is to be favourably considered if the transformers are delivered within the specified time.

West Bromwich.—The Electricity Committee recommends the acceptance of the tender of Messrs. B.I. and Helsby Cables, Ltd., for the necessary extra-high-tension mains and extensions to switchgear, and that of Messrs. Ferranti, Ltd., for the extra-high-tension cubicle, in connection with the additional supply of current to Messrs. J. Brockhouse & Co., Ltd.

Winchester.—Messrs. Ferranti, Ltd., have been awarded the contract for prepayment electricity meters for the Corporation to May, 1916.

THE SCIENTIFIC ORGANISATION OF WAR MATERIAL SUPPLIES IN GERMANY AND INCIDENTAL —— ROBBERY.

By R. STEYLAERS.

OFFICIAL documents published in the *Elektrotechnische Zeitschrift*, dated June 24th, which I give below are of exceptional interest in that they demonstrate a few facts, the gist of which I herewith enumerate :—

1. That as early as August 13th of last year, in the early stages of the war, Germany realised the necessity of organising all her national resources for the monopolisation of war supplies, a necessity which was only recognised by the Allies recently.

2. That the requisition or commandeering of all supplies in the occupied territories of Belgium and Poland was most carefully preconceived, and was, moreover, systematically executed, which is tantamount to robbery. The word robbery, by which I intentionally stigmatise the system, is justified by the fact that, although the Hague Conventions admit the right of the belligerents to requisition war material in occupied territory, they provide an equitable remuneration for such requisitions, whereas we Belgians, as well as the French and Poles, know that requisition bills delivered by the German troops remain up to the present to a large extent quite a negligible asset to the creditors, who have tried unsuccessfully to collect their face value. We know of merchants who received vouchers for such requisitions written in pencil on a scrap of paper torn out of a pocket note-book, and signed by one of their German competitors who requisitioned the goods under the threat of the bayonet.

3. That the specific designation in the official German organisation of definite kinds of war material, which were to be requisitioned by the German troop commanders, not only in Germany, but in the occupied territories, namely, metals of all kinds, jute, hemp, linen, thread, wool, and also *cotton*, besides a number of organic substances amongst which were fatty materials, proved to any ordinary layman the obvious necessity of counteracting such activities by stopping with the aid of all possible means the importation either directly or indirectly of such goods into Germany.

4. That it is clear and quite cynically stated in the organisation scheme reproduced below that Germany was giving all kinds of encouragement to contraband trade in neutral countries, and even maintained agents in Allied countries for the purpose of *utilising all possible means to import such raw materials from outside.*

This fact having been recognised, a counter-organisation should have been established on the same commercial bases to purchase all available material in competition with German agents abroad and transport them to Allied countries. This could be realised with much greater facility by the Allies, owing to their complete control of the markets and seas.

5. That the exploitation of natural resources in occupied territories was systematically carried out by specially formed limited companies, under German Government control, and, therefore, no one will be surprised to hear that Belgium and Northern France have been intentionally robbed by scientific plunderers.

6. With regard to raw materials which Germany has foreseen she might run short of, such as copper, the invaders have been taking for some time the necessary precautions to evolve substitutes. This is substantiated by the substitution of *iron* and *zinc* wire for the usual copper wires in electrical installations. As proof I quote the advertisements of cable manufacturers in Germany :—

"*Zinc Conductors with Rubber Insulation; Iron Flexible Wire; Iron Bare and Insulated Conductors; Iron Conductors Lead-sheathed.*

"HACKETHAL DRAHT UND KABEL WERKE A.G. HANOVER.

"Small stock is still available of Tube Cables with Copper Conductors. Ask for List of Stocks. Largest Diameters only.—Kabelwerk Duisburg."

This explains also why, in the early stages of the war, copper door-handles, bells, door-plates, &c., were removed to Germany, this naturally causing people to believe that Germany was running short of copper, whereas it was only a measure of precaution.

The present condition in Germany shows that the substitution of zinc or iron wire for copper wire or cable, in electrical installations, is being rendered daily more necessary to maintain the huge consumption of copper by monthly wastage of some 8,000,000 shells at least, the recuperation of which is only partly possible.

We may conclude that if the Allies take more care in future to stop contraband metals and other war requisites than has been the case hitherto, Germany cannot possibly continue much longer the expenditure of shells and explosives of which only 30 or 40 per cent. can be recovered from the expended shell cases, on a basis of 12,000 tons approximately, I calculate, of copper required monthly.

A huge effort has evidently been determined upon for the present months of July and August, by the accumulation of all possible natural resources, but once this effort has been spent (let us hope unsuccessfully), the provision of shells and munitions in Germany will suddenly become seriously depleted, with the possibility of their military efforts being brought to a standstill.

German Organisation of the Problem Concerning the Distribution of Raw Materials for the Purpose of War on behalf of the German War Office.

"When the war broke out our War Office had to face the problem of providing Germany with the requisite war material on the hypothesis of a long war. This was the origin of the creation on August 13th, 1914, of a division of the War Office for supplying raw material, the organisation and existence of which is described as follows by the *Norddeutsche Allgemeine Zeitung* :—

"The object of the Division for Supplying War Material concerns generally the obtaining and distributing of the seizable supplies necessary for the requirements of the Army. The seizures and requisitions afford the possibility to dispose of the raw materials and to prepare them for the purpose of the country's defence.

"In case the Government itself does not consume directly this raw material, its appropriate distribution must be made by private industry working on war requisites for the Army.

"The following questions are generally dealt with by the Division for supply of war raw material :—

"1. The limitation as far as possible of requisites used in peace time, the indication of the means to attain this purpose, and to replace such raw material.

"2. Experimenting with and employing new substances to replace raw material.—Recuperation of by-products.

"3. Producing artificial war material by the latest technical and chemical discoveries.

"4. Establishing, and in case of necessity financially supporting, new factories or increasing existing plants.

"5. Imposing the duty on the interested concerns not to do any trade in raw material, and to effect the same only for transformation in their own business.

"6. *The utilising of all possibilities to import such raw material from outside.*

"7. *The obtaining, transporting and distributing of all stocks existing in all occupied enemy territories by which the available stocks can be increased.*

"The division of the material has to be made according to orders from the military Government, taking into account the qualities required for each particular use or industry. The valuation of the seized or requisitioned goods is effected on the basis of prevailing market quotations in Germany. * *Too low quotations should be avoided in order not to discourage importation.* For a number of raw materials it has been necessary to fix maximum prices, as well as to create organisations, *in order to transfer some stocks from enemy country to the Fatherland*, to accumulate them in proper places, to distribute and to account for them.

"The distribution of raw material is sub-divided between collecting and administration Committees for the purpose of defining each

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* This is offering a premium for contraband.

RAW MATERIAL SUPPLY DIVISION OF THE GERMAN WAR OFFICE.

Collection Committees.			*Professional Committees.*
General Division for the study of organisation and administrative questions.	Requisition Division for the execution of seizures and requisitions, Office of Statistics.	Forwarding Division for the execution of the forwarding orders, and for the institution of distribution and collection places.	For metals, chemicals, hides, leather, jute, flax, linen thread, rubber, wool, cotton, hemp, and a series of organic substances.

PRIVATE AND INDIVIDUAL ORGANISATIONS.

Raw material. Limited companies with Control Committees.	*Accounting Committees paying a Governmental survey tax.*	*Valuation and Distribution Committees and Accounting Departments.*	*General Raw Material Administration in Brussels.*
Kammwoll A G. (Carded Wool, Ltd.) Kriegswollbedarf A.G. (War Wool Requisites Co., Ltd.) Kriegschemikalien A.G. (War Chemicals Co., Ltd.) Kriegsmetall A.G. (War Metal Co., Ltd.) Deutsche Rohhaut A.G. (German Rawhides Co., Ltd.) Kriegsleder A.G. (War Leather Co., Ltd.) Deutsche Holzvertriebs A.G. (German Timber Trade Co., Ltd.) A.G. für Verwertung von Stoffabfällen (limited company for recovery of by-products.)	Flax Committee Jute " Rubber " Cotton " Raw Cotton " Horsehair " Wool Trade Association, Leipzig. German Hemp Manufacturers' Association. Forwarding Association of war raw material companies Linen Thread Committee.		

individual raw material territory, such Committees being somewhat like the head of the whole system. The immediate taking-over by the Government of all raw material alluded to, was hampered by serious drawbacks in practice. Therefore the necessary sub-organisations were established on private commercial bases, and the form of limited companies with their controlling committees was deemed particularly suitable. Such limited companies are organised on co-operative bases.

"The profits, however, are not paid out; the Government exercises its control by means of a Governmental commission possessing a right of veto.

"However, when a given industry comprises only a relatively small number of enterprises which are already affiliated to trust organisations, in such case instead of the above-mentioned limited company it is the Valuation Committee which exercises the control, for which a survey tax has to be paid by it to the Government.

"The working ground of these raw material companies comprises, therefore, the taking-over of all stocks or raw materials situated in their district, derived from the neutral resources of the country, or from the occupied territories; the payment of requisition bills; the obtaining of stocks from neutrals; the distribution of raw materials; the confirmation of purchase prices for requisitioned goods and their selling prices, it being understood that any profits made for co-operative purposes (instead of being paid out) once these companies will be liquidated.

"Quite independent of these raw material companies, to which they are adjoined, there are the valuation and distributing committees acting as intermediaries between the interested parties.

"The Valuation Committees have to fix the prices of seized or requisitioned goods for the stocks which have to be seized, in accordance with the German market quotations. The Distribution Committees have to distribute to the individual manufacturers the raw materials which have been sent to the accounting central committees. The obtaining and carrying away of the stocks existing in enemy country are in the charge of the administration of raw material in Brussels and of the commercial appropriation offices at each halting place of the troops.

"We submit herewith a general view of the sub-organisation of the war division for supply of raw material in the German War Office. This is, therefore, the complete scheme of the German organisation for war material."

FORTHCOMING EVENTS.

Tramways and Light Railways Association.—Friday, July 16th. At 10.30 a.m. At Institution of Civil Engineers, Great George Street, S.W. Seventh Annual Congress. Papers on "Glimpses into the Obvious," by Mr. A. V. Mason; "Tramways During War Time," by Mr. J. W. Dugdale; "Electric Battery Vehicles as Adjuncts to Tramways," by Mr. W. H. L. Watson. An informal dinner will be held in the evening at the Trocadero.

NOTES.

Late Legal.—New Phonopore Telephone Co., Ltd., *v.* Electrical Supplies Co., Ltd.—At the Westminster County Court, on Tuesday, before Judge Woodfall, plaintiffs claimed £95 damages from defendants, wholesale factors and agents, for detaining a portable telephone beyond a stipulated period.

Mr. G. C. Kingsbury, for the plaintiffs, said that they were manufacturers of various kinds of electrical instruments, including telephones, and they were the holders of various patents. In February last they were in treaty, through an agent in France, for the supply of a new portable field telephone to the French Army, and a sample of the telephone was in the hands of their carriers awaiting a permit for it to be taken to Paris. On February 26th one of the directors of the defendant company rang up the plaintiffs on the telephone, and asked whether they had a good telephone for sale. An affirmative reply was given, and the plaintiffs' managing director had an interview with one of the directors of the defendant company and explained the position, stating that the sample telephone should be obtained from the carriers and submitted to the defendants the following day if possible. Large supplies were spoken of, it being understood that about a hundred telephones a week might be required. On March 2nd, the sample telephone was obtained by the plaintiffs and handed over to the defendants on the understanding that it would be returned the following day. It was not so returned, however, and the defendants detained it until May 5th, thereby occasioning the plaintiffs very considerable loss, although they only claimed £95—£20 being the value of the telephone.

Mr. Charles Isaac, managing director of the plaintiff company, in giving evidence, said that when he first spoke to one of the directors on the telephone, the latter expressed a hope that the plaintiffs would be able to deliver to them at least 100 field telephones a week. When the sample was submitted, it was clearly stipulated that it must be returned on the following day, and the fact that this was not done had been a loss to the plaintiffs of a very considerable sum.

Cross-examined, Witness denied that the defendants said they desired to get the sample telephone in order to submit it for the approval of the French Government. Mr. Roden, the director of the defendant company with whom witness had the interview, told him that he wished to submit the sample to a customer in London, and would return it without fail on the following day.

Mr. A. H. Nicolson, engineer to the plaintiff company, said when he went to the defendant company to superintend a slight repair to the sample telephone, consequent on an accident, he heard Mr. Roden say that the telephone was to be returned the following day.

For the defence, Mr. Roden said that in the interview with Mr. Isaac, on March 2nd, he told him that the defendant company had received a large number of orders for field telephones, and Mr. Isaac seemed surprised at the magnitude of the orders mentioned, and asked if they were for any of our Allies. Witness replied that they were intended for the French Government.

Cross-examined, Witness denied that he promised the return of the sample telephone on the day following the interview.

His Honour said he wished it had been left to a jury to decide whose memory could best be relied upon. The only issue was whether there was an agreement to return the sample telephone on the day after the interview on March 2nd, and he had come to the conclusion, after weighing all the evidence and correspondence, that there must be judgment for the plaintiffs. The sample telephone had, however, been returned to the plaintiffs by the defendants, and, under those circumstances, he gave judgment for the plaintiffs for 40s. and costs.

Judgment was entered accordingly.

City Importing Co. *v.* Defries & Goldman.—In the Lord Mayor's Court, on Tuesday, before the Common Serjeant (Sir F. Bosanquet, K.C.) and a jury, a claim was made by plaintiffs, of Chiswell House, Finsbury Pavement, E.C., against Defries & Goldman, Ltd., 59 and 60, New Oxford Street, to recover £10 0s. 9d. for electric bulbs sold to the defendants.

Mr. Herbert Jacobs, counsel for the plaintiffs, said that on February 22nd electric bulbs were delivered to the defendants, pursuant to an order, amounting to the sum of £41 1s. 1d. Payment of the account was not made, and various applications produced no result. Ultimately the plaintiffs allowed the defendants to return 4,470 electric bulbs, the defendants retaining 1,350, probably because they had sold them, the price of which, according to the original contract, was 14s. 10½d. per 100, which worked out at the sum now sued for.

Mr. Rueben Segal, partner in the plaintiff firm, gave evidence of having received an order from the defendants for 5,820 electric bulbs. Of those the defendants had retained 1,350, the price of which was now sued for.

The Common Serjeant, in addressing the jury, said the electric lamps in question seemed to be a cheap lot, something less than 15s. per 100. But, he added: "I daresay it is as much as they are worth."

The jury returned a verdict for the plaintiffs, there being no appearance on behalf of the defendants, and upon the application of the plaintiffs' counsel the claim was amended to £10 0s. 9d.

Copper.—Messrs. H. R. Merton's fortnightly statistical circular shows a considerable increase in European visible supplies, the quantity for the end of March being 38,041 tons, an increase of 3,951 over that registered for the end of May. English supplies during the month have increased by 2,311 tons, and French by 2,240 tons. In detailed supplies we find that arrivals in Europe from North America have been exceptionally small, not reaching half the pre-war average. Spain and Portugal continue to send in an encouraging quantity, the amount exceeding the pre-war average by nearly one-half. Unclassified "other countries" also show up well with about one-third more than the pre-war average. Chile shipments were full on the month, but the destination of these is stated as "Europe and U.S.," which may, of course, mean that the U.S. have been taking the larger quantity. Australian shipments are low at 2,500 tons. Total deliveries for the month are low at 28,185 tons, though by no means the lowest for the year.

Electrical Convention at San Francisco.—Last month the Annual Convention of the National Electric Light Association of the United States was held at San Francisco, and was a highly successful event. Mr. E. W. Lloyd, of the Commonwealth Edison Co., of Chicago, was elected president for the new year. President H. H. Scott, remarking that the electricity companies were giving the public six times as much light for $1 as 15 years ago, while the consumers were requesting reductions in the price per kw.-hour, said that it brought home forcibly to them that the sale of energy on a "straight kw.-hour rate" was not equitable, but that in addition to a rate for energy they should have a demand charge and a fixed charge per customer.

The membership of the Association amounts to no less than 13,448, an increase of 431.

During the year 150,000 copies of the Association's *Bulletin* were issued, and the Publications Committee distributed nearly a million pieces of printed matter.

It was stated that returns from 100 towns of 5,000 inhabitants and under showed that 58 per cent. of the houses were wired; in towns of 5,000 to 10,000 inhabitants the proportion wired was 54 per cent., and between 10,000 and 20,000, 60 per cent. On the Pacific Coast the ratio was no less than 98 per cent.; the Atlantic Coast showed the lowest percentage.

The surplus of assets over liabilities was $34,247; the income for 1914 was $136,327, and the expenditure $122,811.

In an address Mr. Samuel Insull said the Association represented an industry with an annual gross income of more than £70,000,000 earned by central stations having a total rating above 8,250,000 h.p. of which one-third was derived from water-power. In 1914 110 million lamps were manufactured in the United States, out of a world production of 250 millions.

Educational.—The following awards have been made in the Faculty of Engineering at University College :—Archibald P. Head Medal and Prize, B. C. Drummond ; Studentship in Heating and Ventilating Engineering, G. F. Mitchell.

Inquiries.—Makers of the "Pyrotite" fuses (centre contact, Edison screw) are asked for.

Electrical Opportunities in China.—China presents an exceptional opportunity now for American manufacturers of electrical machinery and appliances, according to Mr. J. H. Lee, electrical engineer and manager of the Lee Brothers Importing and Exporting Co., of Shanghai, China. Mr. Lee is a member of the Honorary Commercial Commission of the Republic of China, which is making a tour of the United States in the interest of closer trade relations between the two countries. In talking with a representative of the *Electrical World*, he outlined how the European war had affected the electrical supply business in China. For instance, his company formerly handled exclusively wire made in Austria. That source being shut off, and no other having developed, the price of the wire required to meet the Chinese demand has increased to nearly three times what it was at the beginning of the war. Many other electrical products have been affected similarly.

The previous inability or lack of desire of American electrical manufacturers to compete in price with European producers was mentioned by Mr. Lee. He also stated that American goods were usually of better quality than the Chinese market demanded. He considers that the price handicap has been overcome, perhaps permanently, by other conditions, and that manufacturers of the United States are evidencing a desire to meet the lower quality requirements of the Far Eastern trade.

Mr. Lee has made arrangements to represent several American manufacturers of electrical machinery, supplies and appliances in China. He also is negotiating with other concerns. It is his plan to supplant all his previous European accounts with American connections.

Trade with South America.—Mr. Calvert Townley, of the Westinghouse Electric and Manufacturing Co., recently made a tour through South America on behalf of his company's affairs, including every country in that continent except Paraguay, Ecuador and the Guianas. The trip lasted over six months.

On his return he told a representative of the *Electrical World* that in talking of the conditions existing on that continent it was easy to fall into the error of considering South America as a unit, whereas it was composed of many very distinct units where widely varying conditions prevailed. The various South America countries were as different from one another as Canada, the United States and Mexico. But all South American nations had established lines of activity—methods of doing business through channels which were satisfactory to them and which they were not anxious to change. It would be a serious mistake to think of South American markets, as many people seemed to do, as trees laden with ripe fruit waiting to be picked ; rather were they more like fertile fields ready for the planting, but from which crops could be reaped only after a lapse of time and by careful and intelligent cultivation. Also at the present time the purchasing power of all the South American countries was considerably below normal owing to the fact that their revenues came largely from exports, and the markets for these had been curtailed tremendously. Europeans had cultivated the South American trade, they had established banking and shipping facilities, had invested their money in South American enterprises and had organised with varying degrees of thoroughness commercial campaigns to get South American business.

Those who believed that any of the European nations now at war would be permanently out of business in South America after peace was concluded, were liable to be very sadly mistaken. In the future they must expect to have to meet just as keen competition as in the past, and the interference with trade between South America and Europe caused by the war was only temporary.

Mr. Maurice Coster, export manager of the same company, said that the country need not look for any great improvement in trade with Central and South America until the European war had been brought to a close. The Central and South American countries, with the possible exceptions of the Argentine Republic and the United States of Colombia, were not in a position to finance new enterprises.

In order to ensure permanent success and an increase in export trade, the statutes relating to this subject must be revised. The Sherman Act should be amended in order to exclude from its provisions foreign business. Some of the foreign representatives acted in the capacity of "trade spies," and furnished their Governments with information concerning the business done by subjects of competing countries. They even went to the extent of supplying their Governments with detailed copies of invoices of American manufacturers made collectible through foreign banks.

The Government should adopt a definite policy favouring foreign trade, and the banks should be prepared to assist in financing Central and South American Governments and deserving enterprises in those countries, just as foreign banks had done for years with scarcely any losses. Foreign manufacturers have in the past investigated foreign enterprises, and, upon favourable report of the Government agent or other responsible party, have been able to secure the assistance of their banks in financing. The United States must not deceive itself by expecting that the war would so cripple European competitors as to make their competition negligible in the future.

Patents and Alien Enemies.—Application has been made to the Board of Trade for the avoidance or suspension of patents Nos. 21,027/03, granted to Hamilton, and 26,359/12 and 12,926/14, granted to Hamilton & Ferranti, Ltd., by Messrs. Ferranti, Ltd.

The application of Messrs. Babcock & Wilcox, Ltd., for the avoidance of Patents Nos. 27,516/11 and 19,696/12 has been abandoned.

Appointments Vacant.—Sub-station attendants for the period of the war for the Birmingham Corporation ; improver for Hebden Bridge U.D.C. electricity works ; meter superintendent (£2) for Beckenham U.D.C. See our advertisement pages to-day.

Technical Colleges and War Work.—Amongst the greatest difficulties that British instrument-makers have to contend with are the lack of skilled workmen and the scarcity of tools, such as bench lathes, &c., at a time when the national service demands the greatest possible output. In this connection a suggestion that we have received from Mr. R. W. Paul is worthy of consideration by the governors of technical colleges, who, we are sure, would gladly seize any opportunity to help on the nation's work. Mr. Paul points out that the holidays are approaching, when the staffs of the colleges—and the machines—will be liberated from their normal duties. The colleges usually employ at least one skilled mechanic each, and in some cases very expert instrument-makers, whose services during the vacation would be heartily welcomed by firms engaged on this class of work ; the lathes and other small machine tools would also be most acceptable if loaned or hired to the manufacturers until the autumn. We commend this suggestion to the governing bodies of these public institutions, in the belief that they will be acting in accordance with their duty to the nation by adopting it ; the skilled craftsmen must, of course, decide for themselves, but we feel sure that most of them will be only too glad of the opportunity to take part in war work. Mr. Paul will be pleased to make the necessary arrangements, and to put correspondents in touch with other instrument-making works if desired.

Metropolitan Association of Electric Tramway Managers.—Members of this Association accompanied by a number of friends visited Bournemouth on Wednesday of last week, where they were met on arrival by Mr. I. Bulfin, general manager of the Corporation Tramways. A special car conveyed the party to the Hotel Metropole, where an excellent luncheon was provided, and the comfort of the inner man having been satisfied, a motor char-à-banc tour through the most interesting and beautiful parts of Bournemouth, Poole and Christchurch occupied some three hours of the afternoon. On returning to the hotel, the party having taken tea, a move was made to the station, and at 7.11 the homeward journey began, dinner being served soon after leaving Bournemouth. Waterloo was reached at 10.30, and the visitors tired, but thoroughly pleased with their day out, separated for home, sweet home.

The hospitality of Mr. Bulfin was greatly appreciated by the company, which included many well-known and distinguished members of the electrical fraternity, and was eloquently acknowledged by one of them, and Mr. T. B. Goodyer, the popular, energetic and genial secretary of the Association, was simply ubiquitous, much of the success of the day being due to his untiring efforts from start to finish.

Volunteer Notes.—3RD. BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, July 8th, 1915 :—

WEEK END PARADES.—Saturday.—The Battalion will parade at Baker Street Station at 2.30 p.m. "C" Company, under the command of Mr. C. F. Holland, will detrain at Wembley Park to take up a defensive position near the Remount Buildings, throw out Outposts, and watch the approaches from Edgware, Hendon and Neasden. When attacked, they will fall back on the Remount Depôt.

"A," "B" and "D" Companies, under the command of Mr. H. O. King, will detrain at Kilburn Station, and the Officer in command will make what arrangements he thinks fit to carry out the attack on the Remount Depôt at Wembley.

BOUNDS.—A line drawn from Preston to Edgware ; the Edgware Road and Metropolitan Railway on the south. Captain Eastwood will act as umpire, and at the end of operations will send a report in to the Commandant. In the absence of Captain Eastwood, Mr. W. Ridd will perform this duty.

Sunday.—6 a.m., Reveille ; 10 a.m., Church Parade ; 10.20 a.m., Company and platoon drill ; 2.30 p.m., battalion parade.

A. G. JOINER, *Captain and Adjutant.*

A Steam-Electric Dredge.—The Mambuloa Placer Co. has ordered from the New York Engineering Co. a gold dredge to operate in salt water in the Bay of Mambuloa, on the north shore of the Province of Ambos Camarines, Island of Luzon. According to the *Engineering and Mining Journal*, the machinery will be electrically driven, the electric power being generated on board by a steam turbo-generator. The dredge is designed to dig 55 ft. below water line and to stack 35 ft. above the water line. A high-pressure pump will furnish water for washing, being driven by a 125-H.P. motor, and a low-pressure pump will be operated by a 75-H.P. motor. Besides these, there will be fire pumps and the usual accessory pumps for the power plant. A travelling crane, separate stacker hoist and other modern equipment will be provided. It is stated that the total cost of the dredge when erected will be about $250,000.—*Financial Times*

Parliamentary.—Royal Assent.—The following Acts have received the Royal Assent :—Electric Lighting Orders Confirmation (No. 1) Act, 1915. Tramways Orders Confirmation Act, 1915.

Electrolytic Disinfectant.—In the course of his annual report on the working of the electrolytic plant at Poplar, mentioned in our last issue, Dr. F. W. Alexander, medical officer of health to the borough, states that the hypochlorite of magnesia solution is prepared by the electrolysis of water, containing certain definite proportions of sodium chloride and magnesium chloride. In spite of adverse criticisms, the process has been a success for eight years.

Hypochlorite of magnesium belongs to the magnesia and not to the alkali group; it is not caustic, is non-poisonous, and to the clothes is the least destructive of all the hypochlorites. It is obvious that the stable solutions of electrolytically-made hypochlorites of magnesium are preferable to those of sodium and potassium or even calcium, because for the purpose of rendering the three last-mentioned solutions stable there would have to be used hydroxide of the alkali metals or calcium, which are extremely caustic, alkaline, and very soluble, and where varying strengths of electrolytic fluid, containing the hypochlorites of sodium and potassium, are produced, one may add too much or too little of the hydroxides of the alkalis when working with unskilled labour. But when the extremely insoluble hydroxide or oxide of magnesium is added and mixed, one can add and stir in any quantity, but only the necessary amount will be absorbed.

I.M.E.A. Meeting: Electric Vehicle Discussion.—In referring to the remarks of Mr. Meaden, of Wolseley Motors, Ltd., in the electric vehicle discussion at the recent I.M.E.A. meeting, we inadvertently stated that his firm "made" instead of "supplied" both petrol and electric vehicles. It is, of course, well known that Wolseley Motors, Ltd., are introducing the Baker electric, an American production, to this country with the intention of finding out if there is a market and supplying it. Under the circumstances, the firm being large manufacturers of petrol vehicles, we may be permitted to hope that they will soon find it to their advantage to build the electric also.

Fatality.—While George Taylor, electrician to Messrs. William Baird & Co., Ltd., Muirkirk, was at work on one of the high arc lamps he fell from the platform to the ground, fracturing his skull and also receiving a severe scalp wound. He was removed to hospital in a serious condition.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Owing to the serious depletion of the electricity staff, the Bridlington T.C. has had to refuse Mr. Crooks leave to join the Forces.

Mr. A. C. Cramb, the borough electrical engineer of Croydon, has been nominated by the Board of Management of the Metropolitan Munitions Committee to serve as honorary district manager of the Croydon area.

Mr. F. Whitehead, shift engineer in the Accrington Corporation electricity department has resigned, and Mr. A. Goward, of Oswaldtwistle, has been appointed to fill the vacancy.

Mr. C. Newton-Russell, the borough electrical engineer of Shoreditch, has been appointed by the Metropolitan Munitions Committee to be manager of the Eastern District of London.

Mr. Ferguson, temporary engineer-in-charge at the Bermondsey electricity works, has resigned his appointment. Mr. Sparrow, switchboard attendant, is in future to be paid 38s. instead of 32s. per week, while taking a shift.

Mr. G. W. Leeder, of Runcorn, has been appointed shift engineer at Eccles, in place of Mr. A. Helliwell (resigned).

Mr. E. J. Jarvis, of Devonport electricity works, has been granted a commission as second-lieutenant in the Hampshire (Fortress) Royal Engineers.

The West Hartlepool Town Council on Tuesday night appointed Mr. J. W. Spark, electrical engineer and manager to the County Boroughs of the Plymouth, Devonport and Stonehouse area, as its borough electrical engineer, at £400 per annum.

Tramway Officials.—Mr. Stanley Kettle has resigned his position as chief assistant to the Musselburgh and District Electric Light and Traction Co., and has been appointed assistant engineer and depôt superintendent to the Sunderland District Electric Tramway Co., Ltd. Before going to Musselburgh he was for three years assistant engineer for the Ayr Corporation Tramways.

The Derby T.C. has appointed Mr. Gilbert Mann, of Birkenhead, as car-shed superintendent at the Osmaston Road tramway department, at £150 a year.

Mr. C. J. Spencer, general manager of the Bradford City Tramways, has been appointed a transport officer on the Headquarters' Staff of the Bradford City Volunteer Force. Mr. Spencer holds the rank of Platoon Commander.

The Maidstone T.C. has increased the salary of the tramway manager, Mr. Lambert, by £25 a year, as from July 1st.

General.—Mr. J. Shepherd, as previously mentioned in this column, is terminating his engagement with the London County Council to continue the practice of consulting engineer carried on during the past 24 years by Mr. T. S. Watney, at Leeds, under the name of Shepherd & Watney. For 15 years Mr. Shepherd held responsible positions with leading manufacturing companies, turning out practically every type of electrical and other plant, and for the past 13 years he has been with the London County Council tramway department; for eight years he was chief assistant electrical engineer, and since 1910 he has had entire charge of the electrical work of the undertaking. The capital value of the plant directly in his care was £2,340,000, with an annual output of 150,000,000 units, which is larger than that of any other municipal undertaking in the world. He has also assisted in the preparation of the various bulk electric supply schemes for Greater London. Naturally, Mr. Shepherd has had a wide and varied experience in connection with nearly every type of engineering plant, and his numerous friends will join with us in wishing him every success in his new sphere of work. We understand that Mr. Watney will continue his interest in the practice in an advisory capacity.

Among the naturalisation notices in the *London Gazette* we observe the following :—Jens Orten-Boving (Sweden), civil engineer, Ingatestone, Essex, oath of allegiance dated May 28th.

Mr. H. T. Matthew has been appointed Pacific Coast representative for the Society for Electrical Development. For six years Mr. Matthew acted in the capacity of business manager of *Electrotechnical Industry* (now *Metallurgical and Chemical Engineering*), after which he was transferred to the Chicago office of the McGraw Publishing Co., as western manager for the *Electrical World.* For the past three years he has represented the McGraw publications on the Pacific Coast.

A wedding has been arranged and will take place quietly at St. Margaret's Church, Westminster, on July 21st, at 2 p.m., between Mr. Horace Boot, consulting engineer, M.I.Mech E., M.I.E.E., Past President, Inst. Municipal Engineers (borough electrical engineer of Tunbridge Wells from 1895 to 1910), and Mabel, daughter of Thomas Baker, Esq., of Holt. Owing to the war there will be no reception, but all friends will be heartily welcome at the ceremony.

The managers of the Royal Institution have re-elected Sir James Dewar, F.R.S., Fullerian Professor of Chemistry for a period of three years.

Mr. W. Brooks Sayers, who has until recently been engaged as milling machinist at the Royal Aircraft Factory at Farnborough, and is experienced in electric motor drives for machine tools, is relinquishing that work and opening an office at 27 and 28, Great Russell Street, London, W.C., where he will take up initiatory and instruction work.

A large gathering of Freemasons assembled at the Great Eastern Hotel, on Thursday last week, on the occasion of the Installation Festival of the Rolling Lodge, when Mr. J. W. Bulley (London manager to Messrs. Accles & Pollock, Ltd., of Oldbury) was installed in the chair for the ensuing year. Among the visitors were several Grand Lodge officers. The party dined together in the Norfolk Room. Mr. Bulley announced that it was his intention to go up to the next Boys' Festival as a steward, and sums amounting to 30 guineas gave the matter a good send off. Mr. Barlow, director of Accles & Pollock, Ltd., in replying for the visitors, announced that the directors had subscribed £5 5s. as a memento of the occasion.

Roll of Honour.—Among the announcements of appointments of officers to be Companions of the Distinguished Service Order are the following :—

Lieut. Vyvian Augustine Cairns-Cleary, 4th Signal Co., R.E., "for great gallantry in personally superintending the laying of the telephone lines every night over a large area of country which was continually shelled. It was due to his personal exertions and example during the period of April 27th to May 3rd, 1915, that the communications with the brigade were kept up so well."

Major William Frederick Maxwell, R.E. (attd. Lahore Divl. Signal Coy.). —"Near Ypres during the operations from April 24th to May 4th, 1915, he rendered excellent service when responsible for maintaining the signalling communications of the division, under most trying circumstances. The work was very heavy, and he also had to direct the constant repair of lines cut by the continuous heavy fire. This officer has done consistently well throughout the campaign."

Sec. Lieut. Henry Morrant Stanford, 32nd Batt. R.F.A., "for consistently gallant conduct both at Neuve Chapelle and again on May 9th, 1915, during operations near Rouges Bancs, in keeping up communication by mending telephone wires under heavy fire."

The Chesterfield Corporation electricity works have suffered a great loss owing to the death of Mr. T. E. Bennett, second assistant engineer, who was shot in the trenches at the Front on Wednesday last week. Mr. Bennett, who was 33 years of age, had been with the Corporation for nearly 10 years, and he, with several other members of the staff, joined the 6th Notts. and Derbys in November last, and proceeded to the Front in February. This is the first death amongst the large number of the Chesterfield lighting and tramway staff who are serving their country in various branches of H.M. Forces, and great sympathy is felt with Mr. Bennett's family, who reside in Nottingham.

Sergeant Frederick J. Fuller, of the Royal Engineers, one of the charge engineers at Beckenham U.D.C. electricity works, was mentioned by General French in his last report for Distinguished Service in the Field.

Poignant interest attaches to the award of the D.C.M. to Lance-Corporal Beagin, of the 1/7th Worcesters, T.F., who before the war was an electrician employed by Messrs. Whittaker, of Dudley. Beagin secured the distinction near Le Gheer, on April 19th, when the telephone wire, having been cut at an isolated post, which the enemy was shelling, Beagin at once voluntarily proceeded 100 yards across an open space, under shell and rifle fire, and connected up the post again with a spare instrument. Before the announcement of the award, Beagin's death through wounds was officially reported.

Private Harold Kay, 1/6th Manchester Regiment, who has died from wounds received in action in the Dardanelles, was the only son of Mr. T. C. Kay, secretary to Browett & Lindley, Ltd., engineers, of Patricroft, with whom he was being trained. He had previously been with the British Westinghouse Electric and Manufacturing Co., Ltd., and Dick, Kerr, & Co., Ltd., of Preston. He was 21 years of age, joined the Territorials on the outbreak of war, and was drafted to Egypt three weeks later.

Mr. F. G. Sands, formerly engaged at the Ilford U.D.C. electricity works, has been killed in action in the Dardanelles.

Private A. L. Hopton, of the Liverpool Scottish, who was an apprentice at the Corporation electricity works at St. Helens, has been wounded by a shell in France, and is in hospital at Rouen recovering. He joined last September, and went to the Front in January.

Private John Craig Burke, of Oldham, who is reported to have died of wounds received in action, was 23 years of age, and was in the employ of Messrs. J. P. Hall & Co., electrical engineers, Werneth, Oldham.

Private W. H. Nixon, R.M.L.I., Portsmouth Battalion, was killed in action in the Dardanelles, on May 3rd. He was formerly assistant electrician at Messrs. Cochrane's Stanghou mines.

The *Times* states that Lieutenant Hugh Bouchier Phillimore, A.M.I.C.E, 8th Argyll and Sutherland Highlanders (T.F.), who was wounded on June 15th in France and died the same day, was educated at Haileybury, and took up engineering and science, gaining the Whitworth Exhibition. He was for a time in the F.M.S. Civil Service, and more lately engaged in metallurgical work at Kinlochleven, Argyllshire. He received his commission in November, 1913, and after the outbreak of war volunteered for foreign service, and accompanied his battalion as machine-gun officer

Obituary.—The death occurred last week of Captain Halsall Owen, of Burfield, Appleton, Cheshire. Deceased was educated at Liverpool College, and began his business career with the Horseshay Bridge Building Co., of Shropshire, and later was engaged at the electrical works of Messrs. P. R. Jackson, Manchester. Subsequently he joined the firm of Monks, Hall & Co., Warrington, and was appointed secretary and engineer; and in 1911 he was appointed engineer to the Frodingham (Lincolnshire) Steel and Iron Co. Following severe illness in the same year, he retired. He had had long service with the old Volunteers and with the Territorials, and he offered his services to his country upon the outbreak of war, but failed to pass the medical test. He was in his 35th year.

At the funeral of the late Mr. C. E. Spagnoletti, Honorary Member and Past President of the Institution of Electrical Engineers, which took place at West Hampstead Cemetery last Friday, July 2nd, the Institution was represented by Sir John Snell (President), Prof. Carey Foster, F.R.S., Dr. S. P. Thompson, F.R.S., Mr. J. E. Kingsbury, Mr. Roger T. Smith, Mr. H. Hirst, and Mr. P. F. Rowell (secretary).

Mr. Ernest Long, electrical engineer, late of Newcastle-on-Tyne, died at Scotton Grange, Knaresborough, on July 3rd.

NEW COMPANIES REGISTERED.

Siluminite Insulator Co., Ltd. (140,804).—This company was registered on June 28th, with a capital of £1,500 in £1 shares, to acquire and turn to account any invention relating to the manufacture, production, treatment, application, recovery, distribution and use of electric insulating materials of all kinds, etc., and to adopt an agreement with W. E. W. Richards. The subscribers are: E. Spencer, 10, St. James's Place, S.W., barrister, 550 shares; W. E. W. Richards, 133-6, High Holborn, W.C., consulting engineer, one share. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Qualification, £50. Solicitors: Beckingsale & Co., 34, Copthall Avenue, E.C.

Cahirciveen Electric Light and Power Co., Ltd. (4,259).—This company was registered in Dublin on June 29th, with a capital of £1,800 in £1 shares, to carry on at Cahirciveen, Co. Kerry, the business of an electric light supply company in all its branches. The subscribers are: Rev. P. Browne, Cahirciveen, 100 shares; T. Ryan, Cahirciveen, merchant, 50 shares; Miss J. A. O'Sullivan, Cahirciveen, 30 shares; Rev. T. D. O'Sullivan, Cahirciveen, 25 shares; W. J. Leslie, J.P., Cahirciveen, 25 shares; J. F. Mannia, F.R.C.S., Cahirciveen, 20 shares; T. Sugrice, Cahirciveen, merchant, 15 shares. The number of directors is not to be less than three or more than six; the first are T. B. Morley, J. Brenhan, T. C. Fitzgerald, M. J. Healey, P. J. Reardon, and E. L. Cantwell. Qualification, £25. Registered office: Power House, Cahirciveen.

Bachelet French Syndicate, Ltd. (140,823).—Registered June 30th, by Wake, Wild & Boult, 158, Aldersgate Street, E.C. Capital £50,000 in £1 shares. Objects: To adopt an agreement with H. G. Barrett to acquire and turn to account patents, licences and rights, to carry on the business of manufacturers of and dealers in any articles capable of being manufactured thereunder, and that of founders, tool makers, metal workers, boiler makers, electricians, electrical, mechanical, and general engineers, generators and storers of electricity, etc. The signatories (with one share each) are: W. E. Newell, 166, Piccadilly, W., secretary; J. S. Murray, 166, Piccadilly, W., gent. Private company. The first directors (to number not less than two or more than seven) are C. Vane (chairman), 166, Piccadilly, W.; H. G. Barrett, Mill Lane, Clayton, Sussex; D. S. Crowther, Hay Green, Kingston Hill, Surrey; T. B. Burnham, Woodhurst, Crawley; A. Dent, 55, Lee Park, Blackheath, S.E.; and E. Alderton, 42, Piccadilly, W. Qualification, £5. Remuneration, 10 per cent. of the profits available for distribution for dividend, divid[illegible]. Registered office: 166, Piccadilly, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Sherardizers, Ltd.—Debenture, dated June 10th, 1915, to secure £600, charged on company's property, present and future, including uncalled capital. Holder: W. J. Halsey, 23, Queen Anne's Gate, S.W.

Carville Site and Power Co., Ltd.—Issue, on June 18th, 1915, of £10,000 debentures, part of a series of which particulars have already been filed.

Vactite Wire Co., Ltd. (105,696).—Capital, £450 in £1 shares. Return dated December 31st, 1914 (filed May 27th, 1915). All shares taken up; £2 paid; £448 considered as paid. Mortgages and charges, £1,700.

Van Raden and Co., Ltd. (78,383).—Capital, £10,000 in £1 shares. Return dated January 14th (filed May 8th), 1915. 6,754 shares taken up; £1 per share called up on 4,654 shares; £4,654 paid; £2,100 considered as paid on 2,100 shares. Mortgages and charges, £4,600.

North Metropolitan Electrical Power Distribution Co., Ltd.—Particulars of £25,000 debentures, created by resolutions of June 17th, 1909, and May 6th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £5,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

General Cable Manufacturing Co., Ltd.—Debenture, dated June 24th, 1915, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders, Aubert Grenier & Co., Cossony-Gare, Switzerland.

Oxford Electric Co., Ltd. (34,685).—Capital, £175,000 in £5 shares (15,000 pref.). Return dated March 19th, 1915. 20,000 ord. and 11,000 pref. shares taken up; £5 per share called up on 13,200 ord. and 10,000 pref., and £1 per share on 1,000 pref. shares; £118,550 paid (including £1,550 paid on 310 ord. shares forfeited); £34,000 considered as paid on 6,800 shares. Mortgages and charges, £50,000.

Nalder Bros. and Thompson, Ltd. (62,214).—Capital, £22,500 in £1 shares (10,000 pref.). Return dated December 10th, 1914. 9,461 pref. and 11,370 ord. shares taken up; £1 per share called up on 9,461 pref. and 1,370 ord.; £10,831 paid; £10,000 considered as paid on 10,000 ord. shares. Mortgages and charges, nil. Return of allotments made up to April 24th, 1915, shows a further 539 pref. and 161 ord. shares allotted for cash.

Oldham, Ashton and Hyde Electric Tramway, Ltd. (55,318).—Capital, £100,000 in £1 shares (50,000 pref.). Return dated April 5th, 1915. All shares taken up; £100,000 paid. Mortgages and charges, £47,000.

Northwood Electric Light and Power Co., Ltd. (66,312).—Capital, £30,000 in £1 shares (15,000 pref.). Return dated March 18th, 1915. 12,507 ord. and 6,880 pref. shares taken up; £1 per share called up on 8,282 ord. and 6,880 pref. shares; £15,162 paid; £4,225 considered as paid on 4,225 ord. shares. Mortgages and charges, £4,625.

Vera Cruz Telephone Construction Co., Ltd. (107,144).—Capital, £10,000 in £1 shares. Return dated February 1st, 1915. 9,655 shares taken up; £2,500 paid; £7,155 considered as paid. Mortgages and charges, nil.

West Naples Tramways and Valfortore Railway Co., Ltd. (107,436).—Capital, £50,000 in £1 shares. Return dated December 31st, 1914 (filed May 27th, 1915). 7,920 shares taken up; £1 per share called up on 920; £713 12s. 6d. paid, leaving £206 7s. 6d. in arrears; £7,000 considered as paid on 7,000 shares. Mortgages and charges, nil.

London Electrical Trading Co., Ltd.—Particulars of £2,000 debs., created March 16th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £200. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Brilliant Arc Lamp and Engineering Co., Ltd.—Second deb. dated June 23rd, 1915, to secure £90, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: S. H. Cohen, 4, Grosvenor Gardens, Willesden Green, N.W., and M. Nordwald, 125, Brondesbury Road, N.W.

Brook, Hirst and Co., Ltd. (95,264).—Capital, £20,000 in £1 shares. Return dated January 14th (filed May 14th, 1915). 12,500 shares taken up; £12,500 considered as paid. Mortgages and charges, £7,000.

Gell Telegraphic Appliances Syndicate, Ltd. (78,405).—Return dated March 12th, 1915. Capital at date of return, £40,000 in £1 shares. 37,700 shares taken up; 10s. per share called up on 15,000 and £1 per share on 7,700 shares; £15,537 10s. paid (including £337 10s. paid on 1,500 shares forfeited); £22,500 considered as paid, being £1 per share on 15,000 and 10s. per share on 15,000. Mortgages and charges, £1,000. The capital was reduced to £20,000 in 10s. shares on May 25th, 1915.

Carbone Arc Lamp Syndicate, Ltd. (80,279).—Capital, £9,880 in £1 shares (9,500 ord. and 190 "A" def. and 190 "B" def.). Return dated December 31st, 1914 (filed May 5th, 1915). 7,607 ord., 190 "A" def., and 190 "B" def. shares taken up; £1 per share called up on 107 ord. shares; £107 paid; £7,880 considered as paid on 7,500 ord., 190 "A" def., and 190 "B" def. Mortgages and charges, nil.

Cable Accessories Co., Ltd. (93,345).—Capital, £20,000 in £1 shares (4,000 6 per cent. cum. pref.). Return dated May 20th, 1915. 10,500 ord. and 1,800 pref. shares taken up; £1 per share called up on 8,042 ord., 15s. per share on 348 ord., 12s. 6d. on 1,910 ord., 10s. on 200 ord., and £1 on 1,800 pref.; £8,346 15s. paid; £3,050 considered as paid. Mortgages and charges, nil. Return of allotments made up to May 28th, 1915, shows a further 50 pref. and 5,500 ord. shares allotted for cash.

CITY NOTES.

Bombay Electric Supply and Tramways Co., Ltd.

The total revenue from all sources for the year ended December 31st, 1914, including the amount represented by sale of current to the tramways, amounted to £302,570, an increase of £26,102, or 9.44 per cent. The total expenditure was £144,987, an increase of £14,091, or 10.77 per cent. The net profit aggregated £157,583, an increase of £12,010, equivalent to 8.25 per cent. Interest on loans amounted to £1,907, interest on debenture debt £35,668, sinking fund account £6,732, depreciation fund account £27,000, redemption of second debentures of equivalent par value £8,000, contribution to officers' and employès' provident fund £2,303. After making these deductions and adding £4,350 brought forward, £80,322 remains, out of which the dividend on the 6 per cent. cumulative preference shares absorbs £35,995, and a dividend on the ordinary shares of 6 per cent. per annum, free from English income tax, £36,000, leaving £8,327 to be carried forward. The gross tramway receipts were £169,885, compared with £170,672 for 1913, and the working expenses were £85,297, against £81,123. The balance of receipts over expenses is £84,588, compared with £89,549.

Up to the end of July, 1914, the traffic continued to show a progressive expansion. With the declaration of war in Europe the earnings commenced to decline in consequence of the shrinkage of the city's export and import trade resulting therefrom, and the general commercial depression. By the end of the year the net earnings from the traction branch of the business showed a decline of £4,900. Since the commencement of the present year there has been some recovery. For November last year the falling off in receipts had increased to 10.31 per cent. as compared with November, 1913. For March, 1915, the percentage of declension had fallen to 6.16 per cent. The future course of the tramway receipts was likely to depend largely upon the course of the war. The recent recovery in the prosperity of the mill industry at Bombay constituted an encouraging factor, but both the export and import statistics of the port continued to record a heavy decline. In view of the existing situation certain extensions of the tramway in contemplation before the outbreak of war have been deferred.

	1913.	1914.
Miles opened—Route miles	20.38	20.38
Passengers carried	40,692,022	40.449,634
Proportion of expenses to receipts	48 p.c.	51 p.c.
Cars in stock—		
(*a*) Running singly	150	150
(*b*) Coupled as two-car trains	60	80

The gross electric supply revenue, including the sale of current to the tramways, aggregates £132,669, compared with £105,466. The working expenses were £55,734, against £46,284. The receipts, exclusive of the revenue represented by the current supplied for the tramways, amounted to £105,778, compared with £77,569 for 1913. The balance of £76,935 compares with £59,182 for 1913.

The progress of the supply branch continues satisfactory, the net revenue increase of £17,700 having considerably more than wiped out the declension in the net earnings from the traction branch, and recording a substantial advance on the percentage of increase in the net earnings from supply for 1913 as compared with 1912. Progressive as are the figures for 1914, they would have been even better but for the adverse influence of the war during the latter half of the year, which in various ways operated to check consumption.

The directors are continuing the policy of extending the supply mains where the demand justifies them in doing so. Apart from the domestic demand for lighting and fans, the industrial demand for electric energy for power purposes continues to record a marked progression. Amongst the more important contracts recently entered into under this heading are agreements with the British India Steam Navigation Co. and with Messrs. Alcock, Ashdown & Co.

The capital expenditure during the year was £46,461, principally for mains extensions and additional sub-stations and rolling stock. The report also describes the steps taken in connection with the increase of the capital of the company. After the re-opening of the Stock Exchanges an extraordinary general meeting of shareholders was held at which an issue of 12,000 additional ordinary shares of £10 each was authorised. The shares were offered to the shareholders, both preference and ordinary, at £12 12s. per share, in the proportion of 1 share to 10 shares of their individual holdings. As the result of this offer, 9,520 shares were subscribed.

Annual meeting: July 29th.

Crompton & Co., Ltd.

Mr. Carleton Fowell Tufnell took the chair at the annual meeting, held at Salisbury House, on Monday. He said he had again to congratulate the shareholders on the improved position of the company, for he thought they would all agree that the figures laid before them that day were satisfactory. The outbreak of war in August naturally had a detrimental effect on the business. A large number of employés joined the Colours, and the work in hand had to be completed under difficulties and at an increased cost. The company usually had a considerable amount of work in hand for Government departments, and although the value of such work completed and delivered in the period under review was in excess of that usually turned out, the orders from private customers were delayed. He mentioned this because it had been suggested that the increased profits of the company were due to the war, but as a matter of fact, if it had not been for the war the profits would have been better. The net profit was £26,460, as compared with £13,551 in the previous year, and with the amount brought forward they had £28,649 at their disposal. They proposed to place £6,500 to the general reserve fund, as against £2,500 last year. A sum of £3,500 was placed to special depreciation account; £1,608 was being written off preliminary expenses; and the full preference dividend of 7 per cent. was being paid, which would absorb £9,349, and leave £7,691 to be carried forward, as against £2,189. Some of the shareholders might feel a little disappointed that they did not recommend a dividend on the ordinary shares, but their policy of strengthening the company's position would, he was satisfied, receive their approval, for the events of the past year had more than ever convinced the directors of the necessity and value of this conservative policy. With regard to the balance sheet, the expenditure during the year was £12,749, most of which was for additional plant at the works. Stock in trade and work in progress—£196,757—was up by some £10,000. Investments in other companies remained at the same figure; the interest received on these investments was approximately 5 per cent. on the book values. With regard to the profit and loss account, the depreciation had been charged at the usual rate, for all repairs and maintenance had been debited against revenue. So far as the current year was concerned, the volume of orders in hand was satisfactory, and unless something unforeseen occurred to interfere with their working, they were looking forward to a successful year. During the year application was made to the Stock Exchange Committee for a quotation of the company's shares, but the Committee in their wisdom decided to postpone granting it until such time as the existing debentures—which were the original debentures of the old company—had been dealt with. Whilst the war lasted, nothing could be done. The board made suitable allowances for the dependents of their employés who had joined the Colours. In conclusion, the Chairman thanked the management and all concerned for the excellent work they had done in the past year.

Lieut.-Col. J. Clibbourn seconded the motion, and the report was adopted without discussion.

A hearty vote of thanks was passed to the board and staff for the way in which they had looked after the company's interests during an anxious period.

German Electrical Companies.

The Welter Elektrizitats und Hebe Werke, of Cologne-Zollstock report that the working results in 1914 were prejudicially affected by the war and by a serious fire. Although gross profits of £7,100 were earned as against £11,000 in 1913, the turnover for the year shows a slight loss, which has been extinguished by drawing upon the reserve fund. This situation compares with a dividend of 6 per cent. in 1913.

The accounts of the *Continentale Gesellschaft fur Elektrische Unternehmungen, of Nuremburg*, after placing £66,000 to reserve funds for renewals and redemption of the capital of the company's own supply works and allocating £2,600 to the general reserve fund, as against £5,000 in 1913, indicate net profits of £57,000 for 1914, as compared with £100,000 in the preceding year. It is intended to pay a dividend of 3½ per cent. on the preference capital, of which the capital almost entirely consists apart from loans, as contrasted with 6 per cent. in 1913.

The A.E.G. Schnellbahn Gesellschaft, of Berlin, which was formed at the beginning of 1914 by the A.E.G. and the Berlin Electricity Works Co. for the purpose of carrying into effect the agreement entered into in 1912 by the A.E.G. for the construction of an elevated and underground electric railway between Gesundbrunnen and Neukolln, has now presented its first report. It states that work on the first section in the Brunnen Strasse of a length of nearly one mile was commenced in May, and the second section which concerns the tunnelling of the Spree was begun in the autumn. Since the outbreak of the war the works have progressed more slowly than was foreseen, owing to the scarcity of labour and transport wagons, although the hope is expressed that the railway will be completed within the stipulated period. The paid up ordinary capital amounts to £1,000,000, and the preference shares to £1,125,000, interest on which is being paid during construction at the rate of 4½ per cent. and 5 per cent. respectively.

The report of the *Elektrizitats Gesellschaft, late W. Lahmeyer & Co., of Frankfort-on-Main*, which is a holding company belonging to the A.E.G. group, states that the effects of the war were perceptible all round, although these were manifested less in a decline in profits than in the necessity for the subsidiary companies to refrain from increasing their dividends. So far it has been possible to maintain uninterrupted working of the undertakings managed by the company in the country. The foreign undertakings principally concerned are the Kief-Swjatoschin tramway and the Warsaw Electricity Co. The former was sequestrated by the Russian Government in January, whilst the latter, whose administration is located in Paris, realised a greater surplus down to the outbreak of the war, but since that time it has been impossible to obtain further information. The accounts of the Continental Co. indicate gross profits of £197,000, as against £184,000 in 1913, and net profits of £103,000, as compared with £100,000. It is proposed to distribute 7 per cent. on the ordinary capital of £1,312,000, being the same rate as in 1913.

The directors of the *Akkumulatoren Fabrik A.G., of Berlin*, which owns the Tudor battery patents, state in their report for 1914 that as the year includes a period of war-time, they refrain from giving a review of the course of the undertaking in the home and export trade. During the early months of the war, a serious diminution in the turnover took place, but an improvement was noticed in each succeeding month, with the result that the total value of the deliveries for the year reached £1,011,000, as compared with £1,104,000 in 1913. It was impossible to say anything regarding the foreign undertakings as the conditions, even in neutral countries, did not permit of any sound opinion being formed. The gross receipts amounted to £436,000, as against £425,000 in 1913. After defraying general expenses and cost of management, and setting aside £29,000 for depreciation, as compared with £15,000, the net profits and balance forward are returned at £148,000, as contrasted with £147,000, and a dividend is proposed at the rate of 18 per cent. on the ordinary share capital of £600,000, as against 20 per cent. in 1913 and 25 per cent. in 1912.

Consolidated Electrical Co., Ltd.

The ordinary income for the year ended March 31st, 1915, amounted to £5,344, in comparison with £4,786 for the previous year. The general charges amounted to £1,191, in comparison with £1,220. Of the balance of £7,169 standing to the credit of revenue account, the interim dividend of 3 per cent. paid on the preference shares on January 1st, 1915, absorbed £450, leaving a disposable balance of £6,719. The final dividend of 3 per cent. payable on the preference shares will absorb a further £450, and the directors now recommend a dividend on the ordinary shares of 3 per cent. for the year, leaving £2,969 to be carried forward. The investments are, as on former occasions, taken in the balance sheet at cost; and, on the whole, have suffered little in comparison with the general shrinkage in market values since the outbreak of war. The scheme of arrangement referred to at the last general meeting, which it was intended to bring forward in the autumn of last year, could not be proceeded with in consequence of the disturbed financial conditions following upon the outbreak of war.

Mr. Herbert Allen presided over the annual meeting, held at River Plate House, E.C., on Tuesday. He said that on the face of the accounts there was little to indicate that the year under review embraced eight months of a devastating war—a war which had devastated the fields of finance almost as much as the battlefields of Europe. As a matter of fact, during a year of financial disturbance the assets of the company had suffered little, if any, depreciation. Their income showed a substantial improvement upon that of the previous year, and their expenses once more showed a decrease and had established a fresh record. They recommended the payment of a dividend of 3 per cent. on the ordinary shares, which would absorb £3,300 and leave £2,969, which, under the circumstances, the board thought it wise to carry forward. He did not think the board need offer any apology for the slight reduction in the dividend, but, on the contrary, they were almost entitled to congratulate themselves on being in a position to make a distribution of 3 per cent. at a time when well-managed companies of great magnitude and importance had had to drop the payment of dividends altogether. The policy of the board had been to keep the assets as liquid as possible consistently with the need of earning a reasonable return on the money to pay a dividend. On the whole, they could claim to have been fairly successful in this respect. At the outbreak of the war, which was at the time when the reorganisation scheme was to have been brought forward, their assets were divided pretty evenly between short loans and short-term investments. The average yield on the loans was quite satisfactory, and not a penny of the capital was in doubt. It would not have been surprising if the outbreak of war had put a very different aspect on their affairs, but few companies had suffered relatively as little as theirs. Their loans and investments had given undiminished returns, and, so far as they could be valued, were worth little less now than the figure at which they stood in the balance sheet. The one doubtful element, singularly enough, happened to be the most legitimate investment which an electrical trust company could undertake, the Constantinople Telephone Co. He was personally acquainted with the city, and did not know of any city of equal size which afforded such splendid scope for telephone enterprise. The concession was only granted a few years ago, and the service had only been started a few months before this country went to war with Turkey. Obviously, the present state of affairs in Constantinople gave the owners of the telephone company great anxiety, but they by no means despaired of the future. There was every reason to believe that the system had suffered little or no physical damage, and in the long run their interests should suffer little. However, their interests in this company represented less than one-seventh part of their total investments, so that in no event would the loss be serious. The remainder of their investments had given little cause for any anxiety. With regard to loans, one loan represented £25,000 out of a total of £35,000. Litigation arose over this, but they established their case in the Courts. All their expenses were paid, and they received a very substantial proportion of the loan, and the balance was being paid by monthly instalments, and, at the same time, they received a very remunerative rate of interest.

Mr. Wright seconded the motion, and the report was adopted without discussion.

Mr. Kingsbury remarked that he had had something to do with the initiation of the Constantinople Telephone Co., and he felt the greatest confidence in his holding. Constantinople was the only city in the world with a million inhabitants without telephone communication. It had now a system installed with all the experience of a quarter of a century's work behind it. At the present moment *force majeure* was interfering with the company's interests, but before long *force majeure* would be the other way round, and then there could be no doubt of the steady improvement of the position of the company.

Telegraph Construction and Maintenance Co., Ltd.—The directors have declared the usual interim dividend of 5 per cent'

Chili Telephone Co., Ltd.

The aggregate number of subscribers at all centres at the end of the year (March, 1915) was 13,095, a decrease of 880 for the year. The gross revenue in Chile from all sources was $3,163,530, an increase of $6,527. The expenditure in Chile was $1,647,933, an increase of $27,112. The net income in Chile from all sources was $1,515,597, a decrease of $20,585. The average rate of exchange for the year was 8.46d., as compared with 9.60d. in the previous year, giving a decrease for the year of 1.14d. Converted into sterling at this rate, the net income figures are £53,424, a decrease of £8,030. The liquid assets and liabilities in Chile at March, 1915, were valued at 7¾d., the current rate of exchange at that time, as compared with 9½d. a year previously. The balance to the credit of the revenue account, including £3,956 brought forward, is £51,921, of which £3,838 has been expended on replacements, etc., of plant. An interim dividend of 3s. per share, free of income tax, was paid on January 15th last, and after carrying £12,344 to the general reserve and setting aside £5,000 as a special reserve against loss on investments, the directors now recommend a final dividend of 5s. per share, free of income tax, leaving £4,339 to be carried forward.

Annual meeting: July 14th.

General Electric Co., Ltd.

The directors report that for the year ended March 31st, 1915, the net trading profits and income from investments, &c., amount to £164,877, plus £36,740 brought forward, making a total available profit of £201,617. Debenture interest required £8,000; depreciation and provision for removal expenses, £18,855; and the dividend on the preference shares (6 per cent.) absorbed £38,681, leaving an available balance of £136,081. Out of this, managing director's and employés' bonus requires £9,934; balance of expenses of new issue of capital, £13,822; dividend on ordinary shares (10 per cent.), £48,142; reserve account, £20,000; war grants, £7,482, leaving £36,701 to be carried forward. The balance of the reserve account at March 31st, 1914, was £200,000, plus for 1915, as above, £20,000, giving a total of £220,000.

The war has interfered with the company's plans for extension, but, so far, has not affected the volume of business, as the great increase in orders from Government Departments and Government contractors has fully compensated for the decrease in general business. Although the great majority of the company's products are essential for war purposes, the outlook for the coming year is one of some uncertainty, owing to the absence with His Majesty's Forces of nearly 1,000 of the company's most skilled staff and workpeople, and owing to the unsettled state of the labour and raw material markets. Extensions at the Witton Works are now being carried out. The Pirelli-General Cable Works at Southampton have been completed during the year and have started manufacturing. The steelwork of the Kingsway building is erected, but the board have decided to defer completion of the building to a more suitable time. The issue of £400,000 additional capital during the past year has been a great success, and the expenses in connection with such issue are finally disposed of in the accounts.

Mr. J. Y. Fletcher and Mr. S. D. White were appointed directors on January 4th, 1915.

Annual meeting: To-day, July 9th.

We give below the comparable figures from the reports for the three years ended March, 1913, 1914 and 1915:—

	1913.	1914.	1915.
Net trading profit and income from investments	£145,261	£157,894	£164,877
Depreciation and debenture interest	32,543	32 328	26,855
Pref. dividend	19,878	24,000	38,681
	(6 %)	(6 %)	(6 %)
Available balance	124,890	133,896	136,081
Managing director's and employés' bonus	9,284	10,156	9,934
Expenses of new issue of shares	10,275	14,000	13,822
Staff benevolence	3,000	3,000	—
War grants	—	—	7,482
Ordinary dividend	40,000	40,000	48,142
	(10 %)	(10 %)	(10 %)
To reserve account	30 000	30,000	20,000
Balance carried forward ...	32,331	36 740	36,701
Reserve fund total	170,000	200,000	220,000

Russian Electrical Companies. — The Russian Siemens-Schuckert Co. (capital, 15,000,000 roubles) made a profit of 1,149,199 roubles in its fifteenth (1914) working year, and will pay a 5 per cent. dividend.

The United Cable Factories (capital, 6,000,000 roubles) made a profit of 3,337,361 roubles in its ninth (1914) working year, and will pay a 15 per cent. dividend.

Electrical and Industrial Investment Co., Ltd.—A petition for the confirmation of the reduction of capital as agreed at meetings held in March, is to come before the Chancery Division, on July 19th.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—An interim dividend of 2½ per cent. is recommended on the preference shares, but, owing to the uncertainty of the situation, the question of a distribution on the ordinary shares is postponed. Last year the interim dividend was 2½ per cent.

South American Light and Power Co., Ltd.

During the year ended March 31st, 1915, the net profit was £10,001, plus £517 brought forward. A dividend of 5 per cent. will absorb £8,620, there is devoted to writing off the debenture issue expenses £1,500, and £398 is to be carried forward.

	March 31. 1913	March 31. 1914.	March 31. 1915.
Arc lamps, connected	733	813	804
8-c.p. incandescent lamps, connected	52,234	56,142	56,090
Fans, connected	312	311	329
Motors	91	116	126
Customers	1,706	1,924	2,009

To fill the vacancy caused by the death of Mr. F. O. Smithers, Mr. J. A. Goudge has been elected to the board.

Mr. T. P. Gaskell presided on Monday at the annual meeting, held at Dashwood House, E.C. He said that, unfortunately, they had not done so well as in the preceding year, the receipts having fallen by some £1,700 or £1,800. Despite that, however, after paying a dividend of 5 per cent., they had been able to set aside £1,500 to write off a portion of the debenture issue expenses. With the exception of £500, they had now written off the whole of the £5,911 discount on the issue of the debentures. Although they had had a comparatively bad year, he thought they might say they had now turned the corner. The first nine months of the last financial year—to December 31st, 1914—showed a falling off in gross receipts of £3,370 as compared with the corresponding period in 1913, whereas for the remaining three months there was an increase of £273. That, he thought, indicated that the worst was over, and they now had before them a better prospect than at this time last year. Of course, a great deal depended upon the harvest, which would come forward at the end of the year. So far, their advices went to show that the seeding time had been a good one, and they might hope that the results would be correspondingly good later on.

Mr. Edmund Charrington seconded the motion, which was carried.

Puebla Tramway, Light and Power Co.—**The directors have issued a circular to the holders of the first mortgage 5 per cent. bonds containing proposals for modifying their rights and the provisions of the trust deed. They state that owing to the falling off in the company's receipts through the disturbed conditions prevailing in Mexico, and owing to the very uncertain value of the peso, it is impossible for the company for some considerable time to assume that its earnings will realise in sterling an amount sufficient to pay the interest on the first mortgage bonds, to say nothing of providing for the sinking fund.**—***Times.***

Davey, Paxman & Co., Ltd.—For the 15 months **ended March 31st the trading profit was £17,745, making, with the £4,295 brought forward, a total of £22,040. This amount will be applied as follows:—£3,453 to depreciation reserve, £2,375 for directors' fees, £745 to write off balance of South African expenses** ***re*** **gas engine installation, £4,530 for one and a-quarter year's interest on debenture stock, and £650 written off patent licences, leaving £10,287 to be carried forward.**—***Financial Times.***

STOCKS AND SHARES.

Tuesday Evening.

The markets as a whole are partially throwing off the influence exerted over them by the new 4½ per cent. War Loan. Business is still greatly checked, but the severe falls which have been occurring are to some extent arrested. Last week, for instance, there was a rush to sell bank shares, and prices slumped very heavily. This week, people have come in to support them; and a strong recovery in Home Railway stocks is another indication of the way in which the immediate effect of the War Loan is wearing off. Prices of many securities are undoubtedly cheap, and it is not surprising that investors should find it difficult to decide whether duty calls them to subscribe for the War Loan, or to buy more shares of other investments to average holdings acquired at substantially higher prices. Not the least difficult part of a stockbroker's vocation just at the present time is to decide such knotty points for clients who insist upon leaving them to his discretion, because the unfortunate man knows that whatever he does will be wrong.

There seems to be little doubt as to the success of the Loan; and the offer of a thousand million dollars to the United States is evidence that those in charge of the issue have awakened to the desirability of attracting American money to this country—not only for the purpose of getting the money itself, but for assisting the rate of exchange, which is still sufficiently against this country to add greatly to the cost of the extensive war purchases now being made by the Allies.

Further falls have taken place in most of our lists, and the reason is still the disposition to sell on the part of those who want to put the money into the new War Stock. Knowing, as they do, the general trend, the jobbers read their brokers as being sellers in advance. The fall of £3 10s. in Telegraph Constructions is, for example, out of all proportion to the number of shares offered for sale. The Company has declared its regular interim dividend of 5 per cent.—that is, 12s. per share; and the yield at the present price is the substantial one of 7¼ per cent.

In their desire to turn sovereigns into soldiers, the public have been over-anxious to get out of existing investments, regardless of the serious indirect consequences which may arise out of this process. Next week, however, should see quotations responding to the better tone which is already perceptible here and there through the House. The War Loan subscription lists close on Saturday, allotment letters will be out in full before the end of another week, and, although for some time to come the War Loan market is bound to be the most brisk in the Stock Exchange, there should be a noticeable return of interest to other securities.

The rally in Steam stocks has brought about a sympathetic recovery of 3 points in Underground Income bonds, raising them to 72. The £10 ordinary shares hardened to 1¼, and Districts are a little better at 13¼. On the other hand, Metropolitan Consolidated went back a trifle.

The Foreign list keeps dull, and there are more falls in the debenture stocks of the Anglo-Argentine Tramways Co., the Five per cents. shedding 4 points, so that they now stand upon the same platform as the company's 4 per cent. debenture stock. Brazil Tractions are the turn harder at 50½, the Rio exchange keeping fairly steady. Nothing new has occurred in the Mexican division. The death of ex-President Diaz recalls the halcyon days which characterised the decade of his office. However bad may have been the methods by which he brought the country into a condition of order and prosperity, the result seemed to be eminently satisfactory. But since his retirement, four years ago—into which, by the way, he was practically driven—Mexico has been plunged into anarchy and chaos.

The Puebla Tramway, Light & Power Co., in publishing a scheme for funding the interest on its first mortgage bonds, refers to the loss occasioned to the company's revenue by the Mexican upheaval. The exchange, says the report, is now down between 4d. and 6d. per peso, and a further fall is possible. The scheme is for funding the interest on the bonds for five years, during which period it shall be payable only out of net earnings, after the service for the prior lien bonds has been met; any dividends not paid in cash to be satisfied by 5 per cent. non-cumulative income warrants.

The falls in Home Electricity shares include ¼ in City of London ordinary, ⅛ in Charing Cross and Westminster preferences, and 3 points in London Electric debenture stock. Apart from these, the list is fairly steady. Business is quiet in most of the leading issues.

Fresh scaling down has taken place amongst Telegraphs and Telephones. The chief fall is one of £1 in Western Telegraph shares, which at 12¼ are now relatively lower than Eastern Telegraph ordinary. Anglo-American Telegraph stocks have gone back, Globe Ordinary lost 10s., and New York Telephone bonds fell 1½ to 95. The American Telephone and Telegraph Co. estimates that about 100,000 miles of railroad in the United States are operated by telephone, being two-fifths of the total mileage in the country. According to the company, the proportion would be greater still were it not for the expense of installation. Marconis weakened to 1 11/16, a fall of ⅛, notwithstanding the daily expectation of the issue of the company's report. Americans at 12s. and Canadians at 4s. 3d. are less active than they were a week or so ago.

The report of the General Electric Co. shows that the trading profit in respect of the year just passed exceeded that of the previous twelvemonth by about £3,000. It may be recalled that the company issued £400,000 fresh capital last year—half in ordinary and half in preference shares—and the result of this has been to require a further £23,000 to maintain the dividends on the two classes. The *Financial Times* tabulates in convenient form the figures for the past eight years, as follows:—

Year ended 31st March.	Trading profit.	Net profits	Ord. div.	To reserve.	Carry forward.
	£	£	p.c.	£	£
1908	53,700	34,700	5	2,000	nil.
1909	72,100	51,200	5	16,100	nil.
1910	91,100	68,400	5	22,000	8,900
1911	107,900	86,800	5	43,000*	12,200
1912	112,300	101,200	7½	30,000	32,300
1913	124,000	112,700	10	30,000	32,300
1914	133,100	125,600	10	30,000	36,700
1915	135,100	138,000	10	20,000	36,700

* At the same time £92,100 was written off patents and goodwill out of reserve.

Industrials bear the same marks as the rest. To the drop in Telegraph Constructions reference has been made already. The preference shares of the British Insulated, British Westinghouse, and Callenders have eased off 1/16 to ⅛. Babcocks dropped to 2¼, at which price shares have been taken for the North. The Armament division is a little better than it was. Rubber shares keep very steady, upheld by the advance in the price of the raw material to 2s. 7d. per lb., with the prospect of further improvement. Business in this section, however, has not escaped from the check laid upon most markets by the presence of the new War Loan; although when the subscription lists are closed, at the end of the week, rubber shares should be amongst the first to recover from the weight pressing upon speculative investments, as well as upon those of the gilt-edged variety, over the course of the past three weeks.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend, 1914.	Price July 6, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	8¼	—	£6 1 8
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4	—	6 5 0
do. do. do. 4½ Pref. ..	4½	4	— ⅛	5 12 6
do. do. City Pref.	4½	3⅞ xd	—	5 16 2
do. 4 Deb.	4	82	—	4 17 7
Chelsea	5	4½	—	5 11 1
do. 4½ Deb.	4½	88 xd	—	4 17 10
City of London	9	13¼	— ¼	6 15 10
do. do. 6 per cent. Pref. ..	6	12	—	5 0 0
do. do. 5 Deb.	5	105 xd	—	4 15 3
do. do. 4½ Deb.	4½	90 xd	—	5 0 0
County of London	7	11	—	6 7 3
do. do. 6 per cent. Pref. ..	6	11	—	5 9 1
do. do. 1st Deb.	4½	96 xd	—	4 13 6
do. do. 2nd Deb.	4½	90	—	5 0 0
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1⅜	—	8 3 4
do. do. 6 per cent. Pref. ..	6	4⅞	—	6 3 1
do. do. 4 Deb.	4	82	– 3	4 16 5
Metropolitan	3½	8	—	5 16 8
do. 4½ per cent. Pref. ..	4½	3¾ xd	—	6 0 0
do. 4½ Deb.	4½	90 xd	—	5 0 0
do. 3½ Deb.	3½	70 xd	—	5 0 0
St. James' and Pall Mall	10	7¼	—	6 18 0
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70 xd	—	5 0 0
South London	5	3	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7	—	6 8 7
do. 4½ Pref.	4½	4⅝	— ⅛	4 17 4

Telegraphs and Telephones.

	Dividend, 1914.	Price July 6, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	102	—1½	5 17 8
do. Def.	1½	21¾	— ¼	6 18 0
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8¼	— ¼	6 1 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11¾	— ¼	*6 16 2
do. 4 Deb.	4	82½	—	4 17 0
Eastern Tel. Ord...	7	127	– 3	*6 7 0
do. 3½ Pref.	3½	72	—	4 17 3
do. 4 Deb.	4	81	—	4 18 9
Globe Tel. and T. Ord.	6	10¼	— ½	*6 13 8
do. Pref.	6	11¼ xd	—	5 6 8
Gt. Northern Tel.	22	34	—	6 9 5
Indo-European	65/-	52	—	6 5 0
Marconi	20	$1\frac{11}{16}$	— ⅛	11 17 0
New York Tel. 4½..	4½	95	—1½	4 13 0
Oriental Telephone Ord.	10	1⅞	— ⅛	5 6 8
do. Pref.	6	$1\frac{3}{16}$	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 8
United R. Plate Tel.	8	5¾	— ⅛	*7 19 10
do. Pref.	5	4⅜	— ⅛	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12¼	—1	*6 10 6
do. 4 Deb.	4	83	—	4 16 5

Home Rails.

	Dividend, 1914.	Price July 6, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented ..	4	73	– 1	5 9 7
Metropolitan	1¼	25½	— ½	4 18 0
do. District	Nil	13¼	+ ¼	Nil
Underground Electric Ordinary ..	Nil	1¼	+ ⅛	Nil
do. do. "A"	Nil	4/6	—	Nil
do. do. Income ..	6	72	+ 3	*9 10 6

Foreign Trams, &c.

	Dividend, 1914.	Price July 6, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Arg. Trams, First Pref. ..	5½	4⅛ xd	— ⅛	6 13 4
do. 2nd Pref.	5½	3⅝ xd	—	7 11 9
do. 4 Deb.	4	79 xd	– 1	5 1 0
do. 4½ Deb.	4½	80 xd	– 2	5 12 6
do. 5 Deb.	5	79	— 1	6 6 7
Brazil Tractions	6	60½	+ ½	11 17 8
Bombay Electric Pref.	6	10½	—	5 16 10
do. 4½ Deb.	4½	90 xd	—	5 0 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds ..	—	50	—	Nil
do. 6 per cent. Bonds ..	—	80	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	45	—	—
Adelaide Sup. 6 per cent. Pref. ..	6	5	—	6 0 0
do. 5 Deb.	5	98	– 2	5 2 0

Manufacturing Companies.

	Dividend, 1914.	Price July 6, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	2¼	— ⅛	6 4 5
British Aluminium Ord.	5	$1\frac{1}{16}$	—9d.	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	11	—	6 13 4
do. Pref.	6	6	— ⅛	5 0 0
British Westinghouse Pref.	7½	36/-	– 1/6	8 2 2
do. 4 Deb.	4	70 xd	—	5 14 4
do. 6 p. lien	6	100	—1	6 0 0
Callenders	15	11¼	— ¼	6 13 4
do. 5 Pref...	5	4⅝	— ⅛	5 2 7
do. 4½ Deb.	4½	95	—	4 14 9
Castner-Kellner	15	8¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/6	—	Nil
do. do. fully paid	Nil	1¾	—	Nil
do. do. 4 Deb.	4	60 xd	—	6 13 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/6 xd	—	8 17 10
do. do. Pref.	7	1 xd	—	7 0 0
Gen. Elec. Pref.	6	9¾ xd	—	6 3 1
Henley	20	14	—	*8 8 8
do. 4½ Pref.	4½	4¾	—	4 14 9
do. 4½ Deb.	4½	95	—	4 14 9
India-Rubber	5	8¾	—	5 14 8
Telegraph Con.	20	33	—3½	7 5 6

* Allowance made for dividends being paid free of income-tax.

St. James' and Pall Mall Electric Light Co., Ltd.—An interim dividend at the rate of 7 per cent. per annum on both the preference and ordinary shares for the half-year ending June 30th, 1915, has been declared, payable August 7th. The transfer books will be closed from July 24th to August 6th inclusive. The interim dividend paid on the ordinary shares last year was at the rate of 10 per cent. per annum.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 7th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a „ Nitric	„	19/-	..
a „ Oxalic	per lb.	..	..
a „ Sulphuric	per cwt.	..	..
a Ammoniac Sal	„	£49	..
a Ammonia, Muriate (large crystal)	per ton	£40	..
a Bleaching powder	„	£9	..
a Bisulphide of Carbon	„	£21	..
a Borax	„	£22	..
a Copper Sulphate	„	£29	..
a Lead, Nitrate	„	£35	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	7d.	..
a Potash, Caustic (88/90 %) ..	per ton	..	..
a „ Chlorate	per lb.	1/6	..
a „ Perchlorate	„	1/6	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers ..	„	£11 10	..
a „ Recovered	„	£8	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %) ..	„	£10 2 6	..
a „ Chlorate	per lb.	1/1	2⅜d. inc.
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks ..	per lb.	3½d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£115	£10 inc.
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£145	£10 inc.
b „ Sheet, in ton lots ..	„	£145	£10 inc.
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/2¼ to 1/2½	
c „ Tubes (solid drawn) ..	„	1/2¾ to 1/3	..
c „ Wire, basis	„	1/2½ to 1/2¾	..
c Copper Tubes (solid drawn) ..	„	1/2¼ to 1/2½	..
g „ Bars (best selected) ..	per ton	£110	..
g „ Sheet	„	£110	..
g „ Rod	„	£110	..
d „ (Electrolytic) Bars ..	„	£95	£1 dec.
d „ „ Sheets ..	„	£113	£1 dec.
d „ „ Rods ..	„	£101	£1 dec.
d „ „ H.C. Wire	per lb.	1/0¼	$\frac{1}{16}$d. dec.
f Ebonite Rod	„	3/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	1/10	1d. inc.
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/7¼	½d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	67/6	1/- inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£22	..
g Lead, English Pig	„	£25 10	10/- inc.
g Mercury	per bot.	£17 5 to £17 10	£1 10 inc.
e Mica (in original cases) small ..	per lb.	4d. to 2/6	..
e „ „ „ medium	„	3/- to 5/-	..
e „ „ „ large ..	„	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/2 to 1/3½	..
p „ „ rolled strip & sheet	„	1/3½ to 1/6½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£80	..
g Tin, Block (English)	„	£172 to £173	£2 to £3 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/8	..
p White Anti-friction Metals ..	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

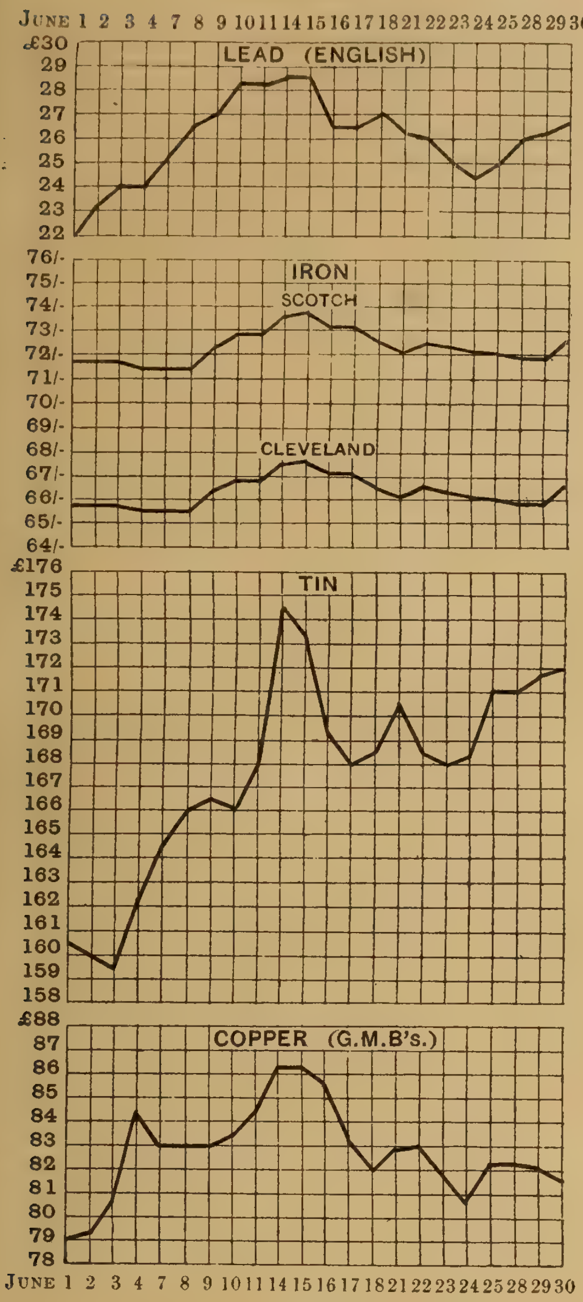
a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Waygood-Otis, Ltd.—Mr. H. C. Walker presided at the annual meeting, held at Cannon Street Hotel on June 28th. He said that a year ago when they met they were suffering from the effects of the building strike, but were anticipating a revival consequent upon its settlement. Circumstances were, however, entirely altered by the outbreak of war. It was anticipated in the early months that business would be seriously affected, but later months brought greater confidence. Higher wages had been granted in consequence of the cost of living, and 300 of their men were with the Forces. They were now engaged upon important contracts, and they were looking forward to the future with confidence. The advantages anticipated as the result of the amalgamation with the Otis Co. were gradually being secured. This time they were not able to pay the ordinary dividend, as they had hitherto been able consistently to do.

Bell Telephone Co., of Canada.—A quarterly dividend of 2 per cent. on the capital stock is payable July 15th.

METAL MARKET.

Fluctuations in June.



The Electric Driving of Saw Mills.—Although in the older method of driving saw mills with steam engines it has been the practice to burn the refuse in the boilers to raise steam, this is not a valid objection to electric driving from the public mains, for it is found that the refuse can be sold, and commands a ready market. An electrical installation was recently laid down by the General Electric Co., Ltd., at Mr. Geo. Shipway's electric saw-mills, Camp Hill, Birmingham, taking three-phase power at 25 cycles, 440 volts, from the mains of the Birmingham Corporation. The current is distributed from an ironclad switchboard to a number of "Witton" induction motors of the open type, varying in size from 50 H.P. downwards. These have been running for a considerable time, and have given the fullest satisfaction. The electric saw mills are situated in one of the busiest parts of Birmingham, where space is valuable, and the motors are mounted on the ceiling, or installed in concrete pits directly below the machines they are driving. In each case the controlling switchgear is situated close to the driven machine. The whole of the floor space is available for the ordinary operations, and in no case is any room taken up by belting or shafting.

Invited to express his opinion on the performance of the electric drive, Mr. Shipway emphasised its economy. To his mind, one of its most valuable features was the ability to shut down those of the machines which were not required, and to run one or more machines as desired through the breakfast hour, or on overtime, should pressure of work make such a procedure desirable.

A NEW BRITISH INDUSTRY.

The manufacture of batteries for portable electric lamps, &c., has assumed special interest at the present time, mainly owing to the fact that the German competition is removed for the time being, so that a good opportunity offers to establish and maintain a British supremacy in this line.

We intend here only to consider batteries of the "dry" type and not accumulators, which latter, owing to their necessarily higher price, are, if better, not so readily saleable, and cannot therefore be made in such large quantities.

"Dry" batteries, on the other hand, more particularly refills for pocket lamps, torches and the like, have been turned out by Germany by the million, and as the cheapest labour can be employed in their manufacture, a good profit can be obtained, even with the low prices which ruled before the war. In fact, the Germans have persistently flooded the world to such an extent with these batteries that a huge demand has been created, which so far cannot possibly be met by this country, either as regards quantity, or, and this is really most important in view of the after-war business, quality.

Batteries or refills of the type under consideration consist usually of two or three cells which are connected in series, and which are contained in a common case mostly made of thin cardboard.

Each cell is composed of a cylindrical or square section vessel made of zinc, which acts as negative electrode and at the same time as container for the electrolyte and the positive electrode.

The zinc vessel is made of No. 5 or so gauge sheet, the thickness being selected according to the length of useful life required of the battery, and is open on top but otherwise carefully soldered, so as to render it quite watertight. This is an important point, as in the case of even a slight leakage, the water contained in the electrolyte would speedily disappear and render the cell inactive.

The carbon electrode is made up by moulding round a circular section carbon a mixture of graphite, manganese dioxide and water, so as to form a cylindrical body, from which the central carbon projects, say, $\frac{3}{4}$ in. The moulded cylinder is kept in shape by means of a wrapper of loosely woven fabric tied with thread.

To the projecting end of the carbon a tightly fitting brass cap is fixed, which is used for making the electrical connection.

The electrolyte is in the form of a more or less viscous paste, usually made with a starchy basis, and containing one or more of the salts of ammonium. Many recipes are extant, but a good formula is :—

8 parts H_2O (distilled)
2 parts NH_4Cl
1 part NH_4SO_4

A sufficiently stiff paste should be made first by stirring into the water an adequate quantity of pure starch of some sort (wheat, rye or rice flour, &c.), and bringing it to the boil. After the paste has cooled somewhat the ammonium salts, which have preferably been finely powdered and thoroughly mixed, are worked in.

The purity of the materials used is very essential, and the ingredients mentioned must never come into contact with metal before being filled into the zinc vessels.

The same remark applies to the carbon, graphite and manganese dioxide used in the positive electrodes. In fact, the purer the materials are, the higher the E.M.F. obtained and the longer the life of the batteries will be.

The paste from which the carbon cylinders or positive electrodes are made should contain a preponderance of manganese dioxide, the actual ratio depending very largely on the obtainable material. For a rough approximation the following formula—

One part graphite
Two parts manganese dioxide

is near enough.

Supposing zinc vessels, carbon electrodes and electrolyte to be ready, the zinc vessels would be filled to a point such that, with the carbon electrodes inserted, the electrolyte just covers the graphite-manganese cylinders. Care should be taken that the brass contact caps are quite clear of the electrolyte.

In order to prevent the corrosion of the contact caps through liquid electrolyte creeping up in the central carbon through capillarity, it is advisable to dip the top part of the carbons in hot paraffin or wax, so as to fill up the pores. The electrical conductivity of the carbons is not affected by this operation in the least.

It is also well to soak the graphite-manganese cylinders in a strong solution of ammonium salts before insertion, as this prevents a portion of the liquid in the electrolyte from filling up the pores of the cylinders, which would result in an increase of internal resistance and a corresponding drop in voltage.

It is a mistake to press the graphite-manganese cylinders from paste containing too little water, as they would not be porous enough, and would only act on their surface instead of right through.

Perhaps it would be well to say a few words about the chemistry of these "dry" cells. As a matter of fact, they are not dry. If they were they would not act. The electrolyte may appear to be dry or nearly so, especially in cases where sulphate of calcium is used instead of starch, but it is just in order to prevent any evaporation that the little cells described above are generally hermetically sealed by means of pitch, paraffin, or the like.

Of course by using, say, nitrate of ammonium, which is highly deliquescent, in the electrolyte, the evaporation can be counteracted more or less successfully and hermetical sealing obviated.

The result to be aimed at is always to get the materials which act on each other as evenly balanced as possible, that is to say, while no surplus gases should be developed, in order to do away with the necessity of vents, a sufficient store of salt should be contained in the electrolyte. Otherwise the chemical action cannot be sustained long enough to give a reasonable useful life.

The cell used in the batteries under review is really our old friend the Leclanché, with greatly enlarged electrode surfaces in close proximity to each other, in order to reduce internal resistance to a minimum.

The composition of the cell can be represented by the following formulæ :—

$$\mathrm{Zn} \mid \mathrm{NH_4\,Cl} + \mathrm{H_2\,O} \mid \mathrm{C} + \mathrm{Mn\,O_2}.$$

When in action, zinc is being dissolved, freeing hydrogen, which in its turn combines with some of the oxygen of the manganese dioxide to form water.

If the hydrogen were not got rid of in this way, tiny gas bubbles would fill the pores and cover the surface of the positive electrode, and the internal resistance would quickly increase to such an extent that the battery would become useless. A back E.M.F. would also be set up.

The theory of these cells is complicated, and has not been very thoroughly investigated. Makers have generally proceeded in an empirical way, and guard their secrets jealously. It would appear that most modern dry cells, at least those which are used for pocket lamps, &c., are really what is called "concentration" cells, that is to say, cells containing two solutions of different concentration, separated by a suitable porous membrane.

In such a cell an E.M.F. additional to the potential differences due to the contact of electrodes and electrolyte is set up, and this is the reason that batteries built on very similar lines by different makers show appreciably different voltages.

Of course the difference in concentration disappears in the course of time as the solutions mix, but in cells as dealt with here, the voltage should not sink below about 1·5 volts until they are nearly exhausted.

The theoretical consumption of zinc is $2/E$ lb. per H.P.-hour where E is the E.M.F. of the battery. Differently put, in a 4·5-volt battery working a ·4-amp. metal-filament lamp, the consumption of chemically pure zinc would, theoretically, be about 7·5 grains per hour.

Some local action takes place even when the battery is open-circuited, *i.e.*, not working electrically, and the concentration of the electrolyte and the strength of the zinc vessels must be selected appropriately to obtain the best results.

As indicated above, hard and fast rules cannot be laid down, as not only the ammonium compounds, but also the graphite, the manganese, &c., and last, but not least, the zinc, vary considerably according to the source of supply. Some experimenting will always be necessary in order to ascertain the best proportions for the materials at one's disposal, but if this be carried out on the lines indicated there should not be many difficulties.

In a further article it is proposed to deal with the tools used in making the various component parts of the complete refill, and to give notes about preparing and filling in the electrolyte, and sealing the finished battery.

As most of the work can be carried out by young girls, and in view of the fact that the coming season is sure to bring a large demand for these refills, manufacturers who are not too busy on Government work would do well to give their attention to this comparatively new industry.

INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

Annual Report.

THE annual report of the Council states that since it has become evident that there is little likelihood of Major Richardson being able to give his services to the Association throughout the ensuing year if he were re-elected to office, his views have been ascertained, and in conformity with the same the Council suggests that his name should be placed on the list of Past Presidents, and that at the first opportunity he should be nominated for another term of office as President. The membership of the Association now stands at 377, a decrease of two on last year's total.

Regarding the model general conditions of contract placed before the annual general meeting in June, 1913, it was resolved that the Association of Municipal Corporations should be consulted, but that body did not move very quickly. In the meantime the Council of the B.E.A.M.A. decided to adopt the model general conditions as issued by the Institution of Electrical Engineers for a period of one year in respect of municipal contracts in order to see how they worked. The B.E.A.M.A. asked for the views of the Council upon this proposal, but under the circumstances no reply could be given, and the matter is left, as heretofore, for each corporation to deal with the manufacturers direct.

With respect to the I.M.E.A. Bill, the Council decided that no further action be taken in connection with the suggestion for a joint private Bill, and that the Association revert to the pressing forward of a Bill promoted in the manner originally arranged.

The Acting President, Mr. A. C. Cramb, had an interview with Mr. Rawlings, the President of the Electrical Contractors' Association, as a result of which the Council decided that no further concessions be made beyond those contained in the Bill as last printed.

After careful consideration of the results of the I.M.E.A.'s Parliamentary propaganda in support of the Bill, Messrs. A. C. Cramb, Bailie Smith, A. H. Seabrook, S. E. Fedden and H. Faraday Proctor were appointed as a sub-committee to meet the B.E.A.M.A. with a view to discussing this question with them.

Particular attention is drawn to the fact that the Corporation of Glasgow has arranged terms upon which it will operate its publicity and sales departments. The Electrical Contractors' Association in Scotland have agreed to terms less advantageous to themselves than those to which the Electrical Contractors' Association take exception in the Bill.

Negotiations are in progress in connection with the question of obtaining powers for local authorities to pay delegates' expenses to annual conferences.

A year ago the Association was invited by the Engineering Standards Committee to nominate two members to represent it on the newly-constituted Sectional Electrical Committee. Mr. A. H. Seabrook and Mr. A. C. Cramb (Acting President) were nominated, and subsequently additional representation was obtained on many of the sub-committees dealing with electrical plant.

The Council has since voted a sum of twenty guineas from the funds of the Association as a donation from the I.M.E.A. to the Engineering Standards Committee.

The Council makes a special appeal to the committees who control municipal electrical supply undertakings to give their generous support to the Standards Committee by making an annual subscription towards the fund.

With regard to the Development Committee formed at the first Council meeting of the session, Mr. Vignoles was appointed hon. secretary, but had volunteered and been accepted for war service. At the request of the Council, Mr.

J. W. Beauchamp accepted the hon. secretaryship of the committee for the time being. Representatives of kindred associations and other persons likely to be of service were co-opted as members, and the work so far accomplished is set out in the Development Committee's report.

Referring to the Long Eaton and Ilford cases, the Council asked the hon. secretary to draw up a statement as to the danger of the gas company's attack and circulate it to the local authorities represented in the Association, asking them to contribute to the expenses of supporting a test case; considerable financial support was promised in response.

Mr. Faraday Proctor subsequently presented a valuable report on the subject to the Council. Having carefully examined the tariffs of over one hundred of the municipal undertakings, he was of opinion that there were only a few which might be subjected to attack on the grounds of the objections alleged in the Long Eaton and Ilford cases. Some of these cases were at the time receiving consideration with a view to amendment, and in other cases the engineers were prepared to recommend amendments if such were thought desirable. The ground would therefore appear to be clear at least as regards the tariffs put forward by the large number of members who replied to the letters of inquiry.

With reference to the moral support given by the Council to the petitions against the Yorkshire Electric Power Co.'s Bill by certain municipalities, as set forth in the last report, a communication was subsequently received from the Association of Electric Power Companies in which it was suggested that the I.M.E.A. had not realised that the Yorkshire Electric Power Co. were only seeking to get lighting powers in the areas in which under their existing Acts they could already supply power. This materially altered the position, and steps were at once taken to make it clear that if the I.M.E.A. had been informed at the time as to the limits of the powers sought by the Yorkshire Electric Power Co., active opposition would probably not have been given.

The Tungsten Lamp Association invited the Council to send representatives to form a joint committee to discuss the outlines of the specification proposed to be put forward by the Tungsten Lamp Association. As the Council was already represented on the Sectional Committee of the Engineering Standards Committee dealing with a similar subject, they did not see that any useful purpose would be served by meeting the Tungsten Lamp Association, bearing in mind the views which the I.M.E.A. representatives held on the matter.

The Council records with satisfaction and pleasure the honours conferred upon Mr. J. F. C. Snell, a past president of this Association, his Majesty the King having bestowed knighthood upon him in recognition of his services to the electrical industry, and the Institution of Electrical Engineers having elected him as their president.

The Council has had under consideration the action of the Local Government Board in refusing loans for extensions, etc., owing to the war, but felt that it could not recommend action being taken on general lines. The case of each undertaking should be considered upon its merits.

With the object of ensuring that members of the staff of electricity undertakings should not be accepted for enlistment without special permission, the War Office had been approached pointing out the desirability of preventing the depletion of the staff below the minimum necessary for the carrying on of the works of electricity departments. The War Office agreed that those who were of necessity engaged on such works were doing equal service to the country as those who had enlisted. The War Office has given consideration to the question of issuing a badge or certificate of exemption, but could not see its way to fall in with the proposal.

The B.E.A.M.A. invited the Council to appoint four members to form a joint Motor Committee. Messrs. A .C. Cramb, A. H. Seabrook, S. E. Fedden and J. W. Beauchamp were appointed to represent the I.M.E.A. The suggestion of the B.E.A.M.A. was that there should be a standard specification which should be adopted by the I.M.E.A., and that an arrangement should be made as to preferential discount to undertakings in their districts where such undertakings have the power to sell motors. The Joint Committee eventually recommended that the I.M.E.A. and B.E.A.M.A. should adopt a standard specification for direct-current motors, preferably that to be issued by the Engineering Standards Committee, and until this was issued, the B.E.A.M.A. motor specification.

Representatives of the Association attended a joint meeting of representatives of the B.E.A.M.A. and the British Engineers' Association to consider the question of the protection of British interests. Proposals were made for the formation of a Government department to be entitled the Board of Industry, or alternatively the appointment of a fully representative committee. It was decided to invite the I.M.E.A. to appoint a representative on the joint committee, one of the main objects being to secure the principle that public money should be expended only on British manufactures. Mr. A. C. Cramb (Acting President) was appointed to represent the Association.

The following resolution was passed subsequently by the joint meeting and the associations represented were asked to adopt it:—

"Resolved that this Association, fully recognising the necessity for the creation of a new Government department whose sole function it shall be to safeguard and promote the industries and commerce of the British Empire, is prepared to co-operate with those other associations who, on the invitation of the British Engineers' Association, have signified their general approval of its proposals that a scheme for the purpose should be prepared and brought before the Government."

The Council appointed Messrs. A. C. Cramb and Thomas Roles as their representatives on the Joint Committee, now designated the Board of Industry Committee.

The Institution of Electrical Engineers submitted to the Council a copy of a report of the Municipal Loans Committee of the I.E.E., which with slight amendment had been adopted by that body. The I.E.E. Committee was preparing a memorandum for presentation to the Local Government Board on the matter. The Council supported the recommendations made by the Institution in regard to the periods allowed for the repayment of loans:—

	Periods recommended. Years.
(*a*) Cables substantially constructed and laid ...	30
(*b*) Conduits substantially constructed	60
(*c*) Accumulators and batteries in cases where the sanctioning authority is satisfied that adequate provision has been made for the proper maintenance of the batteries	15
(*d*) Reinforced concrete	30

The Council decided to subscribe a sum of £10 10s. to the Institution of Electrical Engineers' Benevolent Fund.

The Hon. Treasurer reports for the year ended March 31st that the income from subscriptions remains normal and there is a considerable increase in the revenue from the proceedings (sales and advertisements). There is a surplus for the year of £62 against £65 last year. The total surplus of assets over liabilities is £848. So far the war has had no detrimental effect on the Association from a financial point of view.

Report of the Development Committee.

The full membership at the present time is as follows:—

I.M.E.A. Members.—S. E. Fedden (Chairman), S. T. Allen, F. Ayton, A. S. Blackman, C. McArthur Butler (Secretary, I.M.E.A.), R. A. Chattock, A. C. Cramb, Councillor Crowther, J. E. Edgcombe, Alderman Ellaway, F. M. Long, H. Faraday Proctor, H. Richardson, T. Roles, Alderman Pearson, A. H. Seabrook, Alderman Smith, W. A. Vignoles, G. Wilkinson, J. W. Beauchamp (Acting Hon. Secretary).

Co-opted Members.—Associated Municipal Electrical Engineers (Greater London), W. C. P. Tapper; British Electrical Federation, W. L. Madgen; Cable Makers' Association, L. B. Atkinson; Association of Electrical Power Companies, W. A. Chamen, A. de Turckheim; Electrical Contractors' Association, L. G. Tate; British Electrical and Allied Manufacturers' Association, D. N. Dunlop, A. J. Ireland, G. Maurice, H. C. Siddeley; Society for Electrical Development (America), F. W. Willcox.

Meetings of the Development Committee were held monthly up to the 16th of April, 1915, when it was decided that, owing to the difficulties in carrying out this class of work, brought about by the war, and the increased demand upon the time of members, the meetings should only take place approximately once in three months. Reports of each meeting of the committee are submitted to the Council of the I.M.E.A. for confirmation before action is taken.

In the first instance the following sub-committees were constituted and put in motion—

Publicity Sub-Committee. (London District.)

I.M.E.A. Members: A. H. Seabrook, A. C. Cramb (Hon. Secretary).

Co-opted Members: D. N. Dunlop, C. Palmer, W. C. P. Tapper, L. G. Tate, F. W. Willcox.

Electrical Installations Sub-committee. (Bradford District.)

I.M.E.A. Member: T. Roles (Hon. Secretary).

Domestic Appliances Sub-Committee. (Birmingham District.)

I.M.E.A. Members: R. A. Chattock, G. Wilkinson, S. T. Allen (Hon. Secretary).

Co-opted Members: N. Hyde, C. M. Shaw, T. P. Wilmshurst.

Up to date the principal work which the sub-committees have been engaged in has been as follows:—

Publicity Sub-Committee.—The preparation, in preliminary stages, of a scheme of co-operative advertising, printing, and publicity work. The Sub-Committee has interviewed advertising agents and printing firms, and obtained information with regard to the possibilities of producing publicity matter, and for bringing about an arrangement with a suitable firm for the production of such matter under the guidance of the Publicity Committee, and for the payment towards the funds of the Development Committee of some proportion of the profits which might accrue in the sale of such matter to electricity undertakings.

Mr. Dunlop, on behalf of the B.E.A.M.A., offered office accommodation, and the assistance of himself and his staff, to further these objects particularly in regard to detailed work of purchasing, distributing and collecting accounts in regard to the publicity matter. This offer has been accepted by the Development Committee.

The Publicity Sub-Committee has insisted upon the absolute necessity of providing regular funds and the establishment of at least a small paid staff whose whole time could be devoted to this class of work, leaving the members only the general direction of the publicity campaign.

The Sub-Committee directs attention to the urgent need of the provisions relating to publicity work which are contained in the I.M.E.A. Bill, and feels that its operations must be heavily handicapped until fuller powers are granted to Municipal Electric Supply Undertakings.

Communication has been opened up with the Publicity Committee of the London Electric Supply Companies with a view to combining the efforts of all classes of electric supply undertakings in regard to publicity, to avoid wasteful overlapping and bring about at the earliest moment an organised campaign for the development of public electricity service. Communications have also been received and considered from the Society for Electrical Development, New York.

Electrical Installations Sub-Committee.—In this case, operations have been very much interfered with by the present abnormal conditions, but the Secretary has reported upon the preliminary stages taken to bring together suitable men for procedure with this work as soon as possible.

For the present the Electrical Installations Sub-Committee will proceed so far as possible:—

To examine, tabulate, and describe the various methods of wiring in use, with advantages and disadvantages, with a view to bringing about any possible reductions in the cost of installation work compatible with safety.

To obtain the assistance and opinions of practical men in touch with this class of work, and to promote discussion on the subject.

To promote practical criticisms of accessories in common use, in connection with installation work, with a view to collating information which would be valuable to manufacturers and users.

To take an early opportunity of considering alternatives to the present design of plug contact for heating, cooking, and other purposes, particularly in regard to the possibilities of superseding the ordinary pin or concentric patterns by some more satisfactory form of plug contact.

Domestic Appliances Sub-Committee.—Here also, considerable difficulty has been experienced owing to the war. The Secretary has reported preliminary work done and plans for the immediate future; the proposition being to carry out various investigations with regard to hot and boiling plates, and to invite the advice and criticisms of manufacturers in connection with that subject.

The Sub-Committee's work will be devoted more particularly to points arising in connection with electrical apparatus primarily intended for domestic use, although also useable for business and other purposes. The scope of the committee's work will cover the whole of the apparatus from its connection with the permanent wiring of the installation, that is to say, from where the work of the Electrical Installations Sub-Committee would leave off.

It is suggested that the Sub-Committee shall also collect and analyse information with regard to domestic electrical appliances, their advantages, cost, etc., and that from engineers and users opinions should be sought, and all such information tabulated with a view to making it readily available to the whole of the Committee. Later, it is hoped to expand into the questions of Hire and Hire Purchase; Costs of maintenance of apparatus; and analysis of existing schemes.

The Development Committee considered a letter published in the technical Press, from Mr. C. H. Wordingham to the Secretary of the I.E.E., dealing with the question of establishing a Central Testing Institution or Proving House, and associated itself with the views expressed by Mr. Wordingham therein, but urged that the National Physical Laboratory and its existing organisation should be employed whenever possible, as further support would enable it to extend its field of operations and would have the advantage of assisting to develop a laboratory which is entirely independent of trade interests.

The standardisation of apparatus has received the attention of the Committee. It is proposed in this connection to work as far as possible in conjunction with the Engineering Standards Committee.

From time to time, the Development Committee has had under consideration the general questions arising out of the I.M.E.A. Bill, the restriction of borrowing facilities, and the difficulties arising in connection with the operation of electricity works under the present conditions, and in view of the shortage of labour. In most cases reports have been made to the I.M.E.A. Council, which body has given the matter further consideration as required.

Report of the Electric Vehicle Committee.

The work of the Committee during the year ended March 31st has covered the following:—

The method to employ in gripping the charging cable to the plug was decided upon and a complete design and specification for the plug and receptacle was published in the March issue of *The Electric Vehicle*. An application was submitted to the Engineering Standards Committee for the standardisation of this accessory, and the Sub-Committee of that body, which dealt with the matter, agreed to recommend the Committee to standardise the dimensions of the contacts, as well as to supervise the manufacture of gauges for them. Two firms in this country are now supplying the fitting in accordance with this Committee's specification.

The Committee attaches great importance to the adoption, as far as possible, of a uniform tariff throughout the country for charging vehicle batteries, and has advocated a flat rate of 1d. per unit for "off peak" supply. The list published contains the names of 105 undertakings that have adopted the Committee's recommendation on this matter.

When the Committee got fully to work, it was soon apparent that funds were necessary in order to make real progress. Up to that time what little expenditure had been necessary, was borne by the parent association. It was, therefore, decided to appeal to all electric supply undertakings for financial support, and the accounts show that the response has, on the whole, been satisfactory. The Accumulator Makers' Section of the British Electrical and Allied Manufacturers' Association contributed £50. The total received amounts to £186.

The Committee decided that it would be of advantage to adopt a definite range of charging voltage, and fixed this range between 85 and 120, which corresponds with the voltage which will take care of the charging of forty-four lead-plate cells, or the equivalent of sixty nickel-iron-alkali cells. The Committee has fixed forty-four as the standard number of cells per vehicle for lead-plate batteries.

The Committee has standardised a design for illuminated and enamel plate charging signs, and has appointed official makers for each type. Full particulars have been published.

To serve as a means of bringing before possible users the advantages of the electric vehicle, the Committee decided to publish a quarterly journal, to which it gave the name of *The Electric Vehicle*, and appointed as the hon. editor, Mr. A. H. Seabrook. At the present time, 4,000 copies are published of each issue, and a large portion of this number is mailed free to corporation officials, chairmen of committees, railway managers, engineers, and others who are interested in transportation generally. It was hoped that corporation electric supply undertakings would purchase quantities for distribution among likely users in their territories, but so far only a limited number of undertakings have made use of this potent means of building up a most remunerative business.

As a further means of drawing attention to the merits of the electric vehicle, the Committee designed and published a series of twelve publicity mail cards intended to be sent, at intervals, to possible users by electricity supply undertakings. Four thousand copies of each of the twelve cards were printed, but with regret the Committee announces that, so far, there has been only a very small demand for these cards.

At the instance of the Society of Motor Manufacturers and Traders, the Engineering Standards Committee decided to standardise certain rims for solid rubber tires, and the Committee recommends that these rims, of the sizes given below, should be used for all commercial electric vehicles:—

670 mm. 741 mm. 850 mm.
720 mm. 771 mm. 881 mm.

Joint meetings were held with representatives from the Tungsten Lamp Association, and, with the approval of those representatives, the Committee advises that lamps of the size and voltage recommended by the Engineering Standards Committee in Report No. 69 be adopted as standard for electric vehicles, and that, in view of the small consumption and the comparatively short hours of use to which such lamps are put, they be for the present coupled across a number of cells in the vehicle to give the required voltage, *i.e.*, 12 volts.

With regard to measuring instruments on electric vehicles, the Committee recommends for vehicles provided with lead-plate batteries, the use of a volt and ampere meter for controlling the charge and discharge. Where, however, it is not proposed to remove the battery from the vehicle, and where no constant attendance is provided during charging, it recommends that an ampere-hour meter should be provided in addition to the ammeter for showing the condition of the battery; suitable provision should be made in connection with the ampere-hour meter for automatically opening the circuit when the battery is fully charged. A mileage recorder is considered a necessary accessory, not only for gauging the condition of the battery in conjunction with the electrical instruments, but for keeping a record of the performance of the vehicle, and its efficiency.

In the case of vehicles fitted with nickel-iron-alkali batteries, an ampere-hour meter is the only instrument which need be provided, other than the mileage recorder.

For alarm signals on vehicles a horn, preferably of the electrically operated type, is the most suitable.

It has been arranged that the Commercial Motor Users' Association will allow the Committee a voice in all future arrangements in regard to parades of motor vehicles in so far as such arrangements apply to electric vehicles. The Association has also offered to allocate to the use of this Committee a section in the next edition of its "Night Shelter Handbook for Commercial Vehicles," in which the Committee can set forth information as to charging stations about the country, tariffs, etc., and to include a map upon which these charging stations may be indicated.

Most useful results have followed upon the continued affiliation with the Electric Vehicle Association of America, through the membership of the Honorary Secretary.

The importance of standard charging equipment and methods of charging has been recognised by the Committee, and, for some time, the Technical Sub-Committee has been hard at work upon it. A full report is in hand, which the Committee hopes to publish shortly.

The statement of accounts shows income £344, expenditure £249, and a surplus of £95 for the year.

On pages 902-3 of our issue of June 25th, we dealt briefly with the proceedings at the annual meeting, when the above reports were adopted.

Mr. S. E. Fedden (Sheffield), Chairman of the Development Committee, moved the adoption of the report of the latter, pointing out that it had been decided to form sub-committees to deal with different sections of the work, and also to proceed with the organisation of publicity work.

Mr. R. A. Chattock (Birmingham), Chairman of the Electric Vehicle Committee, who moved the adoption of this Committee's report, drew attention to the large amount of work which had been carried out in the last twelve months in standardising apparatus such as the charging plug, battery sizes, etc., and in connection with charging facilities. He hoped the members would support the journal of the Committee, of which the last issue had been taken up more readily than former ones. The electric vehicle display had been much appreciated by the members, and he hoped it would be repeated in the large towns to impress the advantages of this type of vehicle on the different industries. Many towns were contributing to the funds of the Committee, and he suggested that they should make their contributions annual ones, so as to provide proper financial support to the movement.

The report was subsequently adopted, an appreciative reference being made to the arduous work which had been done by the Hon. Secretary, Mr. Frank Ayton (Ipswich).

Amongst other matters touched on, Bailie Smith (Glasgow) dealt with the coal supply question, particularly as to the results anticipated from the Parliamentary deputation and the formation of a Committee of Members of Parliament to report to the Government.

In the interval, the Committee's recommendations have been made public (see Elec. Rev., June 25th, page 895).

Mr. Faraday Proctor also referred to the movement initiated by Mr. F. C. Raphael for providing an adequate supply of switchboard attendants to fill vacancies caused by the war, etc., and it was decided to leave the matter to the Council.

THE WORK OF THE NATIONAL PHYSICAL LABORATORY IN 1914-15.

(*Concluded from page 6.*)

The principal work of the Electrotechnics section continues to be in connection with the testing of alternating-current apparatus for power measurement. Alternating-current apparatus has been sent for test during the year requiring 6,000 amperes, and the pressures required for precision wattmeters now reach 20,000 volts. There is also a marked tendency to seek for the highest attainable accuracy in steam consumption and similar trials, a demand which is resulting in the production of special forms of integrating test meters for use in this service. An accuracy better than 1 part in 1,000 has always been aimed at in the Laboratory for A.C. power measurements, and there is no difficulty in meeting all demands in this respect.

In the measurement of electrical power by an electrostatic instrument a high resistance is placed across the voltage terminals of the instrument under test if the voltage be more than 100, and a tapping corresponding with 100 volts is connected to the needle of the wattmeter. In practice a resistance of 100,000 ohms is used for voltages up to 5,000. Tappings are made at every 2,000 ohms up to 20,000, and at the subsequent 20,000-ohm points. In this manner the fractions $\frac{1}{50}$, $\frac{1}{49}$, $\frac{1}{48}$, &c., of the main voltage down to 1 can be obtained, besides many other ratios if desired. The checking of such a resistance with low voltages is very simple, and may be conveniently done by successive substitution in one branch of a Wheatstone quadrilateral; any convenient resistances may be used for the other three branches, and balance may be obtained by a variable resistance in series or parallel with one of them. There are ten resistances of 2,000 ohms, which should all be equal, and the sum should be equal to each of the larger sections. The resistances are high, rendering that of connecting wires negligible. Absolute correctness of the resistances is unnecessary, as it is only the ratio of the different sections that is of importance.

In the current circuit a resistance is inserted which will cause the voltage drop of about two volts required to operate the wattmeter. For testing commercial instruments a range of resistances, varying from a few ohms down to a thousandth of an ohm, or less, is required, and for three-phase tests three of each size, amounting to about 30 resistances in all. It is essential that the value of these in terms of the international ohm shall be accurately known. It is, therefore, desirable that apparatus should be available for quickly verifying any of these resistances by comparison with a standard one-ohm coil whose value is known to a high accuracy. It is also essential that resistances in daily use for work of this nature should have a simple numerical value, thus saving a large amount of arithmetical calculation. Any difference from the nominal value should, therefore, be small enough to be negligible in all ordinary work. In practice the resistances are adjusted until the errors do not exceed two or three parts in 10,000, an amount which is corrected for when work of the highest precision is in progress.

The comparison of resistances such as a tenth of an ohm or a thousandth of an ohm with a standard 1-ohm resistance is a relatively simple matter when the resistances have even values. A Kelvin bridge consisting of a number of equal resistances, which need not be adjusted to any particular value, is all that is required, and during the year the design and construction of such an apparatus has been completed.

It consists of two rows of 25 resistances, each unit being 20 ohms. In general some of the resistances are short-circuited, the number depending on the ratio of the main resistances under test. The arrangement is capable of comparing two resistances whose values have an integral ratio denominated by m/n where $m + n$ does not exceed 25. For verifying low resistances of the order of 0·001 of an ohm it is necessary to use intermediate resistances such as 0·1 and 0·01 ohm, using a ratio of 10 to 1 for each step. In such measurements any errors due to inequalities among the 20-ohm resistances are cumulative. It is, therefore, necessary to adjust these to equality with a high degree of accuracy, for the error due to this cause must not exceed 2 or 3 parts in 100,000 in order that the accumulated error in a low resistance, verified in three steps, shall not exceed 1 in 10,000. Balance in the galvanometer circuit is obtained by shunting whichever of the main resistances under comparison is relatively the higher.

Two new water-tube resistances of 0·001 ohm to carry normally 2,000 amperes with an overload to 3,000 amperes have been completed and taken into regular use during the year; also a set of three 0·04-ohm tubes for 500 amperes. These complete the standard resistances required at present for large currents, and it will be of little use extending the range and building resistances for 6,000 amperes until the transformer capacity for obtaining large currents has been increased. Some useful resistances have also been made up for currents up to 25 amperes, consisting of resistance wire wound on frames, with air cooling. The wire is silk covered and again silk wound into parallel twin wires, so rendering the inductance as low as possible. Each wire is arranged to carry 0·5 ampere, dropping two volts across the terminals. As many of these lengths as necessary are put in parallel to make up a resistance of the required magnitude. They will replace the resistances which have been used hitherto for smaller currents, and which consisted of a network of some 20 exceedingly fine bare manganin wires in parallel stretched between terminals and immersed in oil. The large cooling surface and low inductance of these left nothing to be desired, but with the very fine wire transmitting heat rapidly to the oil, sufficient constancy could not be obtained, although every effort was made to protect the alloy with varnish. A gradual change has been taking place in the resistance values for several years, and it has, therefore, been decided to discard them for use in routine work, where the application of corrections is to be avoided wherever possible.

The new three-phase switch for operating the electrostatic wattmeter on three-phase circuits up to 20,000 volts has been in use throughout the year, and three-phase meters have been tested for accuracy with both their current and potential transformers. This represents a considerable step forward in assuring the highest possible overall accuracy of meters for large powers, and has also helped to accelerate the operation of testing them.

The switch, which is of a rotary type, is actuated mechanically from a distance by a flexible steel cord, by means of which the switch can be located in the danger area, and the operating handle be at the hand of the observer who reads the electrostatic wattmeter.

At present, for lack of suitable dividing resistances, it has not been possible to use this switch on circuits above 6,600 volts. Nor, in fact, have single-phase tests to the best accuracy been possible above 11,000 volts. For this reason resistances have now been put on order to increase the range of the highest precision tests up to about 40,000 volts, and at the same time to permit three-phase meters to be tested with their potential transformers up to 11,000 volts. The present dividing resistances consist of two 100,000-ohm sub-divided woven gauze boxes, each capable of use on 5,000 volts. A third one is now to be added exactly similar to the others, and, in addition, sufficient gauze resistance is on order to enable three further boxes, each of 120,000 ohms and of the same current-carrying capacity, to be built at the Laboratory.

The electrostatic wattmeter has been used now for several years with a temporary scale having an arbitary constant. Opportunity has been found in the course of the year to draw a new scale, which is direct reading. It is about 6 m. long, with 3,800 divisions each of approximately 1·5 mm., the precision of reading being to one-quarter of a division.

The new electrostatic voltmeters with light moving systems and bifilar suspensions have been constructed and tested. They have, however, exhibited an unexpectedly large contact difference of potential, which, unless remedied, would detract from the convenience of the instrument in practical use. The matter is, therefore, being looked into in order that the defect may be remedied.

A number of tests have been made on the smaller-sized switches to determine their rating. The principle followed in carrying out these tests is to ascertain the current a switch just fails to break at different voltages, and also the current which produces a "flare" on break. Curves can then be drawn connecting voltage and maximum current. Such curves show that a 50 per cent. increase of voltage is much more exacting than a 50 per cent. increase of current. In breaking a circuit with constantly increasing currents a point is reached when the arc is drawn out far enough to bridge the contacts. As a rule, when this point is reached, there is a marked increase in the tendency to flare—the arc assumes more the character of a flame, and lasts for a longer period. It will continue to break the circuit, however, beyond this point, but in double-pole enclosed switches the presence of a flaming arc on breaking is a source of danger, since short-circuits often occur through the agency of this flame; generally, therefore, the point of flaring marks the maximum possible breaking current for such switches.

Tests have been made on large current transformers up to 6,000 amperes, but difficulties arise due to lack of supply transformers which will give currents of this magnitude. Efforts have been made to determine the order of agreement to be expected in such cases when smaller currents are passed through the transformer a correspondingly larger number of times, thus working with an equivalent number of ampere turns. For precision work this method is not to be recommended, unless exhaustive tests show that it gives correct results for the type of transformer under consideration.

Measurements have been made on the skin effect in two large stranded cables about 1 sq. in. in section.

There has been a large increase in the amount of test work over the previous or any other year. For the portion of the year up to July the work was normal, and slightly lower than in the previous year. As a result of the war, however, there has been a large increase in the Admiralty work and a falling-off in the number of general tests for private firms.

Research work on the heating of buried cables has made good progress during the year. The experimental work was commenced at Bristol, a series of tests, extending over a period of three weeks, being carried out on a number of cables, of size ranging from 0·1 to 0·3 sq. in., laid direct in the ground.

The supply was alternating current, and on one of the larger cables tests were made with frequencies of 50 and 93 cycles per second.

For the measurement of the resistance of the conductor a double bridge method was used, a small continuous current being superimposed on the alternating current by means of an accumulator connected in series with the secondary winding of the transformer. This method proved to be quite satisfactory, allowing of mean observations being taken, with the portable apparatus used, to an accuracy of 0·1 per cent.

Other tests were made at St. Marylebone with some 2-sq. in. machine feeder cables when carrying their normal load of from 2,000 to 2,400 amperes, and at Wolverhampton with two cables, one laid solid in bitumen and the other drawn into a duct.

It has been possible, by slight modification of the Callendar recorder, to make it suitable for the purpose of obtaining records of the temperature of cables under normal conditions of loading. This instrument has, therefore, been purchased, and is now in use. Tests with it have already been made at St. Marylebone with a number of 1-sq. in. and 0·5-sq. in. feeder cables drawn into multi-way ducts, and at Wolverhampton with single cables drawn in and laid solid; it is now installed at Glasgow, giving records of 1-sq. in. triple-concentric cables laid solid in bitumen. The records obtained, showing the heating and cooling of the cable when carrying its normal load over a period of a week, are most interesting.

The work of laying the experimental cables at the Laboratory has been held up for the present, owing mainly to the difficulty of obtaining the necessary cable and labour.

Tests on the temperature rise in twin flexible wires have been completed, and show that very high temperatures are in some cases attained on the portion of the flexible wires nearest to the heating apparatus. This, unfortunately, occurs mainly in the case of small portable apparatus, where the mechanical strain on the wire is greater than with apparatus designed for stationary use.

Heat.—The Laboratory has adopted as its fundamental scale of temperature the Centigrade Thermodynamic scale, which is realised with the exactness required for work of the highest precision in the scale of the constant-volume hydrogen thermometer in the interval between 0° C. and 100° C. From 0° C. to the boiling-point of sulphur (444·5° C.) the practical scale is realised with sufficient accuracy by the platinum-resistance thermometer, as well as by known fixed points with which it is extended to 1,083° C. It has been found that the temperature of the boiling-point of sulphur can be realised in practice to a high degree of accuracy under widely differing conditions.

Improvements have been made in the apparatus available for resistance thermometry.

In connection with the heat losses from cement kilns, an investigation has been commenced into the loss of heat from hot surfaces, a subject on which few reliable data are available. The research includes both flat surfaces and a series of tubes of widely varying diameters. The experiments are directed to the simultaneous determination of the total heat-loss and of the pure radiation, and hence indirectly of the convection.

Results for plane surfaces of various kinds and at temperatures up to 600° C. have already been obtained by very diverse methods, and have led to interesting conclusions, some with an important practical bearing.

Although it has been known ever since the early experiments of Leslie and Count Rumford that a polished surface emits only a small fraction of the radiation given out by a black surface, surprisingly little light has been thrown on the problem of the heat dissipated by a surface since the time of the pioneer workers such as Péclet, Dulong and Petit. The effect of various paints and other coatings on the total emissivity was first investigated, particularly with a view to the possibility of diminishing appreciably by some sufficiently cheap process the radiation from a surface whose emissivity was nearly that of a black body.

As all methods of imparting to the metal a smooth and bright reflecting surface were impracticable by reason of cost, a study was made of the different processes for metallising the surface by application of metallic paint or by the new spray process.

As instances of the nature of the results obtained, may be mentioned first, that over the range of temperatures met with in steam engineering the true radiation-loss, this fraction dependent on the nature of the surface, is approximately half the total loss in pipes of ordinary iron under the usual conditions; and, secondly, that the true radiation from an iron surface may be diminished to one-half of its normal amount by suitable application of a coating of aluminium paint, and even to a less fraction by the metal spray process. These conclusions have an important application to engineering problems. Thus, for example, the useful radiant heat reaching the centre of a room from radiators round the walls is diminished to one-half of its proper value by the addition of the customary coating of aluminium paint, *i.e.*, the "efficiency" of the radiator as an emitter of radiant heat is reduced to one-half.

On the other hand, the application of metallic paint to the unlagged portions of hot surfaces, such as the boiler fronts in the stokehole of a battleship, should materially increase the comfort of the stokers, working in confined spaces, since it would diminish to half value the true radiation, which is uninfluenced by any amount of artificial ventilation.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Small Dental Motor.

A dental motor which can be held in the hand is shown in fig. 1. According to the manufacturer of the device, the SHELTON ELECTRIC CO., of 30, East Forty-second Street, New York, it is the smallest motor designed for commercial purposes ever built. The motor is 1·25 in. in diameter and 1·75 in. long, and weighs only 5·25 oz. It runs at a speed of 15,000 R.P.M., and takes a standard dental chuck, which is driven with a one-fourth reduction in speed. This reduction in speed, it is stated, is accomplished without gears or friction devices

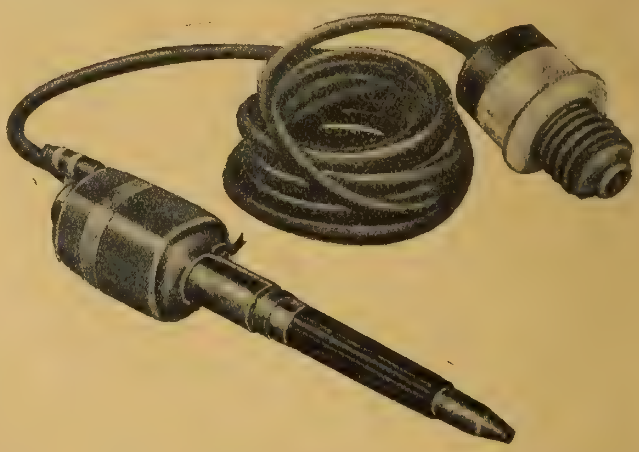


FIG. 1.—DENTAL MOTOR ATTACHED TO CORD WITH RHEOSTAT.

The motor operates on either direct or alternating current. The armature is hand-wound with No. 40 wire. Use is made of special ball bearings, $\frac{1}{16}$-in. in diameter, and the air gap between the armature and field is 0·0025 in. The switch is of the plunger type, and is operated by a lever which can be pushed back if necessary by the back of the hand. The lever can be placed in three positions, that nearest to the motor being for reverse operation, the centre position for stop, and the position farthest away from the motor for starting. The shaft of the motor is hollow, and bakelite is utilised as insulation. The motor is enclosed in an air-tight steel case.

For varying the speed of the motor a rheostat is provided, which can be placed on the floor, and can be operated by a foot-lever. In case it is necessary for the dentist to call on his patients, a rheostat similar to that shown at the end of the cord in the figure is employed. This rheostat is operated by hand.

Besides being adaptable for dental work, the motor can also be utilised for engraving, manicuring, chiropody and as a light bone drill for physicians. There is no sparking on the commutator, it is stated, and the motor takes only 12 watts. The following advantages are claimed for the device:—The motor is light in the hand, as there is practically no back drag or buckling of cable; efficient operation is obtained on account of the direct drive; and it is not necessary to place the motor on brackets, which are liable to be in the way. The motor is also well adapted for use by students in dental schools.—*Electrical World.*

Small Electric Lighting Plants.

MESSRS. WARD & GOLDSTONE, of Sampson Works, Salford, Manchester, have sent us particulars of their Mercure and Sherborne self-contained electric lighting plants, of which a pamphlet has recently been issued.

The introduction of metal-filament lamps brought into prominence the advantages of electric lighting for country houses and cottages, when a public supply was unavailable, and more recently the small low-voltage half-watt lamp has added further to the sphere of usefulness of this class of plant.

Thus under present conditions, the ¾-H.P. Sherborne electric lighting set which we illustrate, though only taking up a space of about 30 in. × 18 in. × 2 ft. overall height, will now light 16 30-C.P. 25-volt half-watt lamps, which is sufficient for a fairly large building.

The Sherborne and Mercure engines are valveless and simple in construction; the lighting sets regularly supplied are rated at (¾ H.P.) 275 watts, 600 watts, 800 watts, 1,400 watts and 1,700 watts.

In connection with these plants a series of batteries of 13 and 27 cells are listed for the 25 and 50-volt installations. Standard switchboards are also supplied, consisting of polished slate panels fitted with voltmeter and ammeter, charge and discharge switch, shunt or series regulator, main switches and fuses, and automatic cut-out or combined cut-in-cut-out.

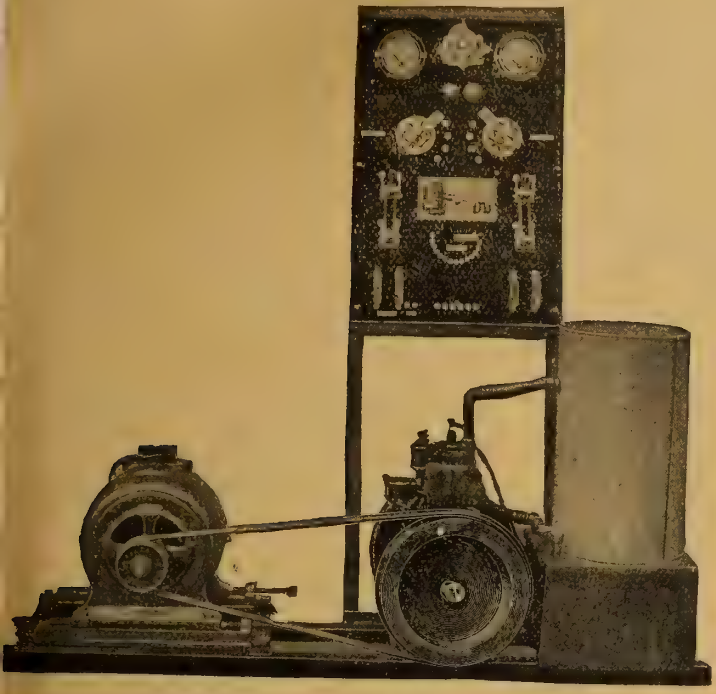


Fig. 2.—Sherborne Electric Lighting Set.

Messrs. Ward & Goldstone point out that they have supplied many of these plants to the Colonies and abroad, while a number of them are in use in this country, where there are many districts in which they can be adopted with advantage.

"Quead" Electric Fires.

Messrs. Ikin & Eads, Ltd., of 47-57, Marylebone Lane, W., have recently patented and put on the market a new pattern of heating element for electric fires, substantially built up in bar form, which is incorporated in their "Quead" electric fire. The element does not involve any new principle; it consists of a number of specially shaped moulded greyish porcelain pieces assembled on an iron spindle, and clamped between terminal plates by nuts. The porcelain pieces are shaped to form a series of open slots running half round the heating unit, and in these the resistance spiral is placed and firmly held.

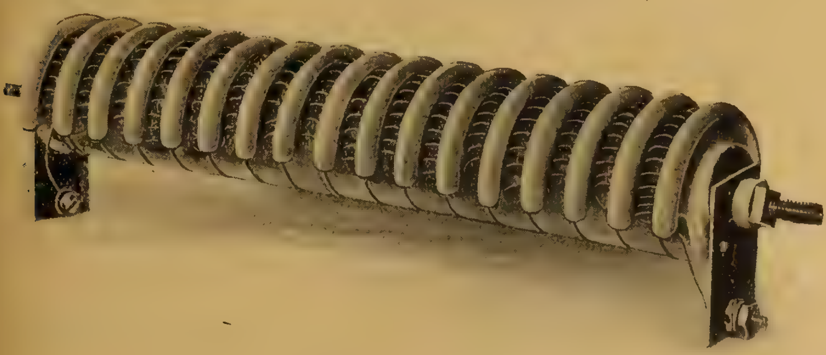


Fig. 3.—Heating Unit for "Quead" Electric Fire.]

The wire is visible, and runs at a red heat, and in turn heats the porcelain supports, giving an excellent effect.

It is claimed for the "Quead" heating unit that it is exceedingly robust, and can be roughly handled, or packed for transit without fear of damage.

An artistic range of cases in cast and sheet iron, copper and brass, bright and black steel, &c., has been designed, and the heaters are mounted singly or in sets, together with the necessary switches, to suit various requirements; we understand that examples of the above fires can be inspected at the firm's premises at any time.

Induction Pipe Heater.

A novel little electric fitting for the motor-car, described in a recent issue of the *Motor*, is an electric primer (catalogued by Messrs. Mestre & Blatge, of 20, Store Street, Tottenham Court Road, W.C.), which consists of a fibre washer with a German silver resistance wire coiled inside it. This is inserted between the carburetter and intake manifold, and is connected through a switch to an accumulator or dry cell. When the engine is difficult to start, the device is switched in, and is said to prove very effective in heating the intake charge. It is also very reasonable in price.

Table Wiring.

The accompanying illustration shows a convenient method of wiring the dining-room table to facilitate the use of electrical cooking devices.

A flush receptacle is put in the centre of the dining-room floor, and three porcelain wall sockets are screwed on the inside edge of the table. Six feet of cord, having a connection plug on one end, is run through the centre leg of the table and wired to the back of the porcelain sockets. The heating devices can then be easily plugged into the sockets.

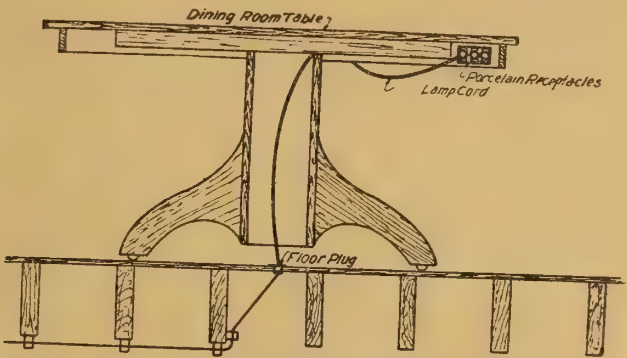


Fig. 4.—Dining-Room Table Wired: Section.

If the table has no centre leg or support, the cord can be brought from the floor and supported to some part of the table on the underside where it will be concealed by the tablecloth.

New Half-Watt Lamps.

Last week we briefly mentioned that the British Thomson-Houston Co., Ltd., had introduced a number of new sizes of "Mazda" half-watt lamps; we are now enabled to reproduce an illustration of one of these—the 100-watt 200-volt size—with a plan (fig. 6) showing the disposition of the filament in a horizontal plane. It will be noticed that the finely-spiralled flexible filament is supported at a great many points, but on the whole the construction is simple. The instruction is given that the lamp must be burned in the vertical position, as illustrated, and that the fittings must be properly ventilated. The light distribution curve of this pattern of lamp will evidently have its maxima above and below the bulb, giving a powerful downward illumination with a suitable reflector. The new sizes are: 25 volts, 15, 30, 60 and 100 watts; 50-60 volts, 30, 60, 100 and 150 watts; 100-130 volts, 60, 100 and 150 watts; 200-255 volts, 100, 150 and 200 watts—all fitted with bayonet caps except the 150 and 200-watt sizes, which have Edison screw caps. The prices of some of the lamps have been reduced.

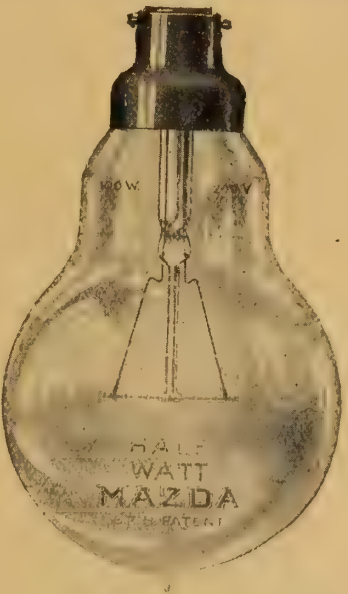


Fig. 5.—"Mazda" Half-Watt Lamp.

Similar announcements have come to hand from other tungsten lamp makers. The **General Electric Co., Ltd.**, draw special attention to the adoption of the registered name, "Atmos type," for their Osram gas-filled lamps. The **Edison & Swan United Electric Light Co., Ltd.**, send us a list of their new "Royal Ediswan" half-watt lamps, on similar lines, and **Messrs. Siemens Bros. Dynamo Works, Ltd.**, send particulars of their new "Wotan" half-watt lamps. **Messrs. Drake & Gorham, Ltd.**, have issued price lists in practically identical terms.

While we have not yet arrived at the half-watt 16-c.p. lamp for use on 200-volt circuits, it is clear that steady progress is being made in that direction; already consumers on 100-volt circuits can put up a 60-watt lamp giving nearly eight times as much candle-power as the 60-watt carbon lamp of 10 years ago, and by using a semi-indirect fitting can light a large room with it effectively. That the new lamps will increase the popularity of electric lighting cannot be doubted; and fortunately they come just at a time when, extensions of plant being barred, station engineers will be glad of their assistance in increasing their connections. But the urgent necessity of a fixed charge, plus small running charge, is emphasised by their arrival.

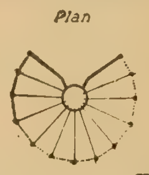


Fig. 6.—Diagram of Filament.

G.E.C. Dust Bellows.

The **General Electric Co., Ltd.**, of 67, Queen Victoria Street, E.C., have put on the market a cheap and efficient dust expeller, which is entirely British made. As shown in fig. 7, it is constructed largely of wood, and is useful for blowing the dust out of electric motors and other appliances without fear of shock, as well as for cleaning typewriters and many other kinds of apparatus.

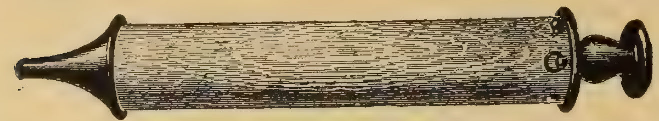


Fig. 7.—G.E.C. Dust Bellows.

Keeping Down the Power Demand.

One of the useful "wrinkles" worked out by the men of the Public Service Co. of Northern Illinois to allow rural power users to have several motors and yet pay a low connected-load charge is shown in the accompanying sketch. Here an installation is diagrammatically represented, which consists of a 3-h.p. motor, a 1-h.p. motor and a 5-h.p. motor, yet the greatest connected load that the consumer can put on the line at any one time is 5 h.p. Tracing the circuits through the three single-pole, double-throw switches, it will be seen that it is impossible to connect more than one motor to the line at a time. The same scheme can, of course, be worked out for any number of motors of any size, in each instance the maximum demand of the installation being limited to the rating of the largest machine.—*Electrical World.*

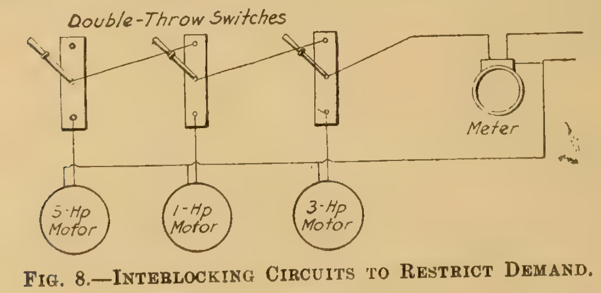


Fig. 8.—Interlocking Circuits to Restrict Demand.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

9,054. "Magnetos." M. Pedersen. June 21st.

9,085. "Electric kettles, urns, and the like." E. A. Welch. June 21st.

9,097. "Electric hot-water storage installations." E. C. R. Marks. June 21st. (Sidney le Fevre Varvel, Australia.)

9,101. "Regulating mechanism for controlling the flow of fluids." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 21st.

9,110. "Oil-cooled electric transformers." A. Duckham. June 21st.

9,111. "Systems for producing electrical discharges from a source of energy." R. Varley. June 21st. (Convention date, March 21st, 1914, United States.) (Complete.)

9,112. "Systems for producing electrical discharges from a source of energy." R. Varley. June 21st. (Convention date, July 1st, 1914, United States.) (Complete.)

9,113. "Telephone transmitters." International Electric Co., Ltd., and R. G. le Noir. June 21st. (Complete.)

9,120. "Electric meters." W. H. F. Murdoch. June 22nd.

9,141. "Apparatus utilising electro-magnets or permanent magnets for the protection of ships, harbours, and the like from torpedoes or mines." F. C. Billing. June 22nd.

9,157. "Electrodes for arc lamps." F. M. Lewis. June 22nd.

9,158. "Electric cooking." Jackson Electric Stove Co., Ltd., R. C. Griesbach, H. H. Holmes, C. H. Smith, & F. H. Williams. June 22nd. (Complete.)

9,230. "Portable telegraph and telephone apparatus applicable for signalling apparatus." W. G. Underwood & Underwood, Ltd. June 23rd.

9,246. "Electric relay." W. R. Sykes Interlocking Signal Co., Ltd., and G. H. Sykes. June 23rd. (Complete.)

9,256. "Telegraphy." D. C. Crowe. June 23rd.

9,279. "Targets for X-ray tubes and the like." British Thomson-Houston Co., Ltd. (General Electric Co., United States). June 24th.

9,282. "Means for driving dynamo-electric machines." W. Langdon-Davies & A. Soames. June 24th.

9,283. "Automatic or semi-automatic telephone systems." Relay Automatic Telephone Co., Ltd. June 24th. (G. A. Betulander, Sweden.) (Complete.)

9,330. "Lampshade and globe holders for gas and electric lighting." F. W. E. Schuer. June 25th.

9,336. "Devices for establishing electric connection between conductors." H. G. Wood. June 25th. (Complete.)

9,345. "Automatic and semi-automatic telephone systems." Relay Automatic Telephone Co., Ltd., & L. C. Bygrave. June 25th.

9,346. "X-ray devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 25th.

9,373. "Electric lampholders and incandescent lamps for the same." W. Maurice. June 26th.

9,374. "Method of and means for producing undamped or persistent high-frequency electrical oscillations for telegraphic and like purposes." J. R. Halliwell. June 26th.

9,386. "Casings for electricity meters." W. Hamilton & Ferranti, Ltd. June 26th. (Divided application on 24,792/14, December 30th.)

9,396. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. June 26th. (Convention date, June 27th, 1914, United States.) (Complete.)

9,399. "Electrical communication systems." S. Tolkowsky. June 26th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

18,357. Method of and Apparatus for Separating Suspended Particles from Gaseous Bodies by means of High-tension Electricity. E. Möller. August 12th. (August 13th, 1912.)

19,518. Circuit Arrangements for Automatic and Semi-automatic Telephone Systems. Siemens & Halske Akt. Ges. August 28th. (August 28th, 1912.)

19,732. Process and Apparatus for Electrically Separating Suspended Bodies from Electrically Non-conducting, especially Gaseous, Fluids. E. Möller. September 1st. (August 31st, 1912.)

25,391. Continuous Brakes and Controllers for the same. W. R. Smith, Wilson, and Consolidated Brake & Engineering Co. November 6th. (May 6th, 1914.)

1914.

4,237. Operation of Low-pressure Electrical Installations from High-pressure Circuits. February 18th. (February 19th, 1913.)

5,240. Means for Attaching Insulators for Electric Wires. T. Wittrin. February 28th. (March 1st, 1913.)

5,345. Reflector for Arc Lamps. H. E. Moul (Korting & Mathiesen Akt. Ges.) March 2nd.

5,467. Electric Switch Arrangement for a Plurality of Conductors, Machine or Apparatus to be connected with the same Bus-bar and adapted to be switched in and out, employing a common safety resistance. Allgemeine Elektricitäts. Ges. March 3rd. (March 4th, 1913.)

6,182. Electric-current Collectors. T. B. G. Janssen. March 11th.

6,341. Electricity Meters. Siemens Schuckertwerke Ges. March 12th. (March 12th, 1913.)

6,520. Means for Electrically Operating Railway or other Signals. Siemens Bros. & Co., and L. de M. G. Ferreira. March 14th.

8,684. Manufacture of Incandescent Electric Lamps. Electric Utility Co., & R. W. Long. April 6th.

11,097. Electric Burglar Alarm Systems. J. P. Williams. May 5th.

11,156. Connecting Arrangements for Electric Circuits. J. H. Wolliscroft & H. T. Boothroyd, Ltd. May 6th.

12,059. Incandescent Electric Lampholders. W. Adams. May 15th (November 14th, 1914.)

14,006. Construction of Electric Contact Conductors for Railway Tracks and the like. J. E. Colas. June 10th. (June 20th, 1913.)

14,022. Cooling of Electric Portable Drilling Machines. Siemens Schuckertwerke Ges. June 10th. (June 19th, 1913.)

14,030. Electric Transformers. F. E. Berry. June 10th.

14,043. Armatures of Dynamo-electrical Machines and the like. W. H Scott. June 10th

14,044. Method of Insulating Coils of Flat Conductors for Electric Machines. Allgemeine Elektricitäts Ges. June 10th. (June 10th, 1913.)

14,108. Centrifugal Compressors. British Thomson-Houston Co. (General Electric Co.). June 11th.

14,415. Dynamo-electric Machines. H. H. Jeffcott. June 16th.

14,733. Electric Switches. P. Dunsire. June 19th.

14,974. Controlling Devices for Electric Circuits. M. E. Custer. June 23rd.

17,415. Automatic or Semi-automatic Telephone Exchange Systems. G. A. Betulander & N. G. Palmgren. July 22nd.

17,797. Socket Terminals for Electric Conductors. W. A. Hill (Apparat-Bauanstalt Fischer Ges.). July 28th.

18,276. Electric Fuses or Cut-outs. A. H. Railing & A. J. D. Krause August 7th.

20,549. High-voltage Insulated Cable. C. J. Beaver & E. A. Claremon October 5th.

23,930. Selecting Devices for Telephone or other Circuits. O. Ima (Siemens & Halske Akt. Ges.). December 11th.

24,227. Number Instrument for Automatic and Semi automatic Telephon Systems. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). December 17t (Addition to 14,614/13.)

1915.

8,060. Electro-magnetic Locking Devices. L. Cadenel. May 31st (Divid application on 13,715/14. June 5th.)

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Vol. LXXVII.] CONTENTS: July 16, 1915. [No. 1,964.

Page
Electric Signalling in Mines 65
Rubber 66
The Telephone Service 67
Light from Power 67
Legal 67
Cracked and Seized Pistons on Diesel Engines (*illus.*) 70
War Items 72
Correspondence—
  Pocket Dry Batteries 73
  Gas *v.* Electricity 73
Business Notes 73
A Low-Priced Electric Vehicle (*illus.*) 79
The Central Power Station of the Randfontein Estates, by R. Turnbull Mawdesley (*illus.*) 80
Notes 83
City Notes 86
Stocks and Shares 89
Electric Tramway and Railway Traffic Returns 90
Share List of Electrical Companies 90
New Russian Customs Tariff (*concluded*)... 91
An Investigation of Dielectric Losses with the Cathode-Ray Tube, by John P. Minton (*illus.*) 91
Societies and Institutions 93
Units from Refuse, by A. J. Abraham 94
New Patents Applied for, 1915 96
Abstracts of Published Specifications 96
Contractors' Column ... ... Advertisement page xviii

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ELECTRIC SIGNALLING IN MINES.

THE report of the investigations made by Dr. R. V. Wheeler into battery bell signalling systems and their dangers, which we recently reproduced in abstract, amply supports his original conclusions regarding the risks attending the unregulated use of electric bell signals.

The series of experiments on the influence of pressure, current and self-induction on the igniting power provides some interesting results. Unfortunately, Dr. Wheeler contented himself with merely tabulating and plotting the results of his experiments. He has failed to notice that his curves follow a simple law which has a physical significance, and which gives order and coherency to an otherwise unintelligible and apparently disconnected series of results. Plotting igniting current in amperes against self-induction in henries, a series of curves is obtained. Now, it has been remarked by Prof. Thornton that similar curves obtained by him are curves of approximately equal energy —"iso-energetics" we may call them. The curves given in Dr. Wheeler's report actually follow a law of the form $Li^{1{\cdot}54}$ = a constant. The value of the constant depends on the percentage of methane, but does not appear to be any simple function of this percentage content, though it diminishes steadily as the mixture becomes more sensitive.

Hence we may say that the igniting power of a break-flash depends upon the $Li^{1{\cdot}54}$ of the circuit, or, approximately, the $Li^{\frac{3}{2}}$. There is, of course, much *a priori* reason to expect that the igniting power of a spark should be proportional to the energy of self-induction liberated, and although these experiments do not quite give an igniting power proportional to $\frac{1}{2}\,Li^2$, yet they distinctly suggest that it is rather to the *energy* stored in the circuit than to the current or voltage, or even the self-inductance, that we must look to obtain the igniting power of a break-flash. In this connection it is curious to note that Dr. Wheeler's results for 6 per cent. methane may be represented by the formula $(L - 0{\cdot}0065)\,i^2 = 0{\cdot}0141$, almost as accurately as by $Li^{1{\cdot}54} = 0{\cdot}0219$—a fact which would suggest an igniting power proportional to the energy, but with an unrecorded capacity in the circuit. No such formula can be found for the other series of values, which follow the $Li^{\frac{3}{2}}$ law very consistently.

The conclusions drawn from these experiments may thus be re-stated simply as follows:—For every gaseous mixture there is a constant value of the product $Li^{\frac{3}{2}}$ beyond which the break-flash will be capable of igniting the mixture. This is certainly more scientific, and appears to us to be far more easily handled than the cumbrous circumlocution of the summary in the report.

The experiments with bells were conducted with a view to reducing the two factors which had been discovered in the preceding experiments to affect the igniting power of the spark, viz., self-induction and current strength. A large number of bells were examined, and all were found to be capable of giving a dangerous break-flash when used with a battery of 10 wet Leclanché cells (15 volts). Still more dangerous were the break-flashes obtained by using dry cells, owing to the smaller internal resistance and consequently larger value of the current. In the majority of cases, however, sufficient non-inductive resistance could be introduced into the circuit to reduce the current available at the break-flash below the minimum igniting current without seriously affecting the ringing power of the bell. Why Dr. Wheeler suggests a winding of brass wire of the same section as the original copper wire, instead of an equally suitable smaller size of copper wire, is to us a mystery.

In order to reduce the effects of self-induction, various methods were tested, including the use of two windings on the bobbins, of which only one is used as the "exciting winding" for the magnet, the other being short-circuited on itself. The principle upon which this method of winding acts is that when the current passing through the exciting winding is broken, it induces a current in the short-circuited winding which absorbs the energy stored by the self-induction of the exciting winding, so that the intensity of the break-flash is greatly reduced.

A similar effect is produced by interposing strips of tinfoil between the successive layers of the winding; in the mass of metal thus introduced eddy currents are set up which absorb the energy of self-induction, which would otherwise be expended at the break-flash.

It is remarkable that the method, well-known to electrical engineers, of shunting the coils with a high resistance, to which Mr. H. R. Kempe drew attention in our "Correspondence" columns, the most obvious method of absorbing the energy of self-induction, should not have been investigated. In fact, the investigations seem to have suffered throughout from the overlooking of the fact that it is the *energy* of the circuit that has to be dealt with, and not the current and self-induction separately. The condenser-shunt method of reducing the sparking energy has been tried by Mr. T. G. Watts (see abstract of paper in Electrical Review of January 1st, 1915), who found that with an ordinary rubbing contact "the introduction of a condenser across the knocking-wires had some peculiar physical influence on the spark," and he adds: "One can only conclude it to be a matter of temperature." Such a remark as this shows very clearly that the function of the condenser was totally misunderstood, and that the experiments were conducted on the "hit or miss" plan rather than on sound scientific principles.

However, Mr. Watts discovered that although putting a condenser across the bell spark gap converted an otherwise unsafe bell into a safe one, and that with rubbing contacts equal safety was obtained in the line wires, yet when the usual method of shorting the wires by means of a file or knife was resorted to, the condenser system proved to be useless.

Another method of reducing the igniting power of the break-flash, which has been found successful by Mr. Watts, is that of the introduction of relays. A relay may, of course, be actuated by a very small current, and the sparking at the contacts will in this case be mild. But Dr. Wheeler adopts the remarkable attitude towards relays indicated by these lines, quoted from the last paragraph of his report:—"All the considerations advanced in this report respecting bells apply, probably with equal force, to relays. *A relay, if introduced into the signalling system, simply takes the place of the bell, and from the point of view of danger at the break-flash on the signal wires, can be regarded as a bell.*" Such a confession of want of knowledge of the function of relays would be amusing, were it not for the fact that on such investigations as these depend the regulations governing safety in mines. The chemical portions of this report are no doubt of the utmost value, but its many shortcomings on the physical side only serve to emphasise the inadvisability of entrusting electrical investigations of such vital importance to chemical experts.

Dr. Wheeler is a distinguished chemist, with a certain amount of electrical knowledge, such as every competent chemist must possess nowadays; but he is clearly not an electrical expert, for a perusal of his report shows plainly that a large proportion of his experiments were conducted over ground which was already familiar to electrical men, and some of his "conclusions" could have been written down by an electrical engineer without recourse to experiments, whilst others would not have been included at all.

Rubber.

There has been quite a cheerful tone in the rubber market lately, and under the influence of decidedly good buying, a considerable proportion of which is attributed to the United States, prices have moved upwards to an appreciable extent, and the market looks good at round the current enhanced values, which have been established in the neighbourhood of 2s. 7½d. for early delivery of the usual standard grade of plantation material. There is no mistaking the activity of consumption in all directions, the destructive use of rubber in the war being one of the most striking features of the industrial situation. There is a good deal of truth in the assertions which have been made that the war will ultimately be settled by the Powers having the best supplies of rubber and motor spirit, and if these really prove to be the ultimate factor, there can be not the slightest question as to the triumphant progress ultimately of the forces of the Entente Powers over the disturbers of peace of Central Europe. Not only have manufacturers in all directions been busy laying in supplies of crude rubber, but there seems to have been some sort of speculative account in the market, the instigators of which, frightened by the rising wave of buying, were forced to come in and cover, thus assisting the progress of the upward movement. War requirements are absorbing enormous quantities of material, and all indications point to a still further burst of buying as the war nears the more critical stages. The American trade is benefiting enormously from orders for Britain, France and Russia for tires, and in all parts of the country plants are engaged at the utmost capacity of production. One order recently placed with an Ohio factory was for half a million dollars' worth of solid rubber tires on behalf of one of the Allied Governments, this coming on top of an order for a similar value, while inquiries for still larger quantities than ever hitherto placed are now being dealt with.

As regards fine hard Para descriptions, these are being rather lost sight of in view of the growing popularity of the plantation product, and business is reported to be quiet in all connections, but in sympathy, of course, with the firmer aspect of the market, for the latter prices have undergone a moderate hardening process. The statistical position taken generally may be regarded as quite satisfactory, and latterly there has been an encroachment upon the home stocks which last month fell to about 8,250 tons, a total which compares with 5,700 tons last year, and 6,500 tons in 1913.

Official advices received from Kuala Lumpur announce that the export of plantation rubber from the Federated Malay States during the month of June amounted to 3,403 tons as compared with 2,708 tons in May last and 2,306 tons in the corresponding month last year.

The following is a comparative table showing the export for three years:—

	1913.	1914.	1915.	
January... ...	2,131	2,542	3,473	tons.
February ...	1,757	2,364	3,411	,,
March	1,737	2,418	3,418	,,
April	1,626	2,151	2,777	,,
May	1,225	2,069	2,708	,,
June	2,005	2,306	3,403	,,
Total ...	10,481	13,850	19,190	,,

The Telephone Service. An editorial in the *Telegraph and Telephone Journal* for July takes us to task for our comments on the conduct of the London telephone service; the article is somewhat belated, as our remarks were published on May 21st, but we feel bound to take exception to some of the points which are raised in it.

The difficulties alleged to be "created by the Board of the late National Telephone Co. in its later years, with regard to the development of the telephone service after 1911," ought rather to be attributed to the policy adopted towards the company by the State; we may remind our contemporary of the French saying, which we paraphrase: That is a wicked company; if you attack it, it defends itself! "We have no wish to urge that the Telephone Service in London is perfect," says our contemporary, with commendable restraint; and it candidly admits that the erratic disposition of the connections between subscribers and exchanges in London arose out of the competition between the Post Office and the Telephone Co.—a competition which, in our opinion, was ill-advised and contrary to the public interest.

The *Journal* digresses to point out that a change of number would have been essential if we had installed a private branch exchange; this is wholly beside the question, but if the case had arisen it would have been due to our own initiative, and we should have had no ground for complaint. What we objected to was a change of a long-established number at the initiative, and to suit the convenience, of the Post Office, regardless of our wishes.

As for the concluding reference to our "suggestion that the present change was made as a reprisal because of past warnings and criticisms of the Telephone Service" in our columns, we emphatically repudiate the "suggestion," which emanates solely from our contemporary. We never looked upon the matter in that light, and we fail to see how our comments can be distorted to produce such an impression.

Light from Power. The report of a case recently decided before a Scottish Court, which we publish herewith, will be read with keen interest by supply authorities. It is, we believe, the first instance in which the question, often raised, has been put to the test, namely, whether a consumer who uses a motor-generator to supply current for lighting his premises can lawfully claim to be charged for energy at the power rate.

On several occasions our Legal Contributor has dealt with the matter, his opinion being that as the energy is used for lighting purposes, the lighting tariff applies, and this view, of course, is endorsed by every station manager. As a matter of equity, we have no doubt that this is the correct view to take, the interposition of the motor-generator being merely a mechanical quibble; the rotary machine, in fact, is in effect precisely equivalent to a stationary A.C. transformer, and no one would seriously maintain that energy used for lighting through the intermediary of a transformer could be regarded as energy for motive power. The Scottish magistrate appears to have been influenced by the fact that the current used for lighting in the case under consideration was generated quite separately from the current used to drive the motor, losing sight of the fact, obvious to an electrical engineer, that the commodity supplied and charged for was not *current*, but *energy*, which flowed in a continuous and unbroken stream from the supply mains to the lamps. We feel sure that if the case could be re-tried, and if this aspect of the matter were properly presented to the Court, the decision would be reversed.

The point is explicitly covered in the London Electric Supply Act, 1908, Sec. 7, which states that "the expression 'power purposes' shall include all purposes to which electrical energy may be applied other than for use *either directly or indirectly* for lighting," and a penalty is prescribed for the use for lighting of a supply given for power purposes under this section. A clause in Sec. 18 of the Electric Lighting Act of 1882 forbids undertakers "in any way to control or interfere with the manner in which electricity supplied by them . . . . . . is used." How this clause would be interpreted by the Courts in this connection we cannot say; it has never been put to the test.

LEGAL.

Adams & McLean v. Adnil Electric Co., Ltd.

In the City of London Court, on July 9th, before his Honour Judge Rentoul, K.C., Archibald C. Adams and Alexander McLean (trading as Robertson & Adams), Glasgow, sued the Adnil Electric Co., Ltd., for £7 2s. 11d., for an allowance as specified in a written agreement in April, and for electric lamps supplied.

Mr. Solomon, defendants' solicitor, said the action ought never to have been brought. The claim was brought under a contract by which the plaintiffs were to act as agents for the defendants in Glasgow, and one clause of the contract specified that in the event of a dispute arising the matter should be referred to arbitration. As a matter of fact, both the parties had appointed their arbitrators, and therefore he asked that the action should be dismissed.

Mr. Adams, one of the plaintiffs, said they had submitted other matters to arbitration, but that had nothing to do with the dispute before the Court, if it could be called a dispute. In his view there was no dispute, because the plaintiffs were employed to act as agents for the defendants, at a salary of £100 a year. That salary was payable monthly, and it was for one of those monthly payments that the present action was brought. The plaintiffs were electrical engineers, and he could not understand why the defendants were refusing to pay.

Judge Rentoul said it was pretty plain according to the agreement that if a dispute arose it was to be referred to arbitration.

Mr. Solomon said his case was that the contract was terminated by the end of March by verbal arrangement.

Mr. Adams said that the plaintiffs had been carrying out the defendants' commands as late as last month. They could not be out of the defendants' employment if that were the case.

Judge Rentoul did not think that the failing to pay wages was a dispute, but arbitration would be a much more satisfactory tribunal than that Court. He would send the case to arbitration and remit the costs. Plaintiffs should have had a lawyer.

Mr. Adams: Good gracious! The lawyers would have laughed at me.

The **Judge** said the action would be dismissed.

Mr. Adams urged that as the agreement was for four years defendants must pay his salary. A dispute must be a contention, and there must be an agreement. He knew of none.

Mr. Solomon added that plaintiffs discontinued acting for the defendants in March. It was mutually arranged in December that it should be so. The agreement stated that if the plaintiffs did not do £4,000 worth of business in electrical goods the agreement would lapse at the end of any one of the four years. Owing to the war, the receipts last year were £1,300, and when plaintiffs and defendants met in December the agreement was annulled, so that the plaintiffs could get other agencies. Defendants thought they were meeting the plaintiffs by giving them that opportunity.

The case was sent to arbitration.

The Burgh of Alloa v. Alloa Theatre Co., Ltd.

In Alloa Sheriff Court, on Wednesday last week, **Sheriff-Substitute J. Dean Leslie** heard expert evidence in the action at the instance of the Provost, Magistrates and Councillors of the Burgh of Alloa against the Alloa Theatre Co., Ltd., trading at the Pavilion, Alloa, for payment of an account for a supply of electricity during the month of March.

Mr. Charles Thomson, town clerk, appeared for the pursuers, and Mr. John Reed, solicitor, for the defenders.

The first hearing of the case was reported in our issue of June 25th, page 885; it was agreed that an expert witness should be heard on either side.

Mr. James Edward Sayers, electrical engineer, Glasgow, who appeared on behalf of the Alloa Town Council, said he had had considerable experience in supplying electrical energy for both power and lighting. He visited the property of the defenders, and inspected the arrangements in use for the electrical energy supplied by the Burgh of Alloa. The service from the street was a three-wire service. Two of the circuits were connected with the 220-volt terminals, and one was connected with the 440-volt terminals. The two 220-volt circuits were connected with the lamps for the general illumination of the building. The third circuit was connected to a pressure transformer. At one side this pressure transformer was supplied at 440 volts, and from the other side current was taken at 60 volts. On this low-pressure circuit there were connected two arc lamps, one lamp belonging to the bioscope and one being an ordinary arc lamp for illuminating the stage.

Mr. Thomson: What has been your experience in the installation of these machines?—They have always been put in for arc lamps which require 60 or 65 volts, and where the pressure of supply has been very much higher, and they have always been put on the lighting rate.

Are you aware that there are differential rates charged for lighting and power?—Yes.

On what are they based?—On a consideration of cost of production, which is governed by long-hour consumption for power and short-hour consumption for light.

What is the difference between a motor-generator and a pressure transformer?—A motor is a machine which you supply with electrical energy at one end to produce rotary motion, which is used to drive machines, shafting, or anything that requires motion. A pressure transformer is a machine into which you lead electrical energy at a certain pressure at the one end, and at the other end electrical energy of another pressure is delivered.

Cross-examined by **Mr. Reed**: Suppose that instead of reducing the voltage we used this generator for the purpose of producing a new current, do you call that a transformer?—Yes.

Is the current registered by the 440-volt meter taken to the motor?—Yes.

Is it not the case that the whole of the current registered by the 440-volt meter in the case of the Pavilion is consumed by this motor?—It is.

Is it not the case that this motor is used for the purpose of driving a dynamo?—It is.

Is it not the case that it is this dynamo which produces the 60 voltage, and is not the current produced by the dynamo entirely different from the current supplied by the Corporation?—It is.

So that the theatre company's dynamo is driven by the current supplied to this motor?—Yes.

Do you mean to say that this current that passes through to the bioscope comes from the Corporation main?—No.

What becomes of the current supplied by the Corporation?—It is used in the motor.

And the current used in our bioscope has nothing to do with the Corporation current?—You cannot get it without the Corporation current.

If we put down a gas engine to drive the dynamo, could we not get electric current?—Yes.

Then the Corporation current is in no sense necessary to produce the current used in the bioscope?—No.

Is it because of the use of what is produced for the bioscope that you say it is light?—Yes.

We use the Corporation current in the same way as any other person getting it for power purposes?—Yes, up to the end of the motor.

And then the Corporation current is all consumed by the time it comes to the end of the motor?—Yes. It is transformed into mechanical energy.

Is it your suggestion that if you have a dynamo driven by a steam engine you are simply altering current?—No.

Does it make any difference, if you make your own current, whether you make it by gas or electricity?—Certainly not.

Supposing we put in a gas engine, should we be using gas for power or for lighting then?—For lighting, because you are using it during lighting hours.

If we use this current for 10 hours a day?—That would be lighting.

Then time has nothing to do with it?—It supplies light at the other end.

We have two arc lamps?—Yes, one for the bioscope, and one to illuminate the stage.

Is that second lamp used for lighting the theatre in any way?—I have not seen it used, but the attendant said it was used for stage effects in the same way as limelight.

Mr. Nicol Paton, electrical engineer, Glasgow, was then examined on behalf of the defenders. He maintained that the current produced by the generator was not what the Corporation supplied. It was wholly generated on the premises by the generator, and was not simply the Corporation current altered. The current from the Corporation entered the motor and left it again, going back to the Corporation main. The current used in connection with the bioscope could be produced by gas plant driving the dynamo. None of the current passing through the 440-volt meter could be used for lighting.

Mr. Thomson, after further evidence, addressed his Lordship, stating that even although the defenders were entitled to power rate, the Corporation were entitled to make their own charges so long as they did not exceed the maximum rate laid down in the Provisional Order. The **Sheriff**: Could you charge at a different rate from what you advertise?—**Mr. Thomson**: We might. The **Sheriff**: Where is your authority for that?—**Mr Thomson**: There is nothing in the Act or Provisional Order to restrain the Corporation from charging any rate provided they don't exceed the maximum price contained in the Order, which is 8d. per unit. They have a discretionary power to make special charges as they may determine.

The **Sheriff**, without calling upon Mr. Reed, decided in favour of the defenders, with expenses against the Corporation. Both expert witnesses, he said, were perfectly clear in stating that the energy was supplied by the Corporation to drive the motor, and there the current stopped. He had no difficulty whatever in arriving at the conclusion that the rate that should be charged should be power rate. There was nothing to show that the circumstances of this motor were any different from any other motor. If the burgh had chosen to say that one kind of motor was to be charged at a different rate from another, that might have entered into the question. They did not advertise that, however, and therefore they must allow a universal rate.

LUNDBERG & SONS v. WESTERN ELECTRIC CO., LTD.

In the Chancery Division on Friday (July 9th), Mr. Justice Eve heard the motion in this action. Counsel for the plaintiffs said the action was for alleged infringement of a trade-mark. Defendants had agreed to treat the motion as the trial of the action, and would submit to a perpetual injunction in the terms of the notice of motion. They would also pay the costs, and would be allowed to dispose of a small quantity of goods in their possession which bore the infringed trade-mark.

Counsel for the defendants assented to the arrangement, and his Lordship made the usual order.

HAMILTON v. MARCONI'S WIRELESS TELEGRAPH CO., LTD.

The action of Mr. John Wm. Hamilton against defendant company, with whom he formerly held an appointment as "sole agent" to recover certain commissions and royalties, came before Mr. Verey, one of the High Court Official Referees, on Monday, July 12th, having been remitted from the Court of King's Bench for inquiry as to damages on a verdict by a special jury in plaintiff's favour.

Mr. Gordon Hewart, K.C., and Mr. Eustace Hills appeared for the plaintiff, and Mr. Ernest Pollock, K.C., with Mr. Stewart Bevan, for the defendants.

Mr. Gordon Hewart, K.C., in opening the plaintiff's case, said that the plaintiff had for some years prior to 1910 had to do with wireless telegraphy in Australia and the South Pacific, and in May of that year he entered into an agreement with the defendant company, whereby he became, for certain purposes and upon certain terms, their sole agent. In 1913, as plaintiff alleged, the defendants wrongfully put an end to that agreement and wrongfully dismissed him from his position, and, accordingly, by writ issued on September 1st of that year, plaintiff commenced action against the defendant company, claiming, amongst other things, certain remuneration, damages, and an account. Ultimately, that action came on for trial before Mr. Justice Avery and a special jury, and after a trial extending over 15 days, it came to an end on March 24th of this year. The jury found entirely for the plaintiff, and awarded him certain damages. But that verdict did not dispose of the matter, because on March 24th, 1914, just about a year before the verdict, an order had been made by the Master in Chambers providing for two things. It was ordered that all matters of accounts should stand over until after the trial of the action, and that the discovery of documents required should stand over also. Those matters were not, therefore, submitted to the jury, but the taking of the account was directed. What remained to be dealt with were the questions which the verdict of the jury did not deal with, and the matter was not quite simple owing to the difficulties which the plaintiff had experienced in obtaining discovery of documents from the defendants. Notwithstanding repeated applications, even up-to-date the discovery was still incomplete. He would not dwell upon the qualifications of the plaintiff, but would at once refer the Court to the agreement made between the parties as contained in a letter dated May 11th, 1910, addressed to the plaintiff by the deputy manager of the defendant company, in which he said that the company accepted his services as sole agent for the Colonies and various places abroad. It was understood that the agency should date from May, 1910, and continue for three years, subject to determination in May, 1911, by either party. It was also stipulated that should the result of the business prove satisfactory the engagement should be for three years certain, with the option of continuing it for another three years. In consideration of the plaintiff agreeing to devote his whole time to the service of the company, he was to receive a commission of 5 per cent. on the gross value of all contracts within the area mentioned, and it was agreed, in the case of shipping contracts, that a sum of £10 per ship should be paid in addition to 5 per cent. on the amount of subsidy paid by the shipowners to the company. All payments in respect of commission were to become due as received by the company, and the £10 per ship was to be paid at the date when the contract was signed by the company. The company also agreed to pay £50 a month as a contribution towards plaintiff's expenses, and in the event of the grouping of the Pacific Radio Co. he was to be offered the position of managing director in that company. The accounts with which the Court was concerned were the accounts relating to, and arising out of, first, the 5 per cent. commission on the gross value of all sales effected, which it was alleged the company had not paid, and, secondly, in relation to the 10 per cent. per ship in respect of ship contracts, in addition to the 5 per cent. Then the plaintiff by his statement of claim said that he had conducted negotiations and had rendered services in procuring business in South Africa, and asked that an account should be taken of all sales that had taken place within that district, and for payment of 5 per cent. on the gross value of all sales in South Africa. The plaintiff was summarily dismissed by the defendants in January, 1913, and he was dismissed upon what the jury had found to be an insufficient pretext that he was doing other work. In 1912 the defendants made arrangements to join forces with the Australian Wireless Co. That was to be done by the creation of a new company to take over the business of the Australian Wireless Co. and the business of the defendant company in Australia and New Zealand. This arrangement having been made, the defendant company found occasion to dispense with the services of the plaintiff, by which he was deprived of two things, one of which was the prospect of a renewal of his agreement for a further period of three years, and of his commission. The verdict of the jury had left undecided the 5 per cent. on the gross value of sales effected, the payments on the shipping contracts of the £10 per ship, and the 5 per cent. commission on the payments by the Shipping Companies. There was also another matter connected with the business in South Africa. Council then dealt in detail with the various items of the plaintiff's claim, and added that plaintiff alleged that on or about October 23rd, 1911, it was agreed through Mr. Godfrey Isaacs, the managing director, that the plaintiff's authority should be extended so as to include South Africa, and the jury had decided that question in favour of the plaintiff. Upon the part of the case relating to the 5 per cent. on the gross sales, certain points were decided in the course of the action. First of all, the Judge determined a point as to the meaning of the term gross values. For instance, there was an item of four stations sold to the Colonial Office for Fiji, and it was decided that the gross value meant the contract price. Another term in the contract was interpreted in the course of the action—the meaning of 5 per cent. payable on the gross value of all sales effected by the company within territory described. The question as to what was meant by effected arose in reference to certain field stations which were sold to the Commonwealth Government of Australia. The defendants said that in fact those field stations were sold to the British Government, and that therefore it could not be said that the sale was within the territory described in the agreement. The plantiff's answer to that was that although the contract was made with the British Government, it was made on behalf of the Government of Australia, and it was held by the learned Judge that it was a sale effected within the territory described in the agreement. Accordingly, as far as those sales were concerned, the question remained to be decided as to what was the amount on which the 5 per cent. was to be calculated. Then there was the question as to what was the number of those field stations—whether it was four, or, as the plaintiff alleged, eight. Other questions which might be said to be questions of principle, were left to be decided by the Referee. For example, there were questions relating to the sale of three ship equipments to the Commonwealth Government of Australia in May and July, 1910. For those equipments the gross value was £2,050, and the commission claimed upon them was £102 10s. The question which arose with regard to that matter was this. The actual contract was dated May 19th, 1910, but the contract provided that the work was to be done and the price paid at the later date (July). Before May 19th, 1910, negotiations had been carried on, and time and labour had been spent upon them; but the plaintiff submitted that in ascertaining the date at which the sale was effected within the meaning of the agreement, they must look, not at the period covered by the course of the negotiations, but at the date of the signing of the contract, which was subsequent to the agreement with the plaintiff, and that he was, therefore, entitled to the commission. The defendants replied that the real business in relation to the sale was done at a date anterior to the date of the agreement. Another question related to the installation for a certain New Zealand battleship. That ship was, in fact, built by the British Government by means of money supplied by the New Zealand Government. The ship was to have been the gift of New Zealand to this country, and it was to have been the gift of a complete ship, not one in which there remained something to be done. Our own Government had an agreement with the defendants, by which they made a fixed annual payment for wireless installation of ships. When the wireless was installed upon the New Zealand ship our Government said that it was covered by the general agreement. The fact was that the money for it was provided by the New Zealand Government, and that the money found its way to the defendant company. The plaintiff was therefore entitled to his commission upon it. A similar question arose with regard to the ships of the Australian Navy. The Australian Government had certain ships built in England under the supervision of the Admiralty. They were paid for by the Australian Government, and were not presented to the British Government, but were kept as parts of the Australian Navy for use in Australian waters. The British Government put the wireless installation upon those ships, and the question arose as to whether that transaction did not come under the general agreement with the Marconi's company. The Australian Government had paid a substantial sum, which found its way to the defendant company, and the plaintiff said he was entitled to his commission in that case also. Those were sales of which the plaintiff knew, but there were others as to which discovery was not yet complete. He next passed to the sale of two high-power stations to the British Government by the defendant company. Those high-power stations were in connection with what was intended to be an Imperial chain of wireless stations—one of them at Singapore and the other at Pretoria—and the plaintiff said that those sales were within his territory, according to the finding of the jury, and that they were effected at the time the contract of sale was made. What happened there was that the defendants undoubtedly did not receive payment for those stations under the contract made at the time, and the reason why they did not had become a matter of history. To put it generally, the defendant company repudiated their contract, but the plaintiff had performed his part. The contract was made on July 19th, 1912. Each station was to cost £60,000, and the defendants were to have 10 per cent. royalty on the gross receipts for a period of 18 years. What those royalties might be expected to be was a matter of calculation. On the whole six stations the royalties were estimated at something between £4,000 and £30,000 a year. Even if the smaller figure were taken, and assuming that the two stations would be no more than the average, each giving a sixth of the whole, they might be expected to yield £1,300 a year, which, for a period of 18 years, would give £23,400. The royalties were only a deferred part of the purchase price of the stations. The contract was not performed, and the stations were not erected, for the reason that the defendants repudiated the contract. What happened was this: There was a provision in the contract whereby it was made to require the sanction of the House of Commons. There was no provision for withdrawal, nor was there any provision for the time within which the sanction of the House of Commons was to be obtained. After the making of the contract, and before the Parliamentary sanction had been obtained, the defendants made known to their shareholders the advantages of the contract, and immediately after that date the scandal arose as to the American Marconi shares, and a committee of inquiry was appointed. For this reason it appeared to be an unfavourable moment to invite Parliamentary approval of the contract. In the result, the defendants abandoned the contract, but the plaintiff had nothing to do with that. Afterwards when a calmer atmosphere prevailed a similar contract was made. The plaintiff said that he did his part, and was entitled to his commission, notwithstanding the fact that the defendants did not carry out the contract. Another important question for the plaintiff was the contract entered into for the sale by the defendants of their business in Australia to a new company, together with all their contracts with the Australian and New Zealand shipping companies. The plaintiff submitted that the sale was one upon which he was entitled to a commission, but the defendants said that it was not a sale within the meaning of the agreement, and that it did not take place until after the termination of the plaintiff's agreement.

Mr. Hamilton, the plaintiff, gave evidence as to the royalties he had received and those to which he considered himself entitled in respect of the installations. He said that he had done a considerable amount of work in getting the Australian Navy equipped with wireless telegraphy. In 1911 he introduced Mr. Marconi and Mr. Godfrey Isaacs to the Ministers of Defence on their visit to this country, when the question of equipment of warships with installations was discussed. He gave evidence as to the part he had taken in obtaining the contracts for New Zealand and Australia and in relation to the high-power stations, and said he was asked by the defendants through Mr. Godfrey Isaacs to stay in England to discuss the question of the Imperial chain, the result of which was that the contract was made on July 19th, 1912, between the Marconi Co. and H.M. Postmaster-General.

The hearing was adjourned.

(To be continued.)

Osram Lamp Litigation.

(Continued from page 42.)

Mr. Horatio Ballantyne was called to give evidence for the defendants. He said that in 1904 there was no manufacture in this country of incandescent electric lamps made with anything but carbon filaments. In Vienna an osmium filament lamp was made, but only on a small scale. The carbon filaments were made by the soft-paste process. The modern hard-paste process was quite different. Tungsten in a very fine condition of sub-division was mixed with a small quantity of sticky lubricating substance. It was not necessary to use a material capable of making a filament by itself. This mixture of metal and binder was rubbed together in a cup or a mortar with a pestle, and when the mixing seemed to be about complete, the substance was passed between steel rollers for the operation of calendering. Thus the material was reduced to a leathery consistency. It was then rolled up and put into the chamber of a hydraulic press capable of exerting a very high pressure. The die through which the material was pressed consisted of a diamond finely perforated, and as the filament was pressed through the die by the press it was received on to a card. By this time the filament consisted mainly of metallic tungsten, which adhered together because of the pressure to which it had been subjected in going through the die. The organic material with which the tungsten had been mixed was merely a lubricant to enable the powder to be forced through the die in the form of a filament. Having got the filament to that stage, the organic substance played no more useful part in the process.

When the filament is made by the hard paste process described, said Mr. Terrell, and is brought to a high temperature, do you consider that is carbonisation?—In my opinion, no. The proportion of carbon with the original mixture in defendants' process prior to any evaporation of the constituents of the binder amounts to about 12·29 parts for 100 of tungsten metal. There is, of course, no carbon as such present in the filament, but the constituents of the binder contain chemically combined carbon to that extent. The constituents of the binder are to a large extent volatile, and during the process of calendering, followed by the drying operation, a large proportion of the volatile matters are expelled so that of this 12·3 per cent. of carbon, which they originally contain, only about 2 per cent. of carbon is left before any heating takes place at all beyond the drying. Proceeding, witness said that on heating in the furnace, the amount of carbon left became only about 0·2 per cent., so that to him, as a chemist, the production of 0·2 per cent. of a substance, which might be called carbon, out of 12·29 per cent. of carbon was not carbonising, in the sense in which any scientiest, skilled in this art, would have understood it in 1904.

Later, witness said that he had made a filament by the soft-paste process, which he understood the specification sued upon to mean. He used tungsten of collodion, which he denitrated before carbonising the filaments. After carbonisation the filament contained 8 per cent. of carbon. The filament was then brought to a state of bright incandescence in an atmosphere of moist hydrogen. After the carbon had been burnt out the filaments were left more or less of a porous character. In making these filaments he passed direct current through them. The first time he saw filaments treated in bulk by external heat was in 1913, and he was greatly surprised to see filaments produced in that way with such fine results. In the specification sued upon the process described was substantially the process described in Welsbach except that tungsten was substituted for osmium. In his view, the conditions laid down in Just and Hanaman involved a soft-paste process.

Is there anything, inquired counsel, resembling Pope's process, either in the plaintiffs' specification or in the Welsbach specification, or in anything you have ever seen?—There is no real resemblance between the Pope process and the process described either in Welsbach or in the plaintiffs' specification.

Proceeding, witness said defendants' process differed from the process in Just and Hanaman or in Welsbach by the very small quantity of binder used, in the difference from the industrial point of view of the process and plant used in preparing the filament, and by the continuous working of the furnaces.

This continuous working of the furnaces prevented any adventitious moisture getting to the filaments, as it was said to do in the "Z" case. Moreover, if the specification sued upon were wide enough to include hard-paste filaments, there was no sufficient description to enable him to make a filament with zinc-chloride cellulose.

You did your best, suggested Mr. Terrell, and so far as following the directions given in the specification went you utterly failed, but after a good deal of practice and bringing the knowledge up-to-date, in one or two cases you succeeded in getting some sort of a filament?—Yes.

Have you tried cupro-ammonia cellulose and tungstic metal?—Yes, and I agree that they would fail with hard or soft paste; but with hard paste I think I could make something if you do not tie me down to using a binder at all, but taking a little water and squirting the mixture.

Now assuming that you use the class of binding media referred to in the specification sued upon and produce a filament, is the equalising process a necessity?—To get a good filament, yes, because the filament after decarbonising is a very porous irregular filament, and, in fact, when you switch on current so as to make it incandescent, you see as a rule spots of bright and dull illumination. That is not satisfactory in a filament, and to remedy the defect equalisation of some sort is necessary.

Witness was then cross-examined by Mr. Walter. He said he did not know that Welsbach had used gum for his binder in 1904. In a subsequent specification for making a filament of oxide and metal, Welsbach did suggest gum.

As you make a material stiffer, suggested counsel, the pressure required to squirt it becomes greater?—If you start at the soft paste stage you can increase the thickness of your paste over a large range of consistency, and still be able to extrude it through the jet by means of the usual apparatus and get a filament. But the apparatus sets a limit to the increase of stiffness to which you can go.

With soft paste you simply use materials, pressures, and so on of a strength requisite to squirt a very soft plastic material?—Yes.

In the other you use the identical apparatus strengthened?—No. Whether you look at the process from the practical, the technological, or the scientific standpoint they are two totally different things.

In 1904 was what you now know as the hard-paste process perfectly well known?—Not to my knowledge.

Take Welsbach 13,116 of 1898; he is directly telling you to keep down your binding agent as well as you can?—Yes, but not for making a metal filament. This is a composite filament composed of oxide of thorium with so much metallic tungsten as will make it conductive. Witness added that he did not say that there were not in 1904 known methods of making stiff mixtures of materials which were used to form into rods.

Should I be wrong, inquired counsel, in saying that from 1898 to 1904 there were an immense number of people at work on filaments?—There certainly were a large number of specifications published between those dates.

From 1898 to 1904, although the suitability of tungsten was well known, nobody has described how to make up a tungsten filament by a built-up process?—No.

Gulcher used another metal of the platinum group, and he pointed out that for the purpose of sintering a metal filament there was no need to use an electric current?—Yes, in the preparation of his iridium filament.

Have you ever tested the effluent gas that passes from the bottom of the furnace in defendants' hydrogen process?—By analysis, no.

Temperatures such as you obtain in defendants' furnace are sufficient to cause steam to oxidise carbon?—I think they are.

Prof. F. G. Donnan, Professor of Physical and Inorganic Chemistry at University College, said in evidence that there was no distinction between plaintiffs' method of removing carbon from the filaments and one of those described in Welsbach. A considerable difference existed between the method of heating the filaments by current and that of heating them by external heat. Where the filaments were composed of a relatively non-coherent material heating by direct current would be the better. But in the defendants' process, when the filaments were put into the first furnace, heated up to 950° C., only the non-volatile portion of the binder remained. This was not removed by the action of steam or water vapour as prescribed in the specification sued upon.

Mr. A. C. Chapman also gave evidence. Generally, he said he agreed with what Mr. Ballantyne had said.

Mr. F. J. Gill, of Peoples Hall Works, Birmingham, said in evidence that between 1908 and 1909 he had studied the specification sued upon with a view to putting the directions given in it into practice. He used the soft paste method in his experiments, thinking that to be indicated, carbonised the filament so obtained and treated it in an atmosphere of steam and hydrogen to remove the carbon.

What was the result, inquired Mr. Hughes?—Witness: It burned out very rapidly.

What do you mean by that?—It scintillated. It oxidised the carbon particles so rapidly that it caused scintillation and the filament broke.

Cross-examined by Mr. Walter, Witness said that he knew the Osram Co. had made filaments on a large scale, but he could not tell when they started.

Did you ever make a filament under that specification?—No. I was never successful in getting a filament.

Do you know they were being made by the Osram Co. in 1908?—They were making them by a process unknown to me.

Mr. T. A. Rose also gave evidence from a filament-maker's point of view. He said he first heard of metal filaments being made in this country in 1908, or about then. For the purpose of this action he had taken the specification sued upon and tried to make a filament in the way he would have put it into practice in 1904. Without importing into the specification any knowledge of hard paste, which did not exist in 1904, he had done his best with the specification. In most cases he failed entirely. In others his results could only be called filaments by courtesy.

In your experience as a practical lampmaker, inquired Mr. Terrell, are there enough instructions in that specification to enable a filament-maker to make filaments?—I should say no.

This concluded the evidence.

Counsel having addressed the Court for their respective clients, his Lordship reserved judgment.

(To be continued.)

Bristol Tramways and Carriage Co., Ltd.

Mr. Justice Neville, in the Chancery Division on Tuesday, July 13th, sanctioned a petition by this company to an extension of its memorandum and articles enabling the company to manufacture aeroplanes, armed motor-cars and the like, and supply electricity to others.

The matter was before the Court on June 8th, when his Lordship expressed his approval of the alteration, but notice of the necessary meetings of the company had not been given in time.

Mr. Clauson, K.C., in support, stated that fresh meetings had been held, which were duly in order, and his Lordship made the order as asked.

CRACKED AND SEIZED PISTONS ON DIESEL ENGINES.

The following is an abstract of the remarks made by Mr. Geo. E. Windeler (Chief Engineer to Messrs. Mirrlees, Bickerton and Day, Ltd.) before a meeting of the Diesel Engine Users' Association last month:—

In dealing with the internal-combustion engine as a heat motor, the points of difference between it and the steam engine are considerable. In the steam engine, to obtain the most economical results, everything possible is done to keep the temperatures of the cylinder liner, piston and ports for the incoming steam, and all surrounding spaces, as near as possible to the temperature of the live steam.

Now, in the internal-combustion engine (in this particular instance I will deal specially with the Diesel engine) everything possible is done to keep down the temperature of the cylinder liner, cylinder cover or breech end, exhaust valves and exhaust passages which are in contact with the fuel or gases. In some types the pistons are water or oil cooled. In a well-designed Diesel engine 40 per cent. of the heat units admitted to the combustion space is absorbed in useful work. Of the remainder, 25 per cent. passes to the exhaust and 35 per cent. passes away to the circulating water and is lost in radiation, so that almost as much heat has to be absorbed by the cooling water as is developed in useful work; therefore special attention has to be paid to water-cooling arrangements to ensure that the circulation is thorough and that no air or steam pocketing is likely to occur, and to the arrangements to prevent short-circuiting in the water circulation, otherwise certain parts are liable to become overheated locally.

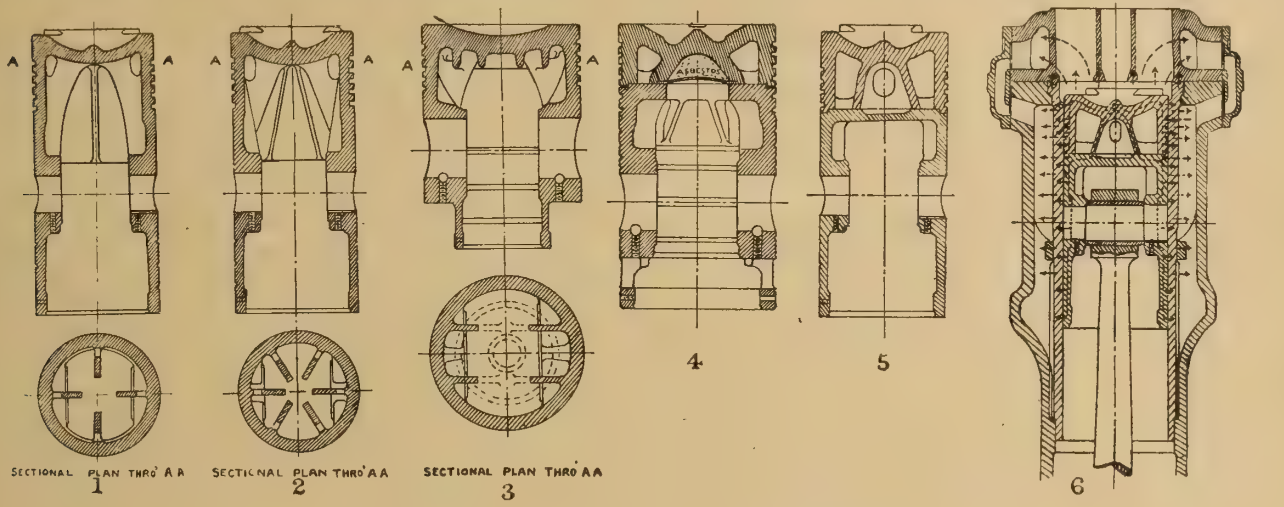
In the course of our investigations we found that the major portion of the defects that had arisen on cylinder covers and pistons was due to serious deposits having been allowed to form in the water spaces of the cylinder covers and on the cylinder liners, and ultimately we came to the conclusion that such deposits were not formed on the liners and cylinder walls during the time the engine was working, but after the engine was shut down. Naturally, the piston, cylinder cover, valves, and such parts as are in contact with the combustion space must have a large number of heat units stored in them; when the engine is shut down these heat units are absorbed by the water which remains in the jacket, the quantity of which is comparatively small, and a very considerable rise in temperature takes place, in fact, sufficiently high in the majority of cases to throw down the salts which were held in solution in the water. We wrote to the various users of our engines suggesting to them, where the circulating water was known to be of a considerable hardness, that they should run water through the water spaces for some time after the engine was shut down—with the most happy results. Most Diesel engine users have now adopted this system, to their advantage.

I have myself inspected a cylinder cover which contained a water space about 6 in. deep, and found a deposit 5 in. thick in the water space. Naturally, the cover had cracked. The aforesaid suggestion was adopted in this particular station, and the results have been very satisfactory indeed.

In an internal-combustion engine without a water-cooled piston, the heat units that have been absorbed by the piston crown must of necessity be dispersed from the crown down the body of the piston, and passed away through the liner to the water space by the contact that the piston forms with the liner. It is, therefore, necessary to study carefully the design of the piston head to obtain the best results. At the same time, the piston must be designed in such a way that the load that is applied to the crown shall be transmitted to the crosshead pin which attaches to the connecting rod, without causing any distortion of the piston, which has to maintain its roundness to enable it to work without trouble in an accurately bored cylinder.

In large engines such as we have under discussion it is necessary to have a fairly heavy section of material to enable the heat units to pass away in the time available, so as to prevent undue heating of that part of the piston which is in contact with the gases.

In fig. 1 is shown a piston with the usual dished top which is supported by four radial ribs, two ribs being carried down to the piston pin boss so as to form a more or less rigid connection between the piston crown and the piston pin, to enable the forces to be transmitted direct with the minimum amount of distortion. It will be noted that this piston is comparatively thin in the crown and in the body, and when fitted to a number of engines, was found to work admirably; but ultimately distortions appeared between the ribs, and it was deemed advisable to modify the design to that shown in fig 2, in which six radial ribs are carried well down the body of the piston from the crown, two being carried to the piston pin boss, with a thicker rib behind the main rib to assist in the transmission of the load. The piston crown was made slightly thicker, and generally this design has been satisfactory, but at times cracks have developed in the piston top; sometimes the cracks have taken a circular form round the base of the centre cone which is formed in the piston. Such cracks, however, are not of serious import, and pistons which have cracked in this manner have been in use for twelve or fifteen months without any trouble, a slight blowing taking place when starting up, which ceases after the piston top has become heated, evidently the expansion closing up the crack. But a more serious state of affairs exists when the piston cracks either radially or diametrically, as it is liable to cause seizures in the cylinder owing to the piston losing its rigidity, and consequently its symmetry. It is desirable under such circumstances immediately to shut down and remove the piston.



Figs. 1 to 6, Illustrating Mr. Windeler's Remarks.

Figs. 1 and 2 refer to a piston 12 in. in diameter; fig. 3 shows a piston 20 in. in diameter, the design of which was similar to the 12 in., but the piston crown was supported by a number of circular ribs projecting into the interior of the piston. Radial ribs were also carried down from the crown of the piston to the piston pin boss. This piston at first appeared to be quite satisfactory, but it was noticed on examining a number of castings that slight cracks had taken place across the tips of these ribs, and on examination it was found these cracks had been set up by the cooling of the casting.

A number of such castings were broken up and found to contain many flaws. It was, therefore, decided to cast the piston in two portions, and diagram 4 illustrates the type of piston which is now generally adopted by the firm. The upper portion is secured to the main body of the piston by six or eight square-necked studs; the object of the square-necked stud, which fits into a square hole in the body of the piston, is to ensure that the stud itself will not come out or get slack when the engine is at work.

The design of this piston top is somewhat novel, inasmuch as there are no ribs embodied in the design, the support to the crown of the piston top being obtained by throwing out a conical-cylindrical chamber, which also has the advantage that it forms another lane by which heat units can reach the body of the piston for transmission to the water spaces. It also permits of uniform expansion. The upper portion of the piston is carefully bedded on to the lower portion, and care has been taken to have sufficient contact area to allow for rapid heat transmission. The internal cone thus formed in the head is filled with asbestos to prevent the heat being thrown down from the crown of the piston on to the connecting rod bearing. This design has several advantages, one being that different qualities of material may be used for the upper portion of the piston and the lower portion. The other is that, should any cracks develop, it is a comparatively simple and inexpensive matter to replace the top. As will be readily understood, the lower portion, which acts as a crosshead, must necessarily be of a quality of iron which is hard and which will attain a high polish when running, and not wear readily; the upper portion should be of a material capable of resisting heat stresses.

Fig. 5 shows a similar design as adopted on the 12 in. pistons. When these modifications were carried out, a number of experiments and analyses were made by our laboratory with the different qualities of material used, and careful records were taken of such, and when any defects developed we were able to trace the particular quality of material that was used. By this comparative method we were able to arrive at a more or less definite conclusion as regards the quality of material which best suited the purpose. Ultimate experiments proved that cast irons containing high percentages of phosphorus were most unreliable, and further investigations proved that the elimination of phosphorus would, to a large extent, remove the difficulty of cracks developing. Great care is taken by us in controlling the mixtures that are used, and each batch of pistons and cylinder covers, liners, etc., is carefully analysed, and records taken by our laboratory so as to ensure consistency of the material as desired.

We have in the works an admirably equipped laboratory where analyses of metals, fuel, and lubricating oils are carefully carried out and difficulties investigated. In this laboratory is fitted one of our standard engines, which enables this department to carry out tests on different qualities of material under actual working conditions. Extensive tests, on different grades and qualities of fuel oils which are sent to us from all parts of the world, are also carried out. Quite recently we had this engine running on liquid tar and on tar oils, with satisfactory results.

Seizures of pistons almost invariably are due to heating of the piston pin and its bearing, and take place almost immediately after starting up. The opinion we have formed is that, when an engine has been set to work and shut down, the heat stored in the piston body is thrown down and tends to evaporate the oil in the top end bearing, with the result that when the engine starts up again, this particular bearing is not amply supplied with lubricating oil. Again, running the circulating water through the engine after shutting down, tends to minimise this difficulty.

In our enclosed type of engines, where forced lubrication is used, this difficulty is to a large extent removed by the fitting of a hand lubricating pump, by means of which lubricating oil under pressure can be pumped to all the bearings, including the piston pin bearing, whilst the engine is being barred round into its starting position before being started up.

As proof of our contention that the heating of this bearing is generally the cause of such seizures, I may mention that the abrasions generally show seizure to have taken place at four points of the circumference of the piston and liner, and if careful note is taken of the position of these abrasions, it will be found that they occur at the point where the piston pin bosses join on to the thinner section of the body of the piston. At this point there is a comparatively sudden reduction in the section of material, allowing one portion of the piston to be extremely rigid, and the other portion more or less flexible; when seizures take place the piston pin becomes overheated, and by reason of its friction fit in the piston body, plus its greater coefficient of expansion, causes an extension to take place, which forces the piston out of shape, flattens the crosshead portion of the piston body, and causes distortion to occur at the four points referred to. If the engine is not shut down quickly, other seizures are liable to occur, but the main seizures will almost invariably be found to occur at these four points.

When piston seizures do occur, it is desirable that the connecting-rod bolts should be carefully examined, as extension of the length of the bolt is likely to take place, and if examination is not made, ultimately fractures of the bolts are likely to occur, with most disastrous results.

WAR ITEMS.

War Loan.—The Underground Railways and allied companies have applied for £400,000 of the new War Loan in addition to a like amount of the original loan, which is being converted.

Messrs. T. Bolton & Sons, Ltd., of Widnes, are making a free gift of War Loan coupons and scrip vouchers to their 2,000 employés, the total cost to the firm being £10,000. They are presenting a £5 coupon to each employé over 18 years of age, and three scrip vouchers of £1 each to each employé under that age, who is still in the employ of the company at the end of the year, reserving the right to withhold same in cases of misconduct or neglect of work. The object is to enable the men to lay by something for themselves and encourage them to do their best in turning out work.

The Walsall Tramways Committee has decided to invest £15,000 in the War Loan.

The Hammersmith B.C. has invested £3,000 of the electricity reserve fund in the new War Loan.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., applied for £77,000 of the new War Loan.

Aberdeen Town Council Electricity Department has invested £5,000 in the War Loan.

It is announced that Messrs. Willans & Robinson, Ltd., have applied for £15,000 of the War Loan. Both this firm and the British Thomson-Houston Co., Ltd., are offering facilities to their workpeople at Rugby to buy vouchers.

As stated in the report of the annual meeting, appearing on another page, the General Electric Co., Ltd., has applied for £100,000 in the new War Loan, in addition to the £100,000 already held in the original Loan.

Kettering U.D.C. last week decided to apply for £2,200 worth of War Loan at 4½ per cent.—1925-45, the money to be taken out of the electric lighting reserve fund.

Other subscribers are as follows:—

Vickers, Ltd.	£100,000
Western Electric Co., Ltd.	25,000
Marconi's Wireless Telegraph Co., Ltd. ...	50,000
Phosphor Bronze Co.	7,000
British Ever-Ready Co.	5,000

Women in German Electrical Factories.—The "Daily Telegraph" Berne correspondent, referring to the increasing employment of women in German factories, says:—"Women are now employed on some of the largest German electrotechnical factories, metal works and iron works, even for labour which it is doubtful that they are physically strong enough to permanently stand." Our readers are already aware that for years past a considerable number of women workers have been employed in the A.E.G. factories. Presumably the Berne correspondent means that the number of such workers has been increased.

Trade Openings Abroad.—France: An agent at Lyons wishes to secure the representation of United Kingdom manufacturers of glassware for electrical installations. Applications should be made, in the first instance, to the Board of Trade Commercial Intelligence Branch in London, and subsequently to the British Consulate at Lyons.

Italy: A firm wishes to represent United Kingdom manufacturers of water meters, electrical measuring instruments, and other technical articles for tramway, railway, and dockyard use; also metals, worked and unworked. Application should be made, in the first instance, to the Board of Trade Commercial Intelligence Branch in London, and subsequently to the British Consulate at Milan.

Canada: A Montreal firm wishes to represent United Kingdom makers of steel tape to be used for covering lead electrical cables. Application, in the first instance, to the Board of Trade Commercial Intelligence Branch in London, and subsequently to H.M. Trade Commissioner for Canada, 3, Beaver Hall Square, Montreal.

Australia: A firm of agents in Brisbane wants to represent British makers of boiler covering and balata belting. A second Brisbane firm wants to represent in Australia British makers of dynamos, starters, switches and lamps. Application, in the first instance, to be made to the Board of Trade Commercial Intelligence Branch in London, and subsequently to H.M. Trade Commissioner for Australia, 81, Pitt Street, Sydney.

Metal Contracts: Australian Complaint.—Reuter dispatches from Melbourne appearing in the daily papers show that Mr. Hughes, the Federal Attorney-General, complains of the Imperial Government's inaction regarding metal contracts. He declares that German influence still prevails, and that it would be much more satisfactory if the Imperial Government declared its policy regarding metals.

A Canadian View of the Future.—At the recent convention of the Canadian Manufacturers' Association, says the "Financial Times," many important questions relating to the industries of the Dominion were discussed and a number of reports of committees of the Association were read. In an address in which he gave some views on the outlook for Canadian manufacturers, Mr. E. G. Henderson, the retiring President of the Association, expressed his judgment as follows:—"We should prepare ourselves for a period, not necessarily of hard times, but of tension, that will call for all the resourcefulness and enterprise we can command. I feel it will be a period that will witness on a considerable scale the weeding out of inefficiency, and place us under the necessity of cheapening our methods of production and improving the quality of our products. For this reason I attach great importance to the proposal that we should equip ourselves quickly and effectively for undertaking research work of every kind relating to our resources."

War-Time Contract Prices.—The Camberwell Borough Council approached the Local Government Board for their sanction to pay certain contractors extra amounts owing to the abnormal conditions created by the war. The Board have replied that, in the exceptional circumstances, should the Council decide to make any payment to a contractor in excess of the amount due under the contract, it should be considered by the Public Auditor at the audit as to its reasonableness, as in the case of other payments for goods supplied or for work done. The Board did not think that payments of this kind should be sanctioned by them before the audit, so as to prevent them being withdrawn from the auditor's review. Under these circumstances, the Council decided to make certain extra payments to their contractors above the contract prices, subject to the contractors giving an undertaking that, if the auditor declined to sanction the extra amount, they would refund it to the Council.

Board of Trade Inquiries.—List No. 28, issued by the Board of Trade Commercial Intelligence Branch, contains inquiries for the sources of supply of the following goods:—

Brass and iron parts, small.—Firms wanted to do the machining.
Insulating brushes and washers.
Small commutators.
Small dynamo armatures.
"Presspahn" or insulating cardboard.
Aluminium bronze wire in fine sizes.

Restricted Lighting.—At Whitley Bay Police Court on the 7th inst., Robert Simpson, manager of the Tynemouth and District Tramways Co., and Thomas Richardson, a driver under the company, were charged with having failed to reduce the inside lights of an electric car at Whitley Bay at 11.30 p.m. on June 19th.—Inspector Jackson said there were three bright, unshaded lights inside the car, and one on the rear platform. Only one blind on one side nearest to the sea was drawn. There was more light than was necessary. Since that date there had been a great improvement, and some of the cars were without lights.—Mr. Simpson said he had an interview with the military authorities in January, and they experimented with two cars. They tried various methods of shading, and in addition reduced the number of lights by half. He was not aware of any new order, but was willing to adopt any practicable suggestion to comply with the wishes of the authorities.—The defendant, Richardson, said he had no control over the lighting of the cars.—The Chairman of the bench said they thought the company were now attempting to keep down the lighting, but previously they had not done as much as they might.—Mr. Simpson was fined 20s., and the charge against the driver was dismissed.

Manchester Companies with German Capital.—At a meeting of the Manchester City Council last week, some discussion took place respecting the constitution of, and the origin of capital in, certain firms with whom it was proposed to place contracts, and the question was adjourned for a month, the town clerk undertaking to ascertain from Somerset House the proportion of German capital.

A Leeds Roll of Honour.—A roll of honour has been prepared of those members of the Leeds City Tramways who have joined the Army or Navy. The names of 604 men are inscribed in gilt letters on a handsome wooden tablet, together with the position they occupied on the tramway staff and there present military rank and regiment.

The Canals in War Time.—In the early days of the war the Waterways Association, with characteristic enterprise, obtained the ear of the Government for a suggestion that, when it became necessary artificially to create employment for the working classes, the development of our inland waterways should be considered a suitable relief work. Instead of the scarcity of employment then anticipated, there is, according to the "Birmingham Post," a dearth of hands to carry on the essential services of the country, and even on their present limited scale the canals could do with many more men efficiently to afford the carrying facilities of which they are capable. Like the railways, they have lost large numbers of their youngest and strongest workmen. But despite the heavy handicap under which they work, the canals are performing a very considerable national service. Barges are slower than trains in normal times, but not always in these days of railway congestion; and manufacturers and traders have in many cases transferred the traffic the railway companies refused to the canals. While there is no boom in waterway transport, the canals are, however, and especially in the Black Country districts, proving specially useful in carrying engineering material with a promptitude that compares very favourably with the railways in these days. Evidently even the neglected canals are "doing their bit."—"Machinery Market."

The Victoria Falls Power Co.—Mr. Bernard Price, acting general manager of the Victoria Falls and Transvaal Power Co., has written a lengthy letter to the Johannesburg "Star," replying to certain questions raised by the Petitioners' Committee, in order to remove public misapprehension concerning the question of German influence in the company's affairs. The Committee asked whether the A.E.G. had a financial interest in the company, and to what extent, and whether it was true that the bulk of the machinery installed in the power stations, etc., was purchased in Germany. Mr. Price, in replying, states that the A.E.G. has no financial interest in the company. He says that the fact that a considerable amount of German machinery has been purchased by the company is readily explained. "In the first place, German banks put up the first mortgage loan required for the purchase of the initial plant, and, in the second place, suitable equipment in some instances could not be obtained in Britain at the date of purchase. The supply of electric power and of compressed air on the huge scale obtaining in this district is a very special business. The Power Company's electric scheme ranks as one of the three largest in the world, and the supply of compressed air in bulk is absolutely unique. It is not surprising, therefore, to find that some of the machinery and apparatus required for equipping such a scheme has not been obtainable from more than one or two firms. While manufacturers of electrical plant in Britain had, speaking generally, built up their businesses with the primary object of meeting the requirements of the relatively smaller schemes to be found in the United Kingdom, where distances are relatively small, voltages are relatively low, and the size of generating unit required is not very large, similar manufacturers abroad had developed designs suited to the larger schemes which had sprung up in their own country, and which schemes were comparable in size and voltage to that in this district. For these reasons my company was forced to purchase some items for the equipment of its stations outside Britain, and it will be found that a similar course was adopted by power companies controlling the largest scheme in Britain itself. It will be understood that these remarks only apply to certain items of equipment. My company has throughout purchased all boiler plant in Britain, and many other items have been ordered from British firms. In some instances also, American firms have competed successfully for my company's business. The power company was promoted by British interests, the Chartered Company taking an active part in its formation. The whole of the share capital was raised in England, and every endeavour was made to raise the first mortgage loan through financial houses in Britain and America, but these endeavours proved fruitless, and the first debentures were eventually raised in Germany. The second loan, however, was raised entirely in England. The directorate is entirely British. Not a single German has been employed by the company since the outbreak of the European War, and recently those few employés who, though naturalised, were of German extraction, have been discharged."

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Pocket Dry Batteries.

I notice in an article on pocket dry batteries ("A New British Industry"), on page 57 of your current issue, that your contributor states that the voltage obtainable from a single dry cell should not fall below 1·5 volts, using peroxide of manganese and graphite only as a depolariser. I have now been manufacturing these cells for some years, and have never been able to obtain this voltage, and it is a generally recognised fact that it is impossible to obtain this voltage in commercial samples. The most that I have been able to obtain is 1·4 volts, and this only for a few days. Most of the text-books on primary batteries mention that in practical working only one volt per cell should be reckoned on for a Leclanché cell, and this is what usually obtains in the pocket dry battery of ordinary construction. Attempts have been made to increase the voltage of these cells by special processes of manufacture and the use of other depolarisers, and in many cases these have been quite successful; it is now quite possible to obtain cells giving 2 volts as their normal working voltage. As your contributor remarks, however, the secret of their construction is jealously guarded by their makers. I should like to have the experience of other makers on this subject.

Dry Battery Manufacturer.

Gas v. Electricity.

Your editorial comments entitled "Electricity Outclassed" are extremely welcome, and it would be of interest to learn :—

1. Why the generosity of the gas company was not manifest before the Council invited tenders from electrical contractors?

2. Why the electrical engineer should waste time on a stringent specification?

3. In view of the fact that the electricity was competing with gas, why it was not possible to frame the specification for a more economical wiring installation?

4. Who decided that 3/20 was to be the smallest cable used, although no point comprised more than a 50-C.P. metal-filament lamp, and the total wattage for the largest dwelling did not exceed 240 watts at 250 volts?

5. By what means the ELECTRICAL REVIEW secured the results of the tenders submitted, whereas competing firms are still ignorant of the result?

6. Whether it is more profitable for the Council to use the gas of a private company in preference to their own electricity?

7. If the Council would show the same noble spirit as is demonstrated by their selection in the form of 5 per cent. interest on the £29 deposits demanded before May 31st and not refunded by July 13th?

8. The advisability of increasing their staff, to permit of replies being sent to correspondents, who up to the present receive no acknowledgment to their repeated inquiries relating to the above matter?

London, W., *July 13th*, 1915. **W. El-les.**

BUSINESS NOTES.

Book Notices.—*Colliery and Mining Machinery.* Part 1. (G.E.C. Bulletin, No. 7.) London: The General Electric Co., Ltd.—This work, issued by the General Electric Co., Ltd., is mainly intended to bring before the mining community the various classes of electrical machinery and equipment manufactured and installed by them, and the illustrations show examples of typical plant erected at collieries by this company. It is, however, not a catalogue, but a descriptive treatise on colliery electrical engineering, and in this respect is much superior to any text-book we have as yet come across. The volume, which consists of 182 pages, is divided into seven sections, commencing with "General Considerations," and ending with "Colliery Lighting," the other sections dealing with colliery power houses and sub-stations; motor-driven plant for collieries; colliery switchgear, &c.; colliery cables; and telephones. Each section deals thoroughly with the subject in hand, the first three being especially good, and a quantity of useful and valuable information is given, which ought to be particularly acceptable to the colliery manager or engineer, such as, for instance, that relating to standard pressures and frequencies, overloads in relation to the rating of machines, and temperature rise. Then there is the question of alternating *versus* continuous current, seven points being given in favour of the former, against two for the latter; the whole question is summed up thus:—"Taking a general view of the whole question, it would appear that alternating current possesses the advantage, except for very small installations." The selection of a suitable voltage and frequency, the type of prime mover, the advantage of utilising waste heat, types of generators, the advantages obtained by the use of rotary converters, the design and connecting-up of transformers, are all dealt with in a thoroughly practical way, considerable space being devoted to the description and operation of the last-named. The importance of obtaining a high power factor, and the much-debated point of "earthed *versus* insulated neutrals" are also discussed.

The two sections dealing with "Colliery power houses and sub-stations" and "Motor-driven plant for collieries" are both exceedingly interesting and instructive, especially the latter. In this section, synchronous and induction motors, phase-advancers, the various methods of motor protection, including pipe ventilation and drip-proof, totally enclosed, and explosion-proof motors, are briefly but practically considered. Then follow the applications of electricity to haulage, winding, pumping, &c., which are all exceptionally good sections, especially the first two named. Indeed, the article on winding is one of the best summaries of the various methods in use that we have seen, and is quite free from that extreme bias that one usually finds in works of this character.

The other sections are all equally good, and the reference to the G.E.C. gas detector is especially interesting. But is it a fire-damp detector? If so, we ought to hear more of it in the near future. The only electrical apparatus used in mines that are not mentioned are signalling appliances and miners' safety lamps. As regards the latter, these perhaps are not of much interest to the General Electric Co., but electric signalling, in view of recent investigations, and the new regulations in regard to winding signals, are, we think, of sufficient importance to merit attention. We can heartily congratulate the General Electric Co. on their enterprise in issuing such a valuable and interesting contribution to mining electrical literature, a copy of which should be in the hands of every colliery manager and responsible engineer.

"The Post Office Electrical Engineers' Journal." Vol. VIII, Part 2. July, 1915. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

Bankruptcy Proceedings.—Dennis Ripley Broadbent, electrical engineer, 50, Hans Place, S.W.—The public examination was held on July 7th, before Mr. Registrar Hood, at the London Bankruptcy Court. The liabilities are returned at £1,160, and assets valued at sufficient to yield a surplus of £1,447 after payment of all debts. Questioned by Mr. E. Leadham Hough, Senior Official Receiver, the debtor stated that upon coming of age in May, 1890, he became entitled under the will of an uncle to about £5,000. In the same year he purchased for £2,500 an electrical engineering business at Putney, which had been carried on as J. D. F. Andrews & Co., Ltd. Witness was a qualified engineer when he purchased that business. In February, 1901, he sold it to a company, which he formed and registered as the "British Electrical Manufacturing Co., Ltd." In the meantime he had expended a further £500 in the business, making his total outlay £3,000. The sale consideration payable to him by the company was £7,650, of which he received £650 in cash, £5,000 in fully-paid shares, and £2,000 in debentures. Witness was of opinion that all the liabilities he incurred in connection with that business had been discharged. He acted as a director of the company, which was not successful and went into voluntary liquidation in January, 1902. The assets were comparatively trifling in value, and the proceeds of the realisation were absorbed in costs and expenses of the liquidation. Witness had not parted with any of his shares or debentures, and had, consequently, lost the whole of the £3,000 that he invested in the company. He had also acted as director and otherwise of another company, to losses in connection with which he also attributed his failure. The examination was formally adjourned for a fortnight, the Official Receiver stating that the first meeting of creditors stood adjourned to enable a proposal to be submitted to the creditors.

George Edward Hipkins, electrical engineer, Dudley.—First and final dividend 3s. 3¾d. in the £, payable July 12th, by Official Receiver, at 1, Priory Street, Dudley.

Herbert Page (Smeeton & Page), electrical engineer, 63, Queen Victoria Street, London, E.C.—Receiving order made July 8th on debtor's petition. First meeting July 22nd; public examination, September 7th, both at Carey Street.

Liquidations.—Venner's Electrical Cooking and Heating Appliances, Ltd.—A meeting of creditors will be held at Blomfield House, 85, London Wall, London, E.C., on Thursday, July 22nd. Liquidator, Mr. G. E. S. Venner. Creditors must send particulars to the liquidator, at 85, London Wall, E.C., by August 24th.

Fleetwood and District Electric Light and Power Syndicate, Ltd.—A meeting is to be held at 90, Cannon Street, E.C., on August 9th, to hear an account of the winding up from the liquidator (Mr. W. Cash).

Consolidated Diesel Engine Manufacturers, Ltd.—July 29th is the last day for receipt of proofs for dividend. Liquidator, Sir W. B. Peat, 11, Ironmonger Lane, London, E.C.

Catalogues and Lists.—India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., 106, Cannon Street, London, E.C.—Illustrated circular giving a list of a number of special lines that the company is manufacturing, including testing sets, rubber gloves, motor-driven turbine pumps, steam-driven sets, ebonite sheet, rod and tube, gutta-percha articles, hose, &c.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Twelve-page publication (V C 1,846), containing fully illustrated particulars and prices of the Santo vacuum cleaners, and attachments for same, also the "Little Briton," the "Perfection," "Magic," "Apex," "Cleveland," and "Economo" vacuum cleaners.

Jackson Electric Stove Co., Ltd., 38, Blandford Street, London, W.—Two illustrated priced cards dealing respectively with rapid boilers and electric boiling pans.

National Boiler and General Insurance Co., Ltd., St. Mary's Parsonage, Manchester.—Illustrated and priced descriptive circular concerning their National patent circulator for preventing external wasting of economiser pipes.

Messrs. Thompson & Co., 48, Watling Street, London, E.C.—6-page descriptive illustrated list, with a number of diagrams of connections, relating to the "Rex" A.C. watt-hour meters for single, two and three-phase currents. These instruments are made throughout in Switzerland, by the firm's principals, the Société Genevoise pour la Construction d'instruments de Physique et de Mécanique, who have been established in Geneva over 60 years as manufacturers of scientific instruments.

Catalogues Wanted.—Messrs. M. G. H. Deura and Co., "The Sports and Music Depôt," of Raja Street, Sialkot City, India, are about to start a new branch of their business dealing with electrical manufactures, and they desire to get into touch with British firms and to receive their catalogues.

Fabroil Pinions.—The British Thomson-Houston Co., Ltd., of Rugby, have received an order through G. & S. Massey, of Manchester, for 93 special Fabroil pinions for power hammers for the French Government to be used in a French munition works. The Fabroil pinion department of the B.T.H. Co is at present very busily occupied.

Accessories for Russia.—A firm in Odessa is anxious to hear from manufacturers of Edison screw lampholders, switches for 2 amperes at 250 volts, junction boxes, "Mignon" plugs, &c. Bankers' references are given. The address will be forwarded to British firms desirous of opening business relations with the South of Russia.

China.—H.M. Consul-General at Shanghai (Sir E. D. H Fraser, K.C.M.G.) reports that the importation of machinery an the installation of electric lighting apparatus in China is worth of the closest study by British firms who are interested in th machinery market. China shows a vigorous and increasing deman for electricity in all its branches. The excellent progress of the Shanghai municipal electricity works is referred to, and the Consul continues :—"The installation of plant in the interior requires specia measures, and cannot be attempted without efficient local representation. The business was largely in the hands of Germa firms, mainly because they were willing to undertake entire contracts and to finance them. British firms, however, have realise the possibilities of the market, and those who have been sufficientl enterprising to meet the local conditions are being amply repai for their trouble, whilst their work has given the greatest possibl satisfaction to the Chinese companies on whose behalf contract have been undertaken. British installations have recently bee completed for the great cities of Soochow, Changchow an Yangchow, in the Province of Kiangsu, and for Ningpo, in th Province of Chekiang, whilst a very large number of smaller plant and dynamos have been supplied for lighting small towns, mission and factories."

Large Capacity Stokers.—The 16-retort Erith-Rile stoker, as built by Erith's Engineering Co., Ltd., of London has, we are informed, the largest capacity of any stoker in use Four of this size are in use in one plant. Its normal capacity i no less than four tons of coal hourly, and it has 50 per cent. overload capacity. Each stoker is applied to an undivided furnace o a single water-tube boiler, 25 ft. wide. The capacity of thi stoker is equal to that of a battery of eight large Lancashir boilers, occupying a site 100 ft. wide. The use of such large-uni boilers is naturally confined to central electricity stations; bu the entirely automatic working of the Erith-Riley stoker permit unlimited unit capacity. The stoker is of the inclined underfee type, with the fires kept continually sliced and the ash continuousl discharged by reciprocating tuyeres and ash-pushers. The air fo combustion is delivered direct to the tuyeres by a suitable fan and both air and fuel automatically respond to load variations Each stoker consists of a series of standardised and interchangeable retort-units; four boilers, each with 4-retort stoker, or tw boilers, each with 8-retort stoker, will, therefore, give identica results to the above-mentioned boiler, with one 16-retort stoker.

LIGHTING and POWER NOTES.

Aldershot.—Plant Extension.—The U.D.C. ha decided to purchase an engine for the electricity works from th Nuneaton T.C., for £650.

Bacup.—A report has been prepared showing the resul of a canvass, and the applications for supplies of current, along th line of a proposed mains extension in Burnley Road, and a Sub Committee has been deputed to go into the matter, with power t take such action as may be deemed advisable.

Barrow.—Plant Extension.—The electrical enginee reported that a large local firm had been taking 1,500 KW. almos continuously for some weeks past, and were in urgent need of a increased supply, and, with that in view, he recommended th erection of the additional cooling tower, for which a loan had bee sanctioned; he also reported that it was necessary to obtain a fa and motor to increase the draught, as owing to the number o boilers in use, the chimney at the electricity works was of insufficient capacity to give the required draught.

Bedford.—The T.C. has decided that the following b a condition of supply of current for power purposes :—For ever 6d. increase in the price per ton for coal over and above 13s. 4d the rate per unit be increased by ·016d. A sum of £1,500 fro the electricity department's reserve fund has been invested in th War Loan.

Belfast.—Price Increase.—The Corporation ha increased the price of electricity for power purposes by ¼d. pe unit, and by ½d. per unit for lighting purposes.—*Freeman' Journal.*

Bradford.—Proposed Loan.—Application is to b made to the L.G.B. for sanction to borrow £20,000 for new main &c., required for extensions necessitated by Government requirements.

The Electricity Committee recommends the Finance and Genera Purposes Committee to support the action of the I.M.E.A., whic has made representations urging that the Government should ho itself financially responsible for all damage to real and persona property situated within the British Isles directly attributable t the present war.

An agreement has been entered into with Messrs. H. Longbotto and Co. with respect to a bulk supply of electricity to their mill.

The electrical engineer has been requested to prepare a report a to the advisability of sinking wells in Valley Road for the purpo of obtaining water for the electricity works.

Bromley (Kent).—Price Increase.—The T.C. has received notice from the Electric Lighting Co. of an increase in the charges for current for all purposes, of 10 per cent. as from the end of the present quarter.

Burton-upon-Trent.—Year's Working.—The annual report of Mr. Thos. Hall, the borough electrical engineer, on the working of the Corporation electricity department, for the year ended March 31st last, shows that the net surplus amounted to £2,566, as compared with £3,056 in the previous year, but as against this decrease £878 was expended on capital account out of revenue, and the usual financial charges were £1,336 higher, due to the recent reconstruction of the power station. The total output sold was 2,914,820 units, of which the major portion, 1,493,288 units, were for power; 104,404 units were sold for heating (double the amount in the previous year); the lighting output also increased, while traction supply decreased. The maximum load was 1,405 kw., and the load factor 25½ per cent. Despite increased output, the coal bill was £600 down, making a saving of £1,213 in two years, due to the use of the new turbine plant. The total working costs amounted to ·686d. per unit (coal, ·205d), and the commercial cost (all in) was 1·3d. per unit sold. Mr. Hall points out that the opening of the showroom, even at a critical time like December, 1914, has had satisfactory results. During the first three months of this year 81 radiators of 213 kw. were sent out; three electric cookers are giving a satisfactory trial, while there has been a fair demand for other apparatus. The total revenue for the year was £18,658, or £1,534 more than in the previous 12 months.

The Lighting Committee of the T.C. has decided to enter into an agreement with electrical contractors regarding the hiring out of apparatus.

Canada.—With a capital of three million dollars and extensive power privileges, a new electric company has been incorporated at Quebec to develop hydraulic powers in the cities of Three Rivers and Quebec, and also in various counties between the two cities. The promoters are Montreal men, and the company expects to furnish electricity to Quebec Trois Riverois, also in the municipalities of Lewis, Beauce, Dorchester, Portneuf, Mentmagny, Megantic, Champlain, St. Maurice, Charlevoix and Saguenay.

Cheam.—Restricted Lighting.—The South Metropolitan E.L. Co. has informed the P.C. that it will charge only half the contract price for public lighting from June 10th until normal lighting recommences, and the Council has accepted this offer.

Chesterfield.—New Plant.—After declining to sanction a loan of £5,000 for new plant for the electricity works, the L.G.B. has now requested the T.C. to forward a block plan of the works showing the existing and the proposed new plant.

Church Stretton.—Prov. Order.—The U.D.C. has referred to the Finance Committee an intimation that a prov. order for E.L. is being applied for by the Electric Supply Co.

Clacton-on-Sea.—Loan Sanction.—The L.G.B. has sent the U.D.C. sanction to a loan of £950 for a new battery for the electricity works. The Council applied for £1,300, and the L.G.B. deducted £350, being £779 outstanding debt on the old battery, less £429 allowed for old material. The loan is sanctioned on the understanding that whatever the actual cost of the battery is, £350 will be defrayed out of current income. Owing to inability to obtain a loan for new cables, the Council has had to defer the laying of certain mains for the present.

Colchester.—Price Increase.—The T.C. has decided to increase the price of current for lighting by ½d. per unit.

Consett.—Street Lighting.—As a result of negotiations with the Cleveland and Durham Power Co., it was stated in Council that the lighting of the streets will cost nothing during the next 15 years; hitherto the Council has paid £800 a year for this service.

Continental.—Spain.—A small central electric lighting station has lately been completed and put in operation in the little town of Sarria (Province of Lugo). The water power of the River Tuliero is utilised.

Donaghadee.—Prov. Order.—The B. of T. has agreed to defer the revocation of the Urban Council's electric lighting order for a year as from August next.

Durham.—Street Lighting.—The T.C. has accepted the offer from the Electric Power Distribution Co., to quote terms for the public lighting of the city.

Edinburgh.—The Electric Lighting Committee recommended that the estimated deficit on the income for the year of £6,200 should be paid out of the reserve fund, and that the charge for electric lighting be increased by ½d. per unit, making the new rate 2⅝d. The price for power remains at the present rate of 1½d. per unit.

Elland.—Price Increase.—The Council has decided to increase the price of electricity for power by 12½ per cent., except in cases of agreements.

Ellesmere Port.—Prov. Order.—The B. of T. has informed the U.D.C. that it will defer the consideration of the revocation of the E.L. order for a year from August 15th next.

Frome.—The U.D.C. has informed the Electricity Supply Co. that it has no power to increase the price of current supplied to the Council under its agreement; the company, however, points out that the increase applies only to the current used at the sewage works, and the matter is to be further considered by the Finance Committee.

Great Harwood.—Prov. Order.—The B. of T. has granted an extension of the electric lighting order until August, 1916.

Hastings.—Year's Working.—The annual accounts of the electricity department, for the year ended March 31st, show that the income amounted to £25,226, a decrease of £111 on the preceding year; the expenditure was £12,732, as compared with £12,467, and the gross profit £12,494, as compared with £12,870 in the year 1913-14, a decrease of £376. After payment of interest, sinking fund, and all outstanding charges, there was a net profit of £845, which was carried to profit and loss account. In the preceding year the net profit was £1,297. The number of units generated was 1,383,072, and sold, 1,277,072. The load factor of the undertaking was 22·77 per cent., and the generating plant capacity 1,850 kw.—*Hastings Observer.*

Heckmondwike.—Price Increase.—The Electricity Committee has decided to increase the charges for electricity by 10 per cent., with a discount equivalent to such increase if payment is made within a specified time.

Hendon.—Public Lighting.—At the meeting of the R.D.C. last week, it was stated that for the public lighting of Pinner a tender was invited from the National Electric Construction Co., which asked to be excused as the capital expenditure would be such that its quotation would be very high.

Lepton.—Prov. Order.—The U.D.C. has agreed to receive a deputation from the Electrical Distribution of Yorkshire, Ltd., with reference to its proposal to apply for a provisional order to supply electricity for lighting in Lepton and other districts.

Lincoln.—Year's Working.—The report of the Corporation electricity department for the last year shows that the total output sold was 2,291,114 units, an increase of 9 per cent. on the previous year, the increased sales being in general power units for the Co-operative Society's Flour Mill, and in lighting largely due to hospital supply. The total works costs were ·753d. per unit (coal ·256d.), and the commercial cost (all in) was 1·242d. per unit. Fuel cost was reduced by 26 per cent. owing to a reduction in cost of coal and the use of turbo-alternating plant for most of the supply, 4·13 lb. per unit being required as against 5·2 lb. The gross profit for the year amounted to £7,831, as against £6,792, and the net surplus to £3,163, as against £2,715 in the previous year.

London.—Hammersmith.—The Finance Committee recommends that application be made to the L.C.C. for sanction to the borrowing and advance of £8,313 to defray the B.C.'s proportion of the cost of the Battersea, Fulham and Hammersmith scheme for linking up the electricity undertakings.

In consideration of the reduction in street lighting, the sum of £150 per quarter is to be allowed off the charges from the quarter ending December 31st last, and during the period of restricted lighting.

The Electricity Committee reports that the Shepherd's Bush Exhibition Co. has agreed to the use of its mains for the supply of energy to premises situate in the exhibition grounds, in consideration of the Council paying the company 15 per cent. of the receipts for current supplied for power and lighting purposes to occupiers other than the company, and 12½ per cent. on receipts for cooking, heating, &c. The Committee recommends the Council to agree to this arrangement.

Bermondsey.—The Street Lighting Committee of the B.C. has considered complaints that some of the streets are too brilliantly lighted, and has given instructions for the electrical engineer to experiment by blacking the tops of some of the lanterns.

Market Drayton.—Street Lighting.—The U.D.C. has accepted the offer of the E.L. Co. for public lighting at the following terms:—Existing lamps contiguous to the mains, with 100 c.p. lamps, from August 1st to May 31st, from sunset to midnight, £2 1s. per lamp; any seven similar lamps, all the year, from sunset to sunrise, £3 10s. each; connect each standard to the existing mains and fix with bracket and reinstatement, £2 10s. per lamp, or, without new brackets, £1 12s. 6d., payable in three equal instalments; lamps not contiguous to the mains to be connected with overhead wires at the same charges.

Melbourne (Derbyshire).—Street Lighting.—The P.C. has invited the E.L. Co. to tender with the Gas Co. for the public lighting of the parish.

Nantwich.—Consent to supply electricity to Berkeley Towers has been given to the Crewe Corporation by the R.D.C.

Newcastle-under-Lyme.—Year's Working.—During the last financial year the Corporation electricity department earned a gross profit of £1,632, as compared with £1,473 in the previous year, and a net profit of £255, as against £205. The output sold was 200,064 units (maximum load 182 kw.), and this included 91,000 units sold for power, as against 40,000 in the previous year. Due largely to the improved day load, fuel costs fell 27 per cent., and total working costs by about ½d. per unit; other factors were a fall in average price of oil fuel from 81s. to 70s. a ton, and the use of a new storage battery, avoiding night shifts. Due to the war the works are short staffed, but the engineer, Mr. de Renzi, considers that the department will be able to avoid increasing the price of energy to consumers, which result will be largely due to the use of Diesel engines.

Queensbury.—Prov. Order.—A subsidiary company of the Yorkshire Power Co. has informed the U.D.C. that it is intended to apply for a prov. order for E.L. The Council has decided to discuss the matter with the representative of the company at the September meeting.

Redditch.—Year's Working.—The accounts of the electricity undertaking for the year ended March 31st last show that the balance carried to net revenue account was £617, as compared with £962 in the previous year. The net result of the year's working was a loss of £2 508, as compared with £3 351 in 1912-13. During the year 1,283,927 units were sold, as against 1,433,666, a decrease of 149.739 in 1914-15. The fuel account was reduced by ·03d. per unit, although the cost of coal had increased by 2s. per ton. The decreased output was due to failure of the turbine plant, which affected the power supply.—*Evesham Journal.*

Rotherham.—Increased Prices.—The T.C. has decided to increase the price of current for lighting by ½d. per unit as from the quarter commencing October next.

Settle.—The R.D.C. has refused to allow the Bentham Electrical Supply Co., Ltd., to place overhead wires on the highway.

Sevenoaks.—Messrs. Young & Son have carried out an expeditious E.L. installation at a military camp. Within 24 hours of the receipt of the order current was ready for use in the officers' mess. The supply is from the mains of the local Electric Supply Co.

Shanklin (I. of W.).—Restricted Lighting.—The U.D.C., having asked for a larger reduction than that offered in the public lighting charges based on the lamps used, the Isle of Wight E.L. Co. has declined to agree, adding that a similar situation has arisen at Ventnor, where the correct interpretation of the contract is to be settled by an arbitrator, and asks that the Council should await the decision, leaving its offer of reduction based on the number of units of current not consumed as still open for acceptance. The matter has been referred to a Committee.

Sheffield.—New Plant, &c.—Mains are to be extended in various parts of the city, at an approximate cost of £3 660. The general manager has reported upon the difficulty in obtaining a sufficient supply of water for condensing purposes at Neepsend during the summer months, owing to the prior rights of the Old Park Silver Mills Co., Ltd., and negotiations have been opened for the transfer of the rights of controlling the water to the Corporation. The Electric Supply Committee is of opinion that there is no present necessity for increasing the existing charges for current. In view of the short terms allowed by the L.G B. for the repayment of money borrowed, the Finance Committee has decided to defray the cost (£3,614) of two water cooling towers out of revenue. The Electric Supply Committee, in view of the heavy demands now being made upon the department for power supplies, has decided to install a small plant (2,000 kw.) which will enable the department to connect a further 5,500 kw. without reducing the margin for spares. The plant has been offered by the British Westinghouse Co., and is partly constructed; the price is approximately £8,500, and the foundation and pipework amounts to about £2,000 in addition, and application is to be made to the L.G.B. for sanction to a loan of this amount.

Year's Working.—The surplus on the working of the electricity undertaking for the year ended March 25th last, amounted to £25,837, and the general manager recommends that a further sum of £14,000 be transferred to the renewals and special expenditure fund (making the total transferred to date, £59.000), and that £10,000 be transferred to the reserve fund. During the period covered by this statement there was an increase in the total units sold of 18,000,000, or 68 per cent., and an increase of 684 consumers, or 11 per cent. War allowances and increased wages to employés since the commencement of the war amount to £2,103. The total number of units sold during the 12 months amounted to 44,873,342, at a total cost of ·42d. per unit.

South Africa.—The Mossel Bay (Cape Prov.) Municipal Council proposes to seek authority from the ratepayers to increase the amount of the approved loan for electric lighting purposes to a sum not exceeding £13,000.

St. Helens.—Proposed Loan.—The borough electrical engineer having reported that it would be necessary to install an additional generator before the winter of 1916, the Electricity Committee has decided to apply to the L.G.B. for sanction to borrow £14,000 for extensions to the electricity works.

Stafford.—The T.C. has decided from September 30th to charge consumers of current a minimum rate of 7s. 6d. per quarter. Under the order there is power to charge 13s. 4d. per quarter for any quantity of current up to 20 units.

Stockton.—There was a profit of £448 on the Corporation electricity undertaking for the past year.

Swansea.—Due to a reduction in the supply to the Swansea Tramways Co. the number of units generated at the Corporation works during the past quarter shows a reduction, and the borough electrical engineer (Mr. Barr) has suggested to his Committee that the Corporation should offer to supply the whole of the tramway company's requirements. The suggestion is being adopted.

Torquay.—The T.C., at the request of the L.G.B., has agreed to postpone the uncompleted portion of the contract for generating plant until after the conclusion of the war. The plant was to have cost £11,000. It was stated that the 1,000-kw. generator could be sold at a profit, which would enable the Committee to replace it at a later date.

Walsall.—The Electricity Committee has decided not to make any increase in the tariff charges at present. Instructions have, however, been given for the withdrawal of the 2½ per cent. discount for payment of accounts within one month, and the engineer has been authorised to disconnect the supply of any customer who does not pay his account within one month of the delivery of the same. Negotiations as to the price to be charged for traction supply are now pending.

Warrington.—Annual Accounts.—The returns of the electricity undertaking for the past year show receipts of £25,419, and expenditure £16.858, leaving a gross profit of £8,561, compared with £9,199 in the previous year. After all charges have been met the net profit is £1,819, compared with £2,935 in 1913-14. The reserve fund stands at £9,358; loans taken up during the year amounted to £13,800, making the total borrowing powers exercised £120,376. The amount of debt extinguished is £39,282, leaving loans outstanding of £81,095.

Westhoughton.—Street Lighting.—The D.C. has sought a reduction of one-half in the amount of the last quarterly account with the Lancashire Electric Power Co. for street lighting on the ground that lamps were not lighted by order of the military authorities. The company, however, has refused to allow the deduction, but the Council is addressing a further letter to it on the matter.

West Ham.—Year's Working.—There was a gross profit of £36,032 on the electricity undertaking for the 12 months ending March 31st last, a decrease of £6,447 as compared with the previous year. The income was £134,074, an increase of £568, as compared with 1913-14. The result of the operations of the sales department was a net surplus of £594. The net revenue account includes loan charges amounting in all to £43,009 (an increase over the previous year's figure of £1,165), also special expenditures amounting in all to £2,278, which leaves a deficit of £8,852. Having considered the income and expenditure accounts of the electricity undertaking for the year ending March 31st last together with the borough treasurer's report thereon, the Electric Lighting Committee recommends that the Finance Committee be requested to include the deficiency of £8,852 in the supplemental estimates at September next. The Committee has decided to enter into new agreements with six firms in substitution for existing agreements, consequent on the increased charges for current recently adopted by the T.C.

West Yorkshire.—Prov. Orders.—The Yorkshire Electric Power Co., Ltd., has given notice of its intention to apply for power to supply electricity for lighting and other purposes in various districts. The Royston U.D.C., the Barnsley T.C., and the Lepton U.D.C. have agreed to meet a representative of the company; the Skelmanthorpe U.D.C. has left the matter over until the next meeting, and the Denby and Cumberworth U.D.C. has decided to submit the notice to the West Riding District Councils' Association. Notices have also been served on the Penistone and Horbury U.D.Cs.

Hospital Lighting.—The L.G B. has approved amended proposals submitted by the W R. County Council for electric lighting at the Middleton Sanatorium, and has agreed to make a grant of £18,000 towards the cost of the Institution.

Weymouth.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £2,200 for necessary cables and services.

Wimbledon.—Prov. Order.—The town clerk is to give the necessary notices of the intention of the Corporation to apply to the B. of T. for a prov. order to supply electricity within the area of the Parish of Cuddington.

TRAMWAY and RAILWAY NOTES.

Barrow.—The T.C., in consideration of certain track improvements and additions, has agreed to make a special rebate of ½d. per unit from the schedule in the 1902 agreement with the B.E.T. Co. for all electricity used over and above 400,000 units per annum. On last year's basis of energy used this would mean a reduction of the account by £136; there is, however, every probability of a larger use of energy.

Birmingham. — Female Labour. — The Tramways Committee has authorised the engagement of women to replace conductors who have enlisted. Their duty will be limited on the average to seven hours a day, and the pay will be at the same rates as already obtain in the service.

Bradford.—Track Renewal.—The Tramways Committee proposes to renew the tramway track in various parts of the city, at an estimated cost of about £15,000.

The Works Sub-Committee recommends an increase of £4 15s. per truck, in the case of the tender of the M. & G. Truck and Engineering Co., Ltd.

The general manager having reported upon the difficulties experienced and likely to arise in maintaining an efficient tramway service owing to depletion of the skilled staff of the department in consequence of Army enlistment and engagement of workmen for war service, the town clerk has been requested to communicate with the Army authorities on the subject.

Burnley.—Year's Working.—The annual report of the Corporation's electrical tramways shows that as a result of the war, the receipts fell by £9,769, while working expenditure decreased by £6,924. The amount paid to the electricity department for power was £17,611. About 50 per cent. of the staff have joined the Forces, and up to March 31st the amount of allowances made to these men was £2,483. Of the balance of £5,069, £1,664 was allocated to the rates, and nothing placed to the reserve fund.

Continental Notes.—Italy.—The electric railway scheme under construction by the Società delle Ferrovie Vicinale, connecting Rome with Fiuggi and Frosinone, and some 23 other towns and localities, and having, with its various branches, an extent of 135 km., is likely to be opened to working by the end of the present year, instead of August, 1916, the period stipulated by the contract with the Government. Although nominally a tramway, the line is practically a railway, having stations for passengers and goods traffic, telegraphic equipment and rolling stock in keeping with this character. The line is only a stepping stone to further developments contemplated by this company, which will render the Lazio Meridionale one of the regions best served by railways in Italy. The Banca Commerciale has financed the undertaking, the Italian Thomson-Houston Co. supplying the electric equipment, the Savona and Piombino works of the firm of Ilva furnishing the steel work, and the Società di Carrozerie Breda, of Milan, the rolling stock.—*Revista Tecnica d'Elettricità.*

Spain.—Plans have been prepared in respect of a projected electric tramway between Palma and Esporlas, in the Balearic Isles.

Doncaster.—The T.C. has referred back to the Electricity and Tramways Committee for further consideration the latter's recommendations with regard to the repair of the Bentley tramway track.

Hull.—Female Labour.—The tramwaymen, says the *Standard*, have withdrawn their resolution to cease work as a protest against the employment of women conductors.

L. & Y. Railway Electrification.—The electrification of this company's branch line from Bury to Manchester, by way of Prestwich, is stated to be nearly completed. Trains have already been run experimentally over certain sections, energy having been supplied by the Manchester Corporation. It was hoped to open the line to the public this month, but the war has caused delay in fitting and equipping the big power station which is being erected by the company near Clifton Junction.

Leeds.—Extensions Deferred.—The City Council has decided that in view of the request of the Treasury with regard to the curtailment of expenditure on new work, several tramway extension schemes shall be deferred until the war is over. The extension of the tramway system from York Road terminus to the Manston Fever Hospital, and the scheme for linking up Guiseley with Otley and Burley-in-Wharfedale by means of railless cars are to be completed; the chief scheme deferred is that which would have provided railless cars for Morley.

London.—L.C.C. and London Electric Railway Co.'s Facilities Bill.—The Parliamentary Committee recommends that in view of the support which the Bill is receiving from various quarters, of the attitude of the B. of T. and of the present Parliamentary situation, the Council should not take any further action on the Bill.

The Highways Committee reports that the powers obtained for the construction of certain tramways included in the L.C.C. (Tramways and Improvements) Acts, 1909 and 1913, and not yet constructed, will expire in August, 1916, and recommends that application be made to Parliament in the session of 1916 for an extension of the time allowed for the construction of the undermentioned tramways from: Farringdon Road north-eastward into Clerkenwell Road; from Battersea Park Road north-westward into Battersea Bridge Road; from Southcroft Road south-westward into Mitcham Road; tramways in Bridge Road, Hammersmith, and junction line leading from the Broadway, Hammersmith, into Bridge Road.

Rochdale.—The T.C. is to be recommended to allow the shell of the new repair shed at the car depôt to be completed, the understanding being that payment to contractors is withheld until the end of the war, the Corporation meanwhile paying interest on the contractors' outlay.

The application of tramway workers for an advance in wages in lieu of the present war bonus is to stand over for a month, when the war bonus question is due to be reconsidered.

South Shields.—Year's Working.—The Tramways Committee reports that the net surplus on tramway revenue account for the year ended March 31st was, approximately, £5,500, and that £3,100 will be available for transfer to the reserve fund.

Stockport.—War Bonuses.—The T.C. has refused applications for war bonuses for tramway and other workers in municipal departments.

Walsall.—The Tramways Committee reports that Messrs. W. A. Stevens, Ltd., have delivered the second 'bus of the six ordered from them, but, owing to the works being temporarily withdrawn from the firm's control, further deliveries cannot be made yet. Messrs. Stevens, however, have offered a vehicle with a saloon body, for £1,050, complete, which can be suitably altered for £200, and the Committee recommends its purchase.

Warrington.—The municipal motor-'buses show a loss on the year's working of £554. The gross profit was £56, compared with £406 for the nine months of the previous year. During the year 771,510 passengers were carried.

Wigan.—Track Renewal.—The Tramways Committee has under consideration an expenditure of about £3,000 on sinking the groove of the rails on the narrow-gauge routes by means of the Woods-Gilbert rail planer. It is estimated that this would extend the life of the rails by five or six years, during which period a depreciation fund could be built up towards renewing the rails at a cost approximating to £30,000.

Wolverhampton.—Year's Working.—The accounts of the Corporation tramway undertaking for the year ended March 31st last show a total revenue of £55,323, and working expenses amounting to £34,605. After repayment of loans, interest, &c., there was a net balance of £9,160, of which £5,416 was transferred to reserve and renewals fund, and £3,744 to the borough rate account. The passengers carried numbered 12,236,785.

TELEGRAPH and TELEPHONE NOTES.

Illicit Wireless Apparatus.—At Prahran, Victoria, Mathew Henry Read, a mechanic in the Postal department, was charged with having in his possession an apparatus capable of being used for tapping messages sent by wireless telegraphy. It was not suggested that he used the apparatus to assist the enemy. Defendant was fined £20, with £4 4s. costs.

The Telegraph Service.—Lord Midleton, in a speech in the House of Lords on the need for economy in Government Departments, recently pointed out several ways in which savings might be effected in the Post Office. He mentioned particularly the loss of £1,250,000 on the telegraph services, partly due to the cheap rates for Press messages, and suggested that the loss might be avoided by raising the rates. On the average a telegram costs the Post Office about 11d. to transmit, while the average payment for a telegram is only about 7½d. But the rate per word and the minimum charge per telegram, as well as the rates and hours for Press messages, were laid down in detail in the Telegraphs Act of 1885, and cannot be varied without legislation.

Wireless in Australia.—The Federal Government in May appointed a Royal Commission to inquire into certain matters in dispute between Mr. J. G. Balsillie, Commonwealth radio-telegraph engineer, and Father Shaw, inventor of the Shaw wireless system. One of the matters involved in the inquiry is whether a wireless system similar to that which the Commonwealth is now operating was previously patented by Father Shaw.—*Sydney Daily Telegraph.*

Wireless Station Sequestrated.—The U.S. Government has taken possession of the Sayville wireless station, the only remaining direct means of communication between the United States and Germany. Various newspapers have been charging the Germans with deceiving the United States by the use of a newly-invented system, by means of which a secret message could be sent between the words of innocent-looking messages without the knowledge of the Censor. The station will henceforth be worked by United States Navy operators. The secret code is said to be based on the principle of long and short silences between letters and words in unimportant messages, instead of long and short sounds. Skilled Morse operators can easily communicate without detection.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—Aug. 11th. One 1,000-kw. d.c. generator complete, liquid starter, &c., for the City Council. See "Official Notices" June 4th.

Adelaide.—August 18th. Magneto and trembling bells, for P.M.G.'s Department. See "Official Notices" July 2nd.

August 18th. Battery material, for the P.M.G. See "Official Notices" July 9th.

August 25th. Dry cells, earth clips, recording counters, and various other instruments and apparatus, for the P.M.G.'s Department. See "Official Notices" July 9th.

September 1st. Condensers, testing sets, rheostats, Morse sounders, and Wheatstone transmitters, for the P.M.G.*

Perth.—August 11th. Bolts and nuts, tubular brackets, side brackets for tubular iron poles, &c., Cordeaux and other insulators, copper wire, &c., for the P.M.G.'s Department. See "Official Notices" July 2nd.

August 11th. Measuring instruments, for the P.M.G. See "Official Notices" to-day.

Sydney.—September 13th. Council. a.c. and d.c. electric motors. Specification (10s. 6d.) from E.L. Department, Town Hall.*

September 6th. Metropolitan Board of Water Supply and Sewerage. Centrifugal pumps and electric motors at Richmond pumping station.* Acting Secretary, 341, Pitt Street, Sydney.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

Barking Town.—July 16th. U.D.C. 1,000-kw. turbo-alternator with condensing plant; cooling tower and pipework; chain-grate stoker, boiler pipe work, &c.; economiser; rotary converter; h.t. switchgear; h.t. mains. See "Official Notices" July 2nd.

Dublin.—July 26th. Corporation. High and low-pressure cables and accessories, transformers, transformer pillars and electricity meters. See "Official Notices" to-day.

Edinburgh.—July 19th. Corporation. Tenders for the works required in connection with the erection of the new electric generating station, Westbank, Portobello. Sir A. Kennedy, 17, Victoria Street, Westminster, Engineer.

July 17th. Corporation. Three, six, nine or twelve months' supply of electrical materials. Forms from Resident Electrical Engineer, Dewar Place.

Erith.—July 19th. U.D.C. One 2,000-kw. turbo-alternator, with condensing plant, switchgear, and all accessories. See "Official Notices" June 18th.

Hull.—July 22nd. Machinery oils for the Corporation Electricity Works.

July 22nd. Corporation. One 5,000-kw. turbo-alternator with exciter and condenser outfit complete. See "Official Notices" July 2nd.

Morecambe.—July 24th. Corporation Electricity Department. 2,000 tons of coal or slack. See "Official Notices" July 2nd.

Portsmouth.—July 19th. Electric wiring and fittings, Wimborne Road Schools, for the Education Committee. Mr. G. C. Vernon-Inkpen, Architect, 40, Commercial Road.

Rotherham.—July 24th. Corporation. 10,000 tons smudge and pea nuts; single vulcanised bitumen-covered cable, h.t. cable, rubber-insulated cable, trolley wire; ampere-hour meters. See "Official Notices" to-day.

Sheffield.—July 30th. Water service conduit screen chamber, penstocks, valves, piping, &c., for the Electric Supply Committee. Forms of tender from Mr. S. E. Fedden, General Manager and Engineer.

South Africa.—Beaufort West (Cape).—September 14th. Municipality. Suction gas engines, dynamo, booster, switchboard, battery, &c.; also poles, copper wire, insulators, street lamps, service connections, meters, &c. Specifications, on deposit of five guineas (returnable), from Chas. G. Trevett, A.M.I.E.E., 70, Fletcher's Chambers, Cape Town. Tenders to Town Clerk, Beaufort West.

CLOSED.

Australia.—Sydney.—The City Council received the following tenders for disconnecting switches and fuses:—

W. G. Watson & Co., £420; alternative, £792.

Australian General Electric Co., £1,418 (recommended); alternative, £1,154.

Bedford.—The T.C. has accepted the following tenders for coal for the electricity works:—

Ellis & Everard, Ltd.—1,500 tons Bentinck Derby slack, at 19s. 4d. per ton.
J. E. Page & Co.—2,000 tons Manners Kilburn slack, at 19s. 10d. per ton.
Mr. Chas. Franklin.—8,000 tons Moira ½-in. slack, at 15s. 8d. per ton.

Bradford.—The Tramways Committee has accepted the offer of the British Thomson-Houston Co., Ltd., of a pair of ventilated type tramcar motors, now on trial in the tramways department, for £210.

The Electricity Committee has accepted the offer of Messrs. Ferranti, Ltd., to supply six various transformers; that of the Brush Electrical Engineering Co., Ltd., to supply two various transformers; and that of Messrs. Wright & Wood, Ltd., to supply 23 motors in connection with the electricity supply to Dumb Mills.

Colchester.—The T.C. has accepted the tender of Messrs. Mellonie & Goulder, Ltd., for the supply to the electricity works of 5,500 tons of Tibshelf best hard nutty slack, at 19s. 6d. per ton.

Dover.—The T.C. has arranged with the Snowdown (Kent) Colliery for a three months' supply of washed beans for the electricity works, at £1 6s. 1d. per ton.

Eccles.—The tender of Mr. E. Beal has been accepted by the Education Committee, at £60, for wiring the Anson Street School and supplying the fittings.

Gillingham (Kent).—The T.C. has accepted the following tenders for coal for the electricity works:—

Spenser, Whatley & Co.—200 tons D.S. nuts, at £1 6s. per ton.
Blackman & Co.—200 tons Cannock ⅝ slack, at £1 1s. 3d. per ton.

G.N. Railway.—The General Electric Co., Ltd., has secured a yearly contract from the Great Northern Railway Co. for the supply of standard Osram drawn-wire lamps and for Osram Atmos-type lamps.

Grangemouth.—The burgh authorities have accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for the supply of tantalum and Wotan lamps for the ensuing 12 months.

Keighley.—The Electricity Committee recommends that the offer of Messrs. Willans & Robinson, Ltd., of a 5,000-kw. turbo-alternator (G.E.C. alternator) for £16,975 be accepted, subject to satisfactory arrangements being made for deferring payment of the purchase money; also that the necessary foundations, piping, switchgear, &c., be constructed and provided, at £3,025.

Leeds.—The Leeds City Council has accepted the tender of the Leeds and Bradford Boiler Co., Ltd., for six steam separators, at £358.

Leek.—The U.D.C. has accepted the tender of the Anglo-American Oil Co., Ltd., for 150 tons of fuel oil for the electricity works; and that of the Littleton Collieries, Ltd., for washed nut coal to the works for a year.

London.—Metropolitan Asylums Board.—The following tenders have been received for the installation of electric light in four blocks at the Grove Hospital:—

Titan Lift Co., Ltd.	(recommended)	£549
Alpha Manufacturing Co.		552
C. H. Cathcart & Co.		600
Toy & Winslow		632
Green & Abbott, Ltd.		637
W. C. Tackley & Co., Ltd.		663
Napier Kimber, Ltd.		863

L.C.C.—The Stores and Contracts Committee has accepted the following tenders for 12 months from July 1st, 1915:—

Iron castings for the permanent way, &c., for the Tramways Department, Schedule 91.—J. Martin & Sons, items 4, 5, 6 and 7.
Steel and iron castings, Schedule 92.—Hadfields, Ltd., items 1, 2, 3, 5 and 6.

Fulham.—The Electricity Committee recommends acceptance of the following contracts for coal as required for the electricity works:—

Myers, Rose & Co., Ltd.—2 000 tons Mansfield 1½ N.S., at 21s. per ton.
Cory Bros. & Co., Ltd.—2 000 tons Hawkins Old C. 1-in., at 20s. 4d. per ton.
Blackman & Co.—2,000 tons Hucknall 1¾ in., at 20s. 6d. per ton.
Phillips & Co.—500 tons Pinxton ¾-in., at 19s. 9d. per ton.
Blackman & Co.—1,020 tons Great Wyrley 2-in., at 20s. per ton.

Mirfield.—The U.D.C. has accepted the tender of Mr. E. Liversedge, Huddersfield, amounting to £33 10s., for providing and fixing electric overhead mains at Upper Hopton.

Peterborough.—The Electricity Committee of the T.C. has accepted the tender of Messrs. J. Fairweather & Co. for Tibshelf peas coal, at £1 0s. 9d. per ton.

Rotherham.—The Corporation has accepted the tender of Scottish Commercial Cars Co., Ltd., for three motor-omnibuses, at £959 each.

Salford.—The T.C. has sealed a contract with the British Westinghouse Electric & Mfg. Co., Ltd., for a high-tension cubicle and control panel for the Electricity Department.

Sheffield.—The offer of Messrs. Meade, King, Robinson and Co. to extend their contract for the supply of petrol to the Tramways Department from January 1st, 1916, to December 31st, has been accepted by the Tramways Committee; as have also the tenders of Messrs. Cammell, Laird & Co., Ltd., for the supply of 500 steel tramcar tires, and Messrs. Brown, Bayley's Steel Works, Ltd., to supply three special sets of 50 tires each. The Electricity Committee has accepted the tender of Messrs. W. Marlow & Sons, at £1,087, for the erection of a transformer sub-station in Fowncett Street.

Stockport.—The T.C. has accepted the tender of Messrs. Hadfield's Steel Foundry, Ltd., at £205, for a tramway lay-out in manganese steel.

Wimbledon.—The E.L. Committee has accepted the tender of Messrs. E. Foster & Co. to supply the following quantities of coal during a period of 12 months:—

5,000 tons Kingsbury Rydor small nuts, at 23s. 10d. per ton.
2,000 tons Elverton (South Leicester) 1½-in. nutty slack, at 20s. 7d. per ton.
1,000 tons Kingsbury 1¾-in. nutty slack coal, at 21s. 10d. per ton.
1,000 tons Nailstone 1½-in. slack coal, at 20s. 9d. per ton.
2,000 tons Ibstock (Deep seam) D.S. nuts, at 24s. 9d. per ton.

Wolverhampton.—The Tramways Committee has decided to purchase 12 motor equipments from Messrs. Dick, Kerr and Co., Ltd., at a cost of £1,380.

A LOW-PRICED ELECTRIC VEHICLE.

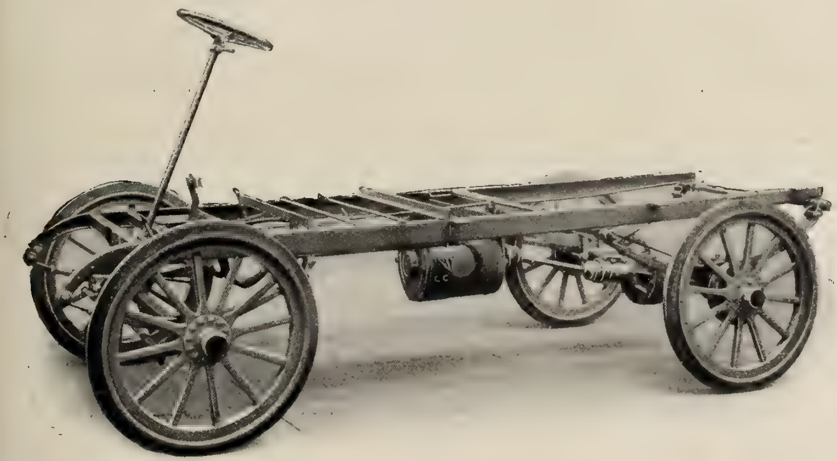
If there is one point on which, in the past, the electric vehicle has failed to convince would-be purchasers, it is on the question of high first cost. Whether the latter has been justified, in a commercial sense, we do not know, but it is, of course, admitted that there are many instances where the adoption of a comparatively costly electric vehicle has resulted in a subsequent saving in running costs and increased convenience and handiness associated with that type of vehicle.

On the other hand, it must also be admitted that there are many business men who cannot reconcile the first cost of the electric, of which cost they are in no doubt, with the estimated saving in working expenses, which, so far as they are concerned, is, after all, only an estimate.

First costs which are high, judged by accepted standards, will always present an insurmountable barrier to many people, as witness the number of carbon lamps still used in places where metal-filament lamps would show a great saving in the lighting bill.

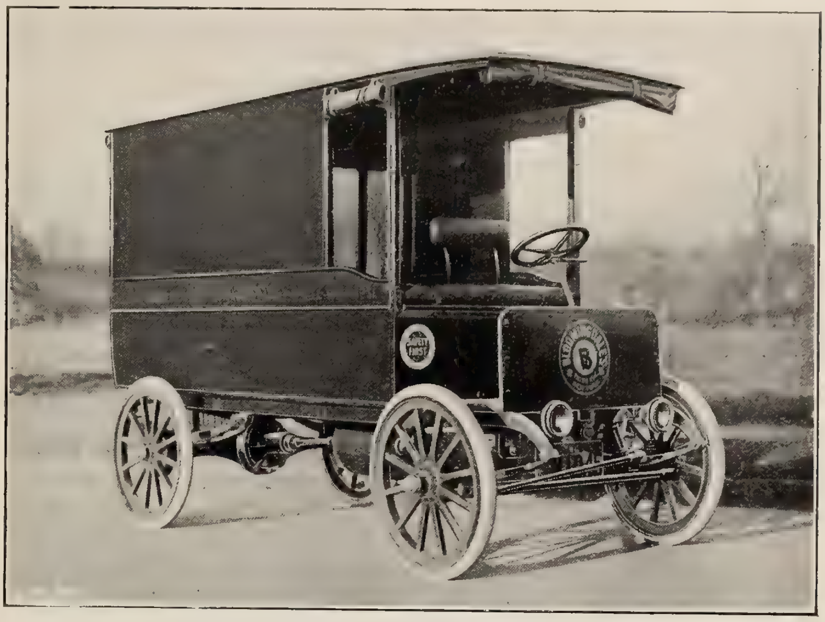
In the case of the electric vehicle it is not easy to justify the high initial cost, and this is generally recognised by the central station communities both in America and this country, where there is considerable scope for the use of a low-priced machine, capable of meeting average conditions of town delivery and showing a saving on present methods. The demand for such a vehicle has been met in the States, by the Ward Motor Vehicle Co., of Mount Vernon, N.Y., who have introduced a high grade delivery van with a rated carrying capacity of 750 lb. and a radius of operation of 35 to 45 miles on one charge, which sells at the low price of $875 (£175) complete.

This vehicle, known as the "Ward Special," we illustrate herewith; the chassis is simple in construction, with channel and bar main framing, and drop forged steel axles with Timken bearings; the rear axle has a pressed steel housing for differential and helical gears. Wheel steering is provided, of the minimum lost motion type, and the road wheels are artillery pattern with 2½-in. tires. The electric equipment consists of a 42-cell 9-plate Ward Philadelphia battery, covered by a guarantee, and this supplies energy to a Westinghouse heavy duty series-wound motor driving through a propeller shaft to the rear axle; a controller of the continuous torque type gives four speeds ahead and two reverse.



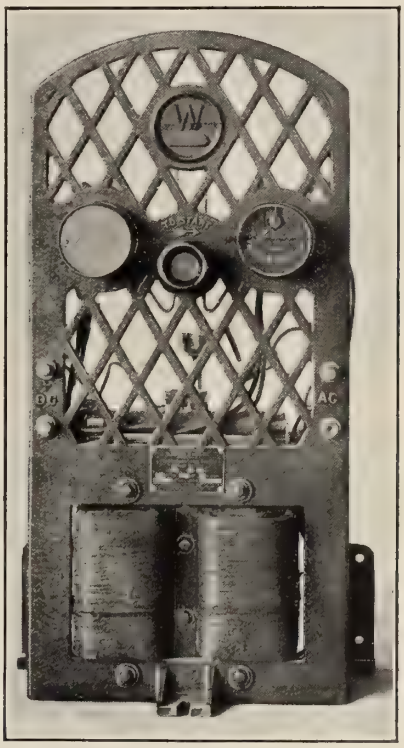
Chassis of the "Ward Special" Electric Van.

Our illustration shows a van body, which is built up with steel panels giving light weight and strength combined. The same vehicle fitted with the Ironclad Exide battery is sold for $1,000 (£200), and with the Edison battery, for $1,350 (£270).



The "Ward Special" Electric Vehicle.

The "Ward Special" has a level road speed of 10 miles per hour, or about twice that of the horse, and less than half the stable room is required as compared with a horse and van. Many of these vehicles have been placed in service and have given a very good account of themselves; we publish herewith the results of a 30 days' test which bears out the makers' claims as to its serviceable qualities, and it is further interesting to note that the Ward Co. is so satisfied with the efficiency of its vehicle that in the New



Ward Rectifier Charging Panel.

York district it has offered a five-year maintenance guarantee, whereby the customer is assured that his expense under this head shall not exceed four cents per car-mile, reckoning an average daily mileage of 25.

To facilitate the use of the Ward vehicle in districts where only alternating current is available, the Ward Co. has introduced a simple form of Westinghouse rectifier outfit for battery charging from 60-cycle, 220-volt single-phase circuits. This gives an automatically tapering charge to the battery, and only necessitates the insertion of the charging plug, closing a switch, and turning a handle to rock the mercury bulb of the rectifier.

The Ward Co. build standard electric trucks up to 10,000 lb. capacity, and it is their claim that if the Ward Special were sold at twice the present price, they could not make it any better than it is being made to-day.

A cheaper type of vehicle is essential to the popularising of the "electric," and the Ward Co. are to be congratulated on having courageously set out to produce in such quantity as to make the marketing of a low-price high-grade vehicle a practical possibility.

Analysis of Performance for 30 Working Days of Ward Special.

Days operated	30
Miles travelled	1,140·5
KW.-hours used	319·5
Number of miles per KW.-hour	3·57
Greatest energy consumption for one day	13 KW.-hr.
Smallest energy consumption for one day	10 KW.-hr.
Average energy consumption for one day	10·65 KW.-hr.
Shortest run	33·5 miles
Longest run	46·5 miles
Average run	38·01 miles
Greatest merchandise load*	1,500 lb.
Smallest merchandise load	500 lb.
Average merchandise load*	1,000 lb.
Current cost per car-mile at 3 cents per KW.-hour ...	$0·008
" " " 4 cents " ...	$·011
" " " 5 cents " ...	$·014
Maintenance (maximum estimate), including repairs and renewal of all mechanical and electrical parts, including tires, battery, and painting of wagon, should not exceed per car-mile	$·04

* The rated merchandise load capacity of this car is 750 lb. The above performance was, therefore, accomplished with an average overload of 250 lb. of merchandise, and in no instance was the car run with less than 500 lb. of merchandise on the springs.

THE CENTRAL POWER STATION OF THE RANDFONTEIN ESTATES.

By R. TURNBULL MAWDESLEY.

It would seem that the prominence deservedly given, in the columns of the technical Press, both at home and in America, to the four power stations—namely, Rosherville, Vereeniging, Simmer Pan and Brakpan — jointly operated by the Rand Mines Power Supply Co., Ltd., and the Victoria Falls and Transvaal Power Co., has somewhat eclipsed the remaining power undertakings in these fields.

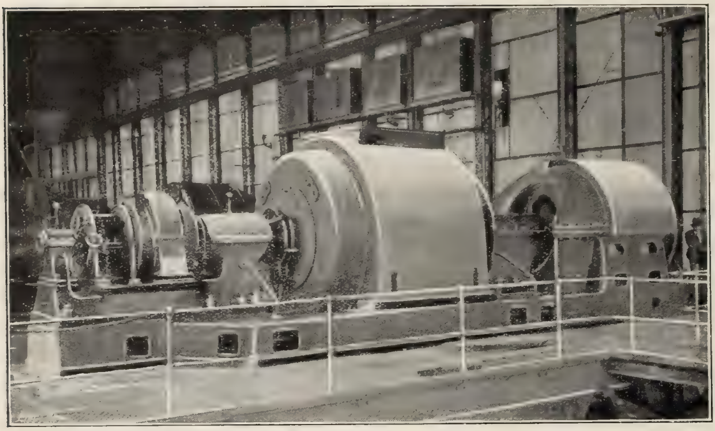


Fig. 1.—British Westinghouse 6,000-kw. Turbo-Alternator.

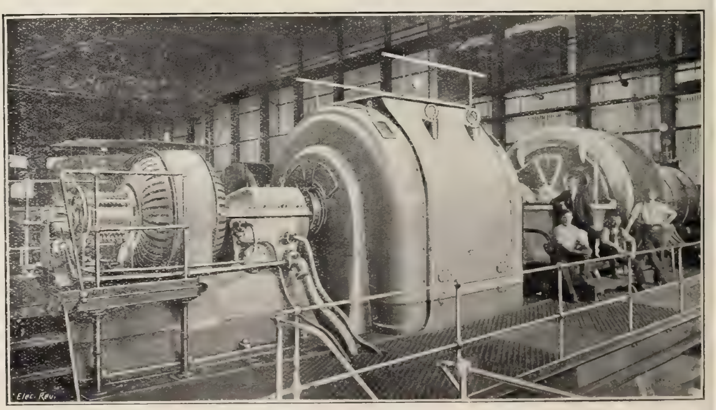


Fig. 2.—Parsons 6,000-kw. Turbo-Alternator.

The Randfontein Estates electrical undertaking has not received more than a brief reference in the English electrical journals, though its importance and the one or two unique features of the plant certainly warrant a clearer recognition.

Briefly and generally, the Randfontein Estates Gold Mining Co. is an amalgamation of smaller companies, the controlling interest in which is held by Sir Joseph B. Robinson. This company owns and operates a number of mining properties on the extreme west of the Rand. Ten main shafts have been sunk on reefs, which are known as the Randfontein Leader and West Reef, and which are all outcrop propositions extending from two miles west of Krugersdorp, to about one mile beyond Randfontein village—a distance of about seven miles, as shown on the surface plan on page 81.

The power station (fig. 3) is situated near the Robinson railway station of the South African railways, at a point which is approximately the centre of gravity of the load distributed, and supplies power to the 10 shafts for hoisting, pumping, &c.; it also furnishes energy for a large number of stamp mills, air compressors, and other necessary appliances.

The whole of the generating plant at present installed is turbine-driven, and consists of two 6,000-KW., three 2,000-KW., and two 1,000-KW. Parsons turbo-alternators, and one 6,000-KW. Westinghouse set, making a total capacity of 26,000 KW.

A general view of the interior of the power station, looking west, is shown in fig. 5.

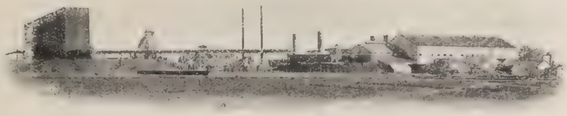


Fig. 3.—Panoramic View of Power Station Buildings.

The latest addition to the plant is the last-named 6,000-KW. set, which consists of a Westinghouse-Rateau impulse turbine, running at 1,500 R.P.M., and driving a 6,600-volt, 50-cycle, 3-phase alternator of the compensated type. The exciter is fitted to the end of the main shaft, and has a radial commutator; the alternator slip-rings are also radial. This machine has a surface-condensing plant situated directly below the turbine exhaust, which is of the Westinghouse-Leblanc type, with electrically-driven air and extraction pumps. The circulating pump is driven by a 275-H.P. three-phase motor. The condensate, which is measured by a Lea recorder, passes into a hot-well common to the three 6,000-KW. machines, and is taken from that point to the feed tanks by small motor-driven rotary pumps, in triplicate.

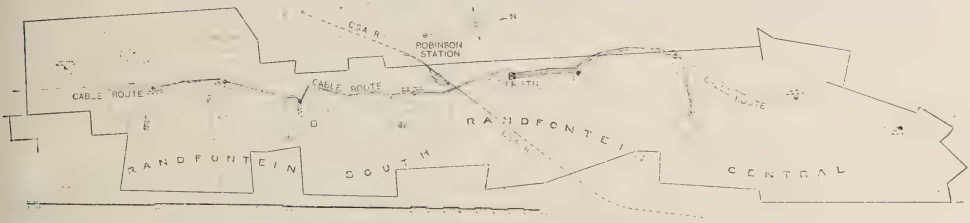


Fig. 4.—Surface Plan of Randfontein Estates.

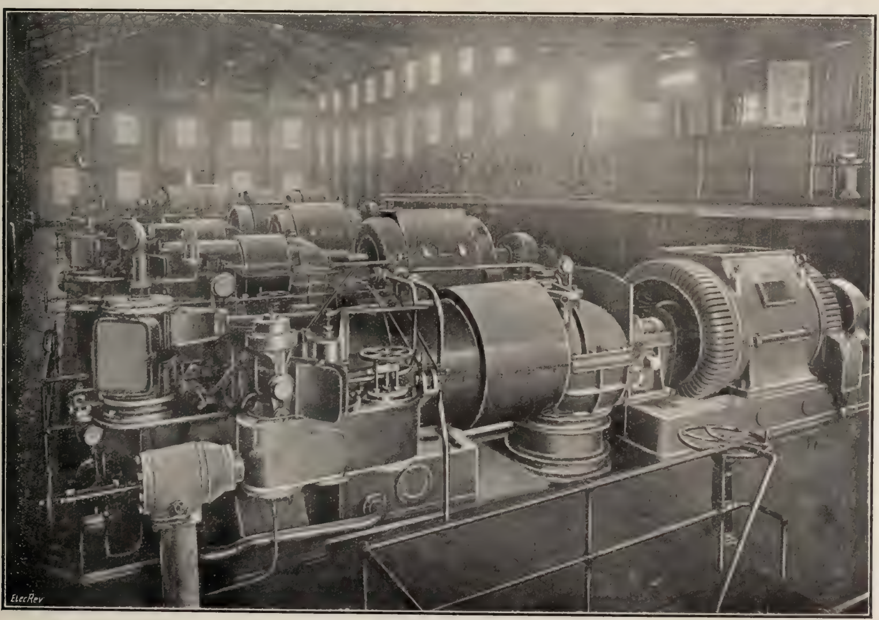


Fig. 5.—General View of Engine Room.

In starting up this turbine a small duplex steam pump is used to furnish oil for the bearings, which pump is automatically cut out as soon as the turbine oil pump, driven by wormgear from the main shaft, is giving sufficient pressure. The latter pump, besides supplying oil at about 7 lb. per sq. in. pressure for the bearings, provides oil at approximately 70 lb. pressure for operating the turbine governor. The lubricating oil, in its return journey from the bearings, passes through an oil cooler, which is supplied with circulating water from duplicate boiler cold-feed tanks placed outside the station proper. This circulating water is quite distinct from the condenser circulating water, which is unfit for this purpose. A small motor-driven rotary pump supplies the cooling water for the Westinghouse 6,000-KW. set cooler, and also for the two Parsons 6,000-KW. sets, which are provided with a gravity oil system, described on a later page.

The speed regulation and governing are effected by a master governor valve operated by oil pressure, which admits steam to the turbine sufficient for three-quarter load, after which the spindle of the master governor valve still travels further without admitting more steam through the main governing valve, and mechanically opens two auxiliary governing valves, for full load and load and a quarter respectively. A further hand-operated overload valve, for 50 per cent. overload, admits steam through the last three of the 16 steam ports; but it is unlikely that this will ever be required.

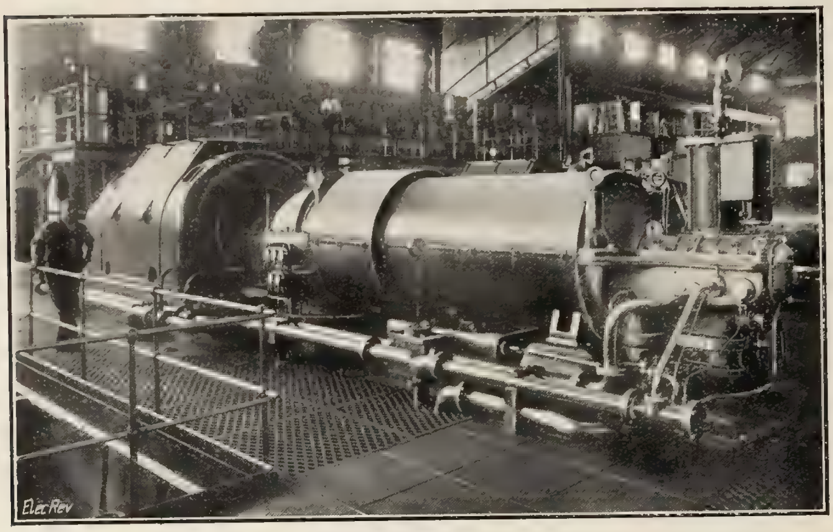


Fig. 6.—Parsons 2,000-kw. Set.

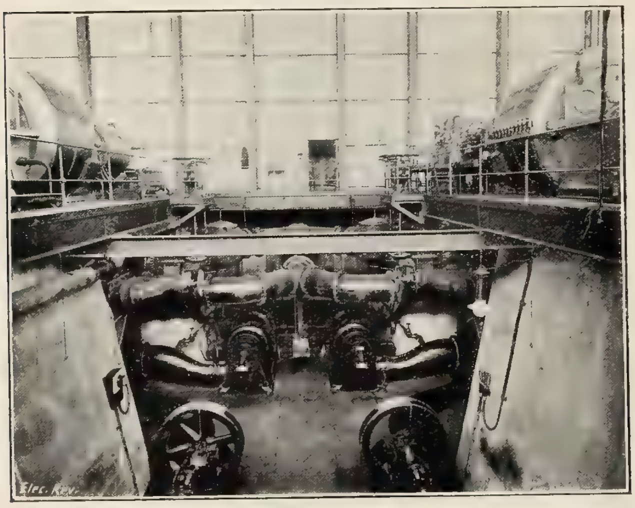


Fig. 7.—Condensing Plant for Parsons 6,000-kw. Sets.

Means are provided for controlling the speed electrically from the switchboard and for tripping an emergency run-away governor valve (actually the main stop valve), which also acts automatically at a speed of 15 per cent. above the normal.

Three current-limiting reactance coils are connected in the main circuit between the alternator and the bus-bars, the main switches being operated electrically by solenoids. There is an individual air-conditioning apparatus used in ventilating this machine. The alternator is totally enclosed, and is ventilated on full loads by an electrically-driven fan, which draws outside air through water-sprays that eliminate all dust, and admit of temperature regulation.

The complete unit (fig. 1), together with the condensing plant, reactance coils, and switchgear, &c, was supplied direct by the British Westinghouse Electrical and Manufacturing Co, Ltd., of Manchester, through their Johannesburg office.

The two 6,000-kw. Parsons turbines, a view of one of which is shown in fig. 2, are of the multiple reaction type, and are each coupled to a Parsons three-phase alternator.

Each of the turbines is provided with two cylinders in tandem, the l.p. cylinder constituting an exhaust-steam turbine, into which the exhaust from the h.p. cylinder enters, at about 14 lb. per sq. in. absolute. By this means the turbine spindles are reduced in length, and allow of a stiff, rigid construction, and four main bearings, instead of two.

The speed is governed by a standard Parsons centrifugal mechanical governor, rotating vertically on a spindle driven from the main shaft by worm gear. This governor, acting through a relay plunger valve, operates a main double-beat valve, which admits steam to the turbine in puffs—the duration, but not the rapidity, of which depends upon the generator load. When the turbine is working at its full load, or above it, the gusts of steam merge into a continuous blast, with the double-beat valve wide open, and stationary. An automatic overload valve is fitted, but the load on any alternator is never allowed to rise above the normal.

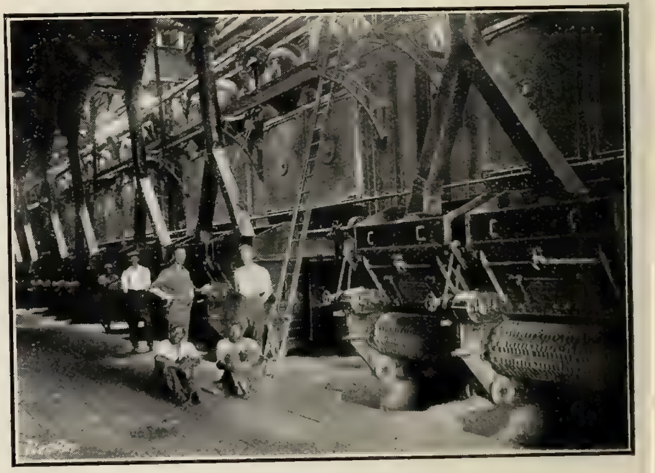


Fig. 8.—No. 2 Boiler House.

A centrifugal emergency governor, working off the same spindle, and which in its operation entirely shuts the steam off the turbine, can be actuated either by the driver or from the switchboard, and is automatic on speeds relatively excessive.

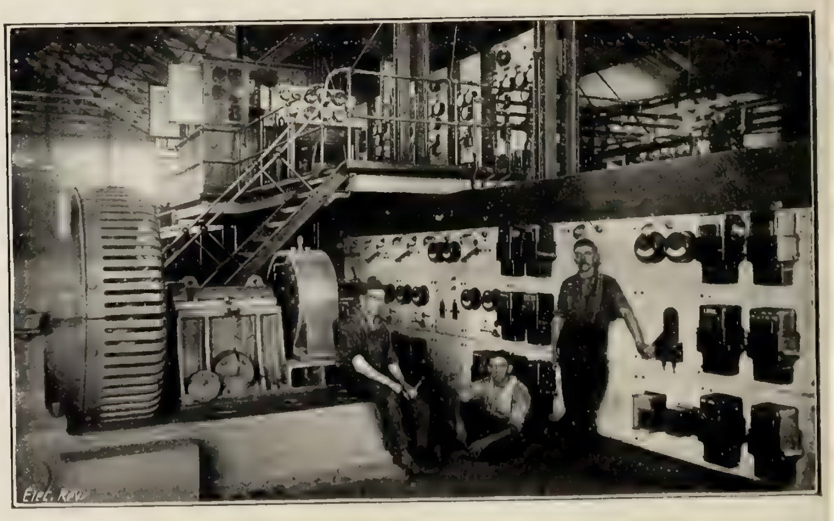


Fig. 9.—Auxiliary Power Distribution Board.

The speed of these sets is 1,000 R.P.M., the alternators being of the totally enclosed self-ventilated type with individual exciters coupled to the ends of the shafts. There is a further arrangement for ventilating all machines—two "Sirocco" fans, electrically driven, being placed in a building adjoining the station, which drive cold air into the cable trenches and through the various alternator windings, discharging into the engine room through the tops of the alternator yokes. In this case care is taken to see that there is a modicum of water kept on the floor of the cable runs, otherwise trouble arises from dust.

(The two 6,000-KW. Parsons turbines are built to the same patterns as those at Lot's Road, and are in many ways similar, except that the Lot's Road turbines are driving Westinghouse alternators, and are set upon Westinghouse bed-plates, laid down by the present writer in 1903.)

Originally the bearing lubrication of these sets was carried out by individual oil pumps driven from the turbine shafts, but the plungers of these pumps have been removed and a gravity system adopted, with an auxiliary oil cooler as well as the two machine oil coolers. The oil after passing through the bearings gravitates into a tank placed in the condenser pit, and from that point is pumped into four tanks by an electrically-driven plunger pump. These tanks are shown just below the crane girder level in figs. 1 and 2. From the tanks, which are provided with an electrical tell-tale, the oil gravitates to the bearings, giving a constant pressure of 5 lb. even when the machine is stationary. A Worthington steam oil pump is used as a stand-by.

The 2,000-KW. Parsons turbines (fig. 6) are of the usual single cylinder construction, and offer no unusual features. These three machines, as well as the two small 1,000-KW. sets, each have an individual oil pump for lubricating purposes, a small hand pump being used on starting up.

Circulating water for condensing purposes is derived from an adjacent shaft, which is one of the wettest on the property. Three artificial cooling ponds have been constructed, a fourth reservoir being used as a settling dam. It was found that the settling-dam water was slightly acid, and it is treated by the addition of lime to neutralise this effect. The water passes from the settling dam into the first cooling pond through a motor-driven rotary pump.

The cooling system consists of one enclosed tower (shown in fig. 3), one open tower, and one open spray pond, the two former being situated at the east end of the station, and the latter at the west end. In addition to the usual spray troughs, in both the open and closed cooling towers, quantities of brushwood are placed in position below the troughs, which have the effect of disintegrating the falling water into spray, and adding to the cooling properties of the towers.

The condensers are all of the surface type; and all, except the Westinghouse condenser, are fitted with the Parsons vacuum augmentor.

The air pumps of the 1,000-KW. and 2,000-KW. sets are of the Parsons triple compound type. In the 1,000-KW. sets the air pumps and circulators are driven by one 60-H.P. induction motor, the circulators direct and the air pump through gearing. The pumps for the 2,000-KW. sets are driven separately, the air pumps by a 13-H.P. motor and the circulating pumps by 70-H.P. motors.

The Parsons 6,000-KW. sets each have an Edwards air pump and a Worthington circulating pump, the former driven by 20-H.P. Westinghouse motors and the latter by 200-H.P. Westinghouse motors (fig. 7).

The effective head that the circulators work against is 40 ft., the condenser discharge being led underground some distance from the generator house, in both directions, where it is raised to launders, leading to the towers, which may be operated in parallel, or singly, as may be desired.

The Edwards air pumps of the 6,000-KW. sets originally were equipped with a lift pump for handling the condensate, but, as mentioned previously, this is not utilised, the water gravitating into a hot-well, whence it is pumped by rotary pumps to the hot-feed tanks. Incidentally, it may be remarked that as this plant is somewhere about 6,000 ft. above sea level, the apparent vacua are affected accordingly (average barometer 24·5 in.).

(To be continued.)

NOTES.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—Headquarters, Marconi House, Strand, London, W.C. Company Orders by Lieut.-Colonel C. B. Clay, V.D., Commandant, for week ending July 24th, 1915:—

MONDAYS.—6 30 and 7.30. No. 1 Platoon, Technical Instruction and Squad Drill. No. 3 Squad, Squad Drill without arms. No. 4 Squad, Squad Drill with arms.

WEDNESDAY.—6.30 and 7.30. Platoon and Company Drill.

FRIDAY.—6.30 and 7.30. No. 1 Platoon, Technical Instruction and Squad Drill. No. 3 Squad, Squad Drill with arms. No. 4 Squad, Squad Drill without arms. Orderly Sergeant, Corbett, R. W. T. Recruit Orderlies, Squad 3, Spiers, S. V.; Squad 4, Foxton, J.

Munition Work.—Owing to shortage of material, it has been impossible to arrange work for Saturday, July 17th.

Camp at Thames Ditton.—The Architects will welcome any member of the E.I.V.T.C. who wishes to spend the week-end in camp. Names must be given to the undersigned by Wednesday morning, and members going to camp must take with them blankets, knife, fork, spoon, cup and soup-plate; expenses about 7s. 6d.

Punctuality on Parade.—Owing to the amount of time lost on falling-in on parade, members are reminded that drills commence at 6.30 and 7.30, and every man must be in position when the fall-in is sounded. Any member who is not present when his name is called will not count a drill for the hour for which he is late.

E. G. FLEMING,
Company Commander and Acting Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, July 15th, 1915:—*Week-end Parades.*—Saturday: Afternoon operations. The Battalion will parade at Baker Street Station at 2.30 p.m., and proceed as follows:—The right-half Battalion will detrain at Harrow, the left-half Battalion will detrain at Preston Road. Both forces will be told off into small Patrols under the command of N.C.O.'s. Officers will act as umpires. The Preston Road Force will watch the approaches from Harrow, working along the cross roads of East Lane and Preston Lane; from the latter point, northwards along the Preston Lane to Preston and the N.E (north-east) along the lane leading to the road from Kenton to Kingsbury Green. They are not to go west of this line. The Harrow Force will reconnoitre towards Forty Farm, Uxendon Farm, Preston and Kingsbury Green, and will endeavour to break through the opposing line of Patrols on the Preston Lane line, and reach Camp.

Bounds.—North.—Road from Harrow to Kingsbury Green *via* Kenton. *South.*—East Lane to Forty Farm, and Camp.

Sunday.—6 a.m.—Reveille; 7 a.m., Sergeant-Major's Parade under the supervision of Mr. F. H. Stevens; 10 a.m., Church Parade; 10.20 a.m., Company and Platoon Drill: 2.30 p.m., Battalion Parade.

ADVANCE PARTY.—It is proposed to send an Advance Party of one officer and 25 men to Ongar to get the Camp ready for the Corps. N.C.O.'s and men desirous of volunteering for this duty, are requested to send in their names to their Company Commanders, who will forward them to Headquarters as soon as possible.

A. G. JOINER, *Captain and Adjutant.*

Batteries for Egypt.—We have received a letter from a correspondent in Egypt in which he asks us to draw the attention of British storage battery makers to the excellent opening that exists there now for their manufactures, the business having been previously almost entirely in the hands of Germans. The writer says that any company choosing to start such a business should have an efficient inspector living in the country, preferably in Cairo, and he would have to know some other language (preferably French) besides English. The German firms paid their representative a good salary and commission. Our correspondent is willing to furnish further information to any firm who cares to communicate with him through us.

Foreign Trade.—THE JUNE FIGURES.—The following are the electrical and machinery figures given in the official returns for June:—

	Month of June. £	*Inc. or dec.* £	*Six months,* 1915. £	*Inc. or dec.* £
IMPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	83,908	− 40,493	455,208	− 349,437
Machinery ...	923,670	+ 234,611	4,377,390	+ 233,046
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	293,806	+ 22,526	1,486,998	− 217,231
Machinery ...	1,856,202	−1,242,180	9,800,741	−9,668,814

Institution and Lecture Notes.—Physical Society of London.—At the meeting held on June 25th, a paper, entitled "Conduction of Electricity Through Metals," was read by the president, Sir J. J. Thomson. The discovery by Kamerlingh Onnes, that at the temperature of liquid helium some metals can exist in a state in which their specific resistance is less than one hundred thousand millionth part of that at 0° C., appears to necessitate the abandonment of the ordinary theory of metallic conduction, as the experimental conditions prohibit the explanation of the phenomenon by an abnormal increase either in the number or mean free path of the free electrons. The effects observed by Kamerlingh Onnes may, however, be accounted for by a theory of metallic conduction previously given by the author in "The Corpuscular Theory of Matter," and explained in the paper.

A paper "On an Unbroken Alternating Current for Cable Telegraphy" was read by Lieut.-Col. G. O. Squier, Ph.D. The paper proposed a new angle of view in the method of transmission of signals in the submarine telegraph cable, and described some apparatus for operating on the general principles involved. An ocean cable was considered as a power line, and starting with the standard form of circuit which would be used in case it were required to operate an electric motor through an ocean cable, experiments were described to determine the minimum possible variations required in such a circuit to permit the alternating current received to be interpreted in dots, dashes and spaces of the present alphabet. The uninterrupted alternating current used in transmission was operated on synchronously by the ordinary transmitting tape, so as to alter the impedance of the transmitting circuit at the instants when the current was naturally zero. Dots, dashes and spaces were each sent by semi-waves of either sign, but of different amplitudes. The alternating current received might be read directly from the record made by a siphon recorder, or this current might be employed to operate a siphon Morse printer, by means of an adaptation of Muirhead's gold-wire relay, or a Heurtley magnifier and a local wire relay. A special form of cable dynamo to operate at frequencies from 4 to 10 was used in the experiments described. The fundamental principle was developed of never metallically "breaking" the transmitter circuit, which permitted of greater accuracy in balancing the duplex bridge.

The Council has decided to sanction and adopt the letters F.P.S.L. as the official indication of Fellowship of the Society. The Council has appointed a Committee to consider any scientific suggestions or inventions which Fellows of the Society may care to bring before it in connection with the war.

Illuminating Engineering Society (U.S.A.).—At a recent meeting Dr. C. P. Steinmetz was elected president of the Society.

Royal Institution of Great Britain.—The following resolutions were unanimously passed at a recent meeting of the members of the Royal Institution:—(1) That the Royal Institution is desirous, as it always has been, of rendering to His Majesty's Government in relation to the war every assistance which lies within its objects as defined and governed by the Charter and Act of Parliament governing the Royal Institution, and by the conveyance and deed of trust of the Davy Faraday Research Laboratory. (2) That with a view to giving effect to this desire letters be addressed to the First Lord of the Admiralty, the Minister for War, the Minister of Munitions, and the Chairman of the Inventions Board of the Admiralty, requesting them to communicate with the managers, in case there is any field of research in relation to or connected with chemical and physical science, or either of them, to which the professors, assistants, and staff of the Royal Institution, or of the Laboratory, can usefully direct their attention, with a view to giving assistance to His Majesty's Government in the conduct of the war, or in case they desire that any members of their respective staffs shall be admitted to work in the Laboratory in the prosecution of any such research.

Patents and Alien Enemies.—Applications have been made to the Board of Trade for the avoidance or suspension of the following patents:—Nos. 8,487/06 and 30,101/10, granted to Rogler and Hoerbiger, by the Lilleshall Co., Ltd., Messrs. John Musgrave & Sons (1913), Ltd., and Messrs. Belliss & Morcom, Ltd.

Standardisation of B.A. Screws.—The standardisation of B.A. screws, taps and dies, and gauges has been before the Small Screws Sub-Committee of the Engineering Standards Committee for some time; on account mainly of the difficulty of finding satisfactory methods for the standardisation of the small screws and gauges, no definite decisions have been formed, but certain provisional conclusions have been reached which have enabled the National Physical Laboratory to issue a tentative list of dimensions which, there is reason to believe, may at the present juncture be of service to persons using the screws and assist in obtaining interchangeable work. The scheme is embodied in a number of tables intended to secure a fairly easy fit; for some purposes it might be necessary to reduce somewhat the limits given, and the tables are accompanied by notes regarding the permissible variations. The question of gauging has also been considered, and tables for the sizes of gauges are given. Particulars can be obtained from the National Physical Laboratory, Teddington, which is prepared in the interim to certify screws, &c., which fall within the prescribed limits as B.A. screws, taps or gauges.

Appointments Vacant.—Two switchboard attendants, for the Cleckheaton D.C. electricity works. See our advertisement pages to-day.

Inquiries.—Makers of a machine for compressing the graphite-manganese cylinders for dry cells are asked for.

Electrical Contractors' Association of Scotland.—At the annual meeting of the Glasgow Branch of the Association on Thursday last week, the chairman said that during the year there had been a net increase of seven members to the Branch.

Over a year ago the Committee received a deputation from the Electricity Committee of the Corporation, which was instructed to see what arrangements could be come to in order to have a first-class electrical showroom for Glasgow. The deputation wished first of all to give the E.C.A. the opportunity of opening and carrying on this showroom, but the Committee did not consider a showroom either a necessity or a profitable thing for either party to run. The representatives of the Corporation stated, however, that a showroom must be opened, and after many meetings it was arranged that the showroom should be opened and run by the Corporation.

The principal points arranged were:—The showroom should exist primarily for exhibition of electrical appliances; if a sale was made it would be at the usual trade retail selling price; all work resulting from inquiries at the showroom would be done direct by a contractor, and there would be no hiring. The agreement was for a first period of five years.

He had seen it stated that the conditions agreed to were less favourable to the Association than the I.M.E.A. Bill proposed. He thought any contractor reading the two sets of proposals would have no difficulty in seeing that in their case they were protected from rate-aided cutting with its attendant inferior workmanship, whereas in the I.M.E.A. proposals their trade would have been cut away from them to be run at a loss by a municipal "Kaiser." Another thing was that they knew Mr. Lackie and what he intended to do with the showroom.

Some time ago the wrights and masons had a difference of opinion with the architects and measurers regarding conditions and form of contract, and Sir G. Askwith was asked to arbitrate on the questions raised. The Association's representatives had attended a number of meetings regarding this. Up till now a measurers' schedule had been a schedule of rates. The new proposal was that they should have a contract total price accepted, not a schedule of rates, and any alterations beyond a small margin to be a mutual arrangement between architect and contractor. A complete set of conditions and rules of contract was being arranged, and later a model form of schedule would be drawn up for use by the measurers.

The Association had had proposals for agreements between the E.C.A. of Scotland and the Dynamo and Motor Manufacturers and also the Tungsten Lamp Association. They were not satisfied in either case with the inducements offered to them.

The Committee had now started to consider the question of rules for apprentices, and a draft set of rules had been drawn up.

They had given the men an extra 1d. per hour war bonus under their agreement with the engineers and shipbuilders. A slight alteration had been made in the rules for workmen, in a friendly spirit on both sides.

The Association, as a whole, was now on a firm basis both as regarded membership and finance.

Australian Railways.—The *Sydney Daily Telegraph* states that the Minister for Railways has in preparation an amendment of the Railways Act. This, in addition to giving the Government power to initiate a policy in regard to railway matters, also provides for the appointment of five Railway Commissioners. The railway administration will be divided into four departments —electrical, locomotive, existing lines, and traffic. In charge of each will be a sectional commissioner, while the fifth will act as chief, supervising the work of his colleagues.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. B. J. Cochrane, assistant electrical engineer to the Sydney, N.S.W., City Council, has, according to *Tenders*, been appointed general manager and chief engineer to the City Electric Light Co., of Brisbane. Mr. Cochrane will take up his new duties in August.

Mr. Seabrook, the general manager of the Marylebone electricity undertaking, has been asked to act as chairman of an operating Sub-Committee of the Metropolitan Munitions Committee, and also to act as district supervisor of various works.

The Gillingham (Kent) T.C. has granted Mr. G. Sampson, assistant meter reader at the electricity works, permission to join the Forces for the period of the war. Similar permission has also been given to Mr. P. Lines, of the electricity works staff.

The Dartford U.D.C. has increased the salary of Mr. R. Jones, assistant electrical engineer, from £150 to £160 per annum. The Committee recommended three yearly increments of £10 each, but the question of future increments has been deferred pending the receipt of a report on the wages of employés in the department.

With reference to the third item appearing in this section last week, we regret to learn that the information there given was not quite accurate. The announcement should read as follows:—Mr F. Whitehead, charge engineer on the gas plant at the

Accrington Corporation electricity works, has resigned, and Mr. A. Goward, shift engineer, has been appointed to fill the vacancy. Mr. Goward was appointed shift engineer in November, 1912.

Mr. W. B. Child, assistant electrical engineer to the Leek U.D.C., has resigned, having obtained another appointment.

Mr. W. E. Lloyd, secretary and manager of the municipal electricity works at Bacup, has resigned.

Among the members of the Hammersmith B.C. electricity department staff who have taken up duties under the Crown since the commencement of hostilities are the following from the official staff:—A. T. Gordon Smith, sergeant-major, Hon. Artillery Company; T. H. Meacock, sergeant, 13th County of London Regiment; H. R. Watts, private, Hon. Artillery Company; J. E. Pearce, sergeant, London Electrical Engineers; W. J. Whyman, private, 13th County of London Regiment; P. C. G. Sly, private, 4th Grenadier Guards.

Mr. C. H. Thorpe, engineer-in-charge of the Hammersmith B.C. electricity works, has resigned his appointment.

Mr. W. E. Claret, the works superintendent of the Maidenhead Corporation electricity works and late chief assistant engineer of the Smithfield Markets Electric Supply Co., Ltd., has been appointed chief engineer to the Hale End works of the British Xylonite Co., Ltd.

Sapper A. Duncan, who has been employed in the Harrogate Corporation electricity department for 14 years, latterly in charge of the meter and test-room department, is now serving in the London Electrical Engineers unit.

At a meeting of the Farnworth Council on July 6th, the chairman of the Electricity Committee reported that the electrical engineer, Mr. A. J. Hutchinson, had an opportunity of accepting a commission with the Royal Engineers, and was wishful to do so. The Council gave full consideration to the matter, and, in view of the depleted staff, it was resolved to request Mr. Hutchinson "to continue his duties here, as he is serving his country in a useful capacity in the performance of his present duties."

Tramway Officials.—The Wolverhampton T.C. has been asked to grant an honorarium of £50 to Mr. C. Owen Silvers (the deputy tramway manager), in recognition of the extra services rendered by him in connection with the laying of the double track in Bilston Road, and also for the increased responsibility which has fallen upon him consequent upon the absence of the tramway manager (Mr. W. A. Luntley) through illness.

The Colchester T.C. has voted a gratuity of £25 to Mr. R. C. Bullough, tramway manager, on account of greatly increased responsibility and work since the outbreak of war.

General.—At the last meeting of the Technical Education Sub-Committee of the Bradford City Council, it was reported that the External Examiner in Electrical Engineering was unable to act during the present year, and it was resolved that Mr. P. J. Pybus, M.I.E.E., be invited to act in his place.

The engineer engaged at the power station of the Bradford Technical College having obtained a commission in the Mechanical Transport Section of the Army Service Corps, has been granted the necessary leave of absence, and Mr. R. H. Harrop has been appointed as acting station engineer.

Mr. A. G. Ellis, A.C.G.I., who for the past two years has been with Messrs. Brown, Boveri & Co., in Baden, Switzerland, and is now vice-chief of the transformer department, was married on June 7th to Miss E. H. Price, at St. Leonard's Church, Hythe. From a letter which we have received from him, we learn that the war has exercised very little effect on things in Switzerland, although that country is ringed round with fighting nations; at the works they are "quite busy."

The following announcements appear in the *London Gazette*:—

Territorial Force.—*Royal Engineers:* London Electrical Engineers.—Thomas Clifford Mann to be Second Lieutenant.

Tyne Electrical Engineers.—Noel Gordon Hollebone to be Second Lieutenant.

The staff of Messrs. Crompton & Co., Ltd., Chelmsford, have presented a case of cutlery to Mr. Frank Harvey, on his marriage. Mr. Harvey has been with the firm for nearly 14 years.

The marriage took place at Fetteresso Church, on June 30th, of Mr. Hubert Wm. Drury, electrician, of Torquay, and Miss Margaret McLennan, second daughter of Mr. Geo. McLennan, of Fetteresso, Stonehaven.

Mr. E. E. Stockens, from Aberdeen, has this week taken up the position of manager of the Blackburn telephone service in succession to Mr. Barnes.

The local Munitions Committee formed for Blackburn and District includes Mr. P. P. Wheelwright, borough electrical engineer of Blackburn.

Mr. Spencer Hawes, M.I.E.E., has been appointed managing director of the Reading Electric Supply Co., Ltd. Mr. E. Rowley Hill retired from the post of engineer and manager at the end of June last.

Mr. A. R. Courtenay (late acting manager of the G.E.C. publication department) was gazetted on May 20th Sub-Lieutenant in the Royal Naval Air Service, Armoured Car Aeroplane Support (Royal Naval Volunteer Reserve), and is now undergoing a course of gunnery.

Roll of Honour.—Private A. G. Bell, of the 1st Northants, who was meter reader at the Kettering U.D.C. electricity works, has been killed in action in Flanders. Private Wm. Mace, of the 2nd Northants, who was arc lamp trimmer at Kettering, has lost his right arm and also had his jaw fractured, while fighting in Flanders. Another member of the Kettering staff, Private G. Munden, of the 2nd Duke of Cornwall's Light Infantry, jointer's mate, has been home suffering from frostbitten feet.

Corporal John Wilson, of the London Scottish, who has been killed in France through the bursting of a bomb he was in the act of throwing, was assistant secretary to Messrs. Balfour, Beatty and Co., Ltd., electrical engineers.

Private Geo. Vivian Ash, of the 15th Lancs. Fusiliers, who was chief clerk in the Bury (Lancs.) Corporation tramways office, has been killed in action.

Sergeant Harvey Andrews, 8th Lancs. Fusiliers, who has been killed in action in the Dardanelles, was, until the outbreak of war, switchboard attendant at the Salford Electricity Works in Frederick Street. He had served four years in the Territorials, and was in his 20th year.

Private George B. Wilson, of the 4th East Lancashire Regiment, an engine driver at Darwen electricity works, has been wounded.

Private L. Edwards, formerly employed by Messrs. C. Macintosh and Co., Ltd., Manchester, has been killed in action.

Sapper Arthur Haydock Ogden, B.Sc.Tech., who has died from wounds received in the fighting at the Dardanelles, was 26 years old, and was in the employ of the Lancashire Dynamo Co., at Trafford Park. He was educated at Sale High School, Rossall School, and the Manchester University.

Private J. Orrell, 18, an employé at the Westinghouse Works, Trafford Park, has been killed in action.

A member of the staff of the Ilford Urban District Council's electricity department (he was engaged in the inquiry office) has been granted the D.C.M. whilst on active service in France. We refer to 2,159 F. J. Burke, Signal Section "B" Company, 6th Battalion London Regiment, 47th division. The circumstances are related as follows, in a letter from Rifleman A. Homewood, dated July 10th:—

> Our brigade took part in a recent big battle in which it suffered heavy losses, and during a heavy bombardment by the Germans our communication wires got broken. Two men—Riflemen Layton and Rifleman Lambert—set out to mend these wires, but sad to say, they never returned. The bombardment was growing more severe when Rifleman Burke, of the Signallers, volunteered to run a wire from the firing line to headquarters. This seemed almost certain death, as the road which he was to take was nothing more than a death trap. The road (Willow Road) was being heavily shelled when he set out, but somehow he managed to get the wire through this "hell of fire," for which he has just been awarded a well-deserved D.C.M.

In a letter dated July 7th, Rifleman Burke gives, in reply to a request, the following fuller particulars:—

> We were at a place on the line—I'm afraid I cannot mention the name; but they were not trenches, the front line was composed of a breastwork of sandbags, which we had to approach across open country up a road, part of the way. There was a village about halfway between headquarters and the firing line, and I was responsible for the upkeep of the telephone lines. I had two linesmen at the village and one in the breastwork. We had a station at the village and two in the front line. About 6 o'clock on Whit Saturday morning they started shelling headquarters and gradually worked their way up to the village. About 6 30 our Signal Sergeant came to me and said all communications were broken between the village and the front line, although we had double wires the whole way. He said the two men had gone out from the village, but he was anxious to get communication, so asked me to go up and see about it. I went up the line and when I got to the village I had to take cover for over two hours before I could cross a road to the signal station. I got across at last and found they had not yet got into communication, and the other two fellows had not returned. I started out to follow the wires, which ran one on each side of a road up to the breastwork, but they were shelling the road so heavily that it was impossible to go near it, so I went back to the station, and they said the only thing to be done was to run a new wire, so a lance-corporal and myself took out a reel of wire and ran like the devil across the open country on the left of the road. We had to drop flat several times when shells dropped much too close to be pleasant; we had to stop for a breather half way in an old trench. We eventually got to the signalling dugout and connected up, thus getting into communication; then we had to run all the way back. Nearly all the men we saw were wounded, and the sights we saw that day were enough to make one sick of war for ever. The distance we ran the wire was about 500 yards. Luckily, the wire lasted through the bombardment, which did not cease until after 3 o'clock that afternoon. We got a chance a few days afterwards to put the original wires in working order. . . . I might say the two fellows who went out to mend the wire did not return, but we found them the following day; they had been killed by a shell.

Second-Lieutenant Theodore E. Williams, who for some six years was on the staff of the Hendon Electric Supply Co., Ltd., at Golder's Green, has fallen whilst fighting in Belgium. He was killed at Ypres on the 1st inst. He received his commission in the 1st Somerset Light Infantry only a few weeks ago. He was originally attached to the Artists' Rifles.

The Marylebone electricity department has received information that the following members of its staff are wounded:—Gregory, W., 1st East Surrey Regiment; Higgins, W., 3rd Middlesex Regiment; Gamble, A., 1st King's Royal Rifles; Ward, C., 1st London Regiment. Snow, A. J., 13th London Regiment, is a prisoner of war in Germany; and Gill, G., 10th Middlesex Regiment, has been discharged, medically unfit from accident.

Lieut. W. J. C. Budd, 2nd South Wales Borderers, who was killed at the Dardanelles on June 28th, was chief clerk in the Shanghai municipal electricity department from 1904 onwards. He received his commission in Shanghai in December last. He went from England to the Dardanelles on June 10th. He was 39 years of age.

Sub-Lieut. J. A. E. Tremayne, R.N.V.R., who was killed at the Dardanelles on June 19th, served his apprenticeship at Messrs. W. H. Allen's works at Bedford.

Obituary.—Mr. E. R. Callender.—The death occurred at Warren Cottage, near Dawlish (Devon), on Sunday, of Mr. Ernest R. Callender, who was an electrical engineer on the Manchester Ship Canal.

NEW COMPANIES REGISTERED.

F. Husband, Ltd. (140,919).—This company was registered on July 8th, with a capital of £1,000 in 10s. shares (1,000 7 per cent. pref.), to acquire the business connection of an electrical engineer belonging to F. Husband, and the benefit of his British patent rights in connection therewith. The subscribers (with one pref. share each) are: S. E. Pinney, 13, Thorpe Road, Amhurst Park, N., clerk; J. A. Fraser, Rutland House, Southend Road, Beckenham, Kent, solicitor; M. Lawrence, 22, Eastfields Road, Acton, W., clerk. Private company. The number of directors is not to be less than two or more than three; the first are F. Husband and J. A. Fraser. Remuneration £105 per annum divided between them. Registered office: Craven House, Kingsway, W.C.

J. Farr and Co., Ltd. (140,905).—This company was registered on July 7th with a capital of £1,500 in £1 shares, to adopt an agreement with J. Farr, trading as J. Farr & Co., for the purchase of the business of an electrical engineer and dealer in electrical goods of all kinds carried on by him at Upper Parliament Street, Nottingham. The subscribers (with one share each) are: Mrs. M. A. Farr, Carisbrooke Drive, Nottingham; P. J. Smith, St. Peter's Chambers, Nottingham, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are J. Farr (governing director, subject to holding 1,000 shares) and Mrs. M. A. Farr (both permanent). Remuneration of J. Farr as governing director £250 per annum; of other directors as fixed by the company. Solicitor: P. J. Smith, St. Peter's Chambers, Nottingham. Secretary: H. Onion, 81, Beech Avenue, Nottingham.

Birmingham Central Supply Co., Ltd. (140,884).—This company was registered on July 6th, with a capital of £2,000 in £1 shares, to take over the business carried on by W. Parsons and Mrs. R. E. Parsons at 84a, Tilton Road, Small Heath, Birmingham, Warwick, as the Central Supply Co., and to carry on at Birmingham and/or elsewhere the business of engineers, manufacturers of and dealers in electrical apparatus, equipment, machinery and appliances, and gas and electric fittings, hardware, and machinery of all kinds, magnetic, telegraphic, telephonic, chemical, scientific, and other appliances and apparatus, implements, goods, wares, and products, refiners of and dealers in illuminating, lubricating, fuel and other oils, etc. The subscribers (with one share each) are: W. Parsons, Oriel, Warwick Road, Olton, Birmingham, merchant; Mrs. R. E. Parsons, Oriel, Warwick Road, Olton, Birmingham. Private company. The number of directors is not to be more than five. W. Parsons is sole permanent director and chairman. Solicitor: G. Williams, Bank Buildings, Cradley Heath, Staffs.

Wholesale Electrical Co., Ltd. (140,845).—This company was registered on July 1st, with a capital of £2,000 in £1 shares (1,000 pref.), to take over the business of manufacturers of and dealers in electrical supplies carried on at 54 & 56, Oxford Street, W., as the Wholesale Electrical Co., and to adopt an agreement with T. W. Greaves. The subscribers (with one share each) are: T. W. Greaves, 54-56, Oxford Street, W., electrical engineer; F. W. Evans, 140, Copleston Road, East Dulwich, S.E., electrical sales manager. Private company. The first directors (to number not less than two or more than three) are T. W. Greaves and F. W. Evans (both permanent). E. H. Bevnes may retain office as secretary while holding 200 shares. Qualification, £200. Remuneration, £5 per annum. Solicitors: Crawford, Ely and Co., 45, Great Marlborough Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Altrincham Electric Supply, Ltd. (40,795).—Issue, on July 5th, 1915, of £1,800 debentures, part of a series of which particulars have already been filed.

New System Private Telephone Co., Ltd. (73,732).—Capital, £10,000 in £1 shares. Return dated June 15th, 1915. All shares taken up; £8,000 paid; £2,000 considered as paid. Mortgages and charges: Nil.

Standard Electric Co., Ltd. (68,643).—Capital, £10,000 in £1 shares (5,000 pref.). Return dated May 26th, 1915. 3,077 pref. and 5,000 ord. shares taken up; £1 per share called up on 4,177 ord. and 10s. per share on 400 pref.; £4.377 paid; £3,700 considered as paid, being £1 per share on 823 ord. and 2,677 pref., and 10s. per share on 400 pref. shares. Mortgages and charges: £3,500.

Phillips Commutator Grinder Co., Ltd. (94,544).—Capital, £25,000 in £1 shares. Return dated June 23rd, 1914 (filed April 8th, 1915). 5.452 shares taken up; £1 per share called up on 3,602; £3,603 3s. paid (including £1 3s. paid on 105 shares forfeited); £1,850 considered as paid on 1,850 shares. Mortgages and charges: £550.

CITY NOTES.

Electric Light and Power Supply Corporation (Sydney).

The report for the half-year ended April 30th shows further expansion in business and increased profit. It is difficult to make any fair comparison of the accounts, as the dates of closing them have been altered, but the directors give the following statement:—

	Half-year to June, 1914.		Half-year to April, 1915.
Consumers	2,353	......	2,911
Revenue	£17,957	......	£21,448
Expenses	8,348	......	9,149
Net profit	9,609	......	12,299
Brought forward	2,680	......	3,158
Available	£12,289	......	£15,457

After deducting debenture interest, dividends at 7 per cent. per annum were paid on the share capital, and appropriations were made for depreciation and other purposes. The £15,457 above is absorbed by debenture interest, £3,473; dividend, £4,409; reserve for depreciation of assets, £5,300; and debentures flotation expenses, £702; leaving £1,573 to be carried forward. The share capital is £125,980, and debentures £100,300. In June last year the share capital was £51,280, and debentures £175,000. The second debentures are in process of conversion into shares. The registered office is to be altered to Margaret Street, Rozelle.

General Electric Co., Ltd.

The annual meeting was held on Friday last at the Cannon Street Hotel, E.C. Mr. H. Hirst said that every abnormal movement noticeable in the country since the outbreak of the war had recorded its imprint on the company, and a summary of their experiences, arranged chronologically, might be of interest. On August 3rd, Bank Holiday—on the eve of the war—the Government desired prompt execution of emergency orders, and for this the immediate return of the staff to certain works was essential. It was a matter of pride to them, and also reflected great credit on their workpeople, that in spite of its being holiday week, over 99 per cent. turned up to give them the best of their work. The few days of financial unsettlement which followed the outbreak of hostilities did not seem to materially affect the electrical industry; whilst the month of August, which with them was generally the quietest month of the year, became one of the busiest. It appeared that factors and the trade, fearing a shortage of supplies, decided to fill up their stocks and, consequently, indulged in over-buying. The reduction of their stock as compared with last year, was largely due to this policy on the part of the trade, and owing to their reduction of output in consequence of the shrinkage of labour, and lack of raw material, they had not as yet been able to sufficiently replenish it. Their considerable export business was partially checked owing to difficulties of freight and insurance, and also by their desire to safeguard the supplies for the home market. Early in September they suffered severely by well-meant, but ill-conceived, Press attacks on the Osram Lamp Works, Ltd., with which they were so intimately associated, owing to the prevalence in that company of German capital. The Press did not then sufficiently distinguish between German-owned trading concerns and factories established in this country which were useful and essential to national purposes. The importance of the Hammersmith works, not only to them but also to the Government and the country, was very great, and it was, therefore, exceedingly gratifying to him to announce that a way had been found, with the knowledge of the Treasury and the Public Trustee, which would give the future control of these works, he trusted for ever, into British hands. By the end of September or the beginning of October they felt the first effects of the depletion of their staff and workpeople. A great many of their employés enlisted on the declaration of war, and it required no recruiting officers at their works to encourage young men to join the Colours; about 1,000 of them were now serving with His Majesty's Forces. On the declaration of war three of the sons of the late Chairman, Mr. G. Byng, enlisted. One of them—Mr. Harry Byng—a man trained as an engineer, winning honours at Harrow, Faraday House, and Harvard University, he was sorry to say had since fallen in action in Flanders whilst leading his platoon to attack. Of their men, 11 had already laid down their lives, 50 were invalided, wounded, or missing. Thirty-one had obtained commissions, amongst whom were Mr. Leonard Byng, a director of the company, and also his (the Chairman's) only son. They all readily volunteered to leave the works they loved in order to offer their all to that greater cause which had absorbed our thoughts unceasingly for eleven months, and he feared would occupy them for as many months to come, or even longer. They had arranged to keep open all the positions of those who had enlisted, and to pay 50 per cent. of the salary to the dependents of all married men, to make special allowances to a certain number of unmarried men who had relatives dependent upon them, and to set aside 10 per cent. of the salary of all unmarried men other than above, so that they might have some cash reserve on their return to civil life. It was not until the end of October that they realised what great quantities of their normal productions were required for war purposes. It was a matter of great satisfaction to the board that their determination to maintain single-handed certain industries for patriotic reasons had at last been rewarded by the knowledge that they had proved not only of indispensable service, but of vital importance to the welfare of the country. The time was not yet opportune to make a statement of recent developments referring to this subject, but whenever that moment arrived it would be a fine page in the history of their company and a lesson, he trusted, to the country at large. The company was, fortunately, in so strong a position, that should there be in the immediate future, owing to exceptional circumstances, a reduction of profits, they would quickly be able to make good, after victory had been achieved, when those markets which were now being starved called for replenishments from British works. In order to cope efficiently with the increased work created by the growth of the business, it had been found necessary to add to the number of the directors. They had selected from among the staff Mr. James Young Fletcher, who had been with the company for over twenty years, and had graduated from the ranks to the position of branch manager, and subsequently manager of the Osram lamp business; Mr. Sidney D. White, who had grown up with the company since its inception, and who was in charge of all the Government work carried on by the company; and Mr. George Maurice, who was head of their fixture business, also a servant of the company of over twenty years' standing, and fully conversant with their intricate and detailed business. They would be asked to confirm the election of Mr. Fletcher and White, but he was sorry to say it would not be possible to confirm that of Mr. Maurice. At his own suggestion, he decided on a trip to America in the month of March in order to open up business connections, principally for the purchase of raw materials which were unobtainable elsewhere. He was most successful, but, unfortunately, fell a victim to the murderous *Lusitania* crime. His loss would be deeply felt by them all, and the blank caused in their organisation would be very difficult to fill. With regard to the accounts, although the year showed a progress in profits, the absorption of some £22,000 extra for dividends owing to the increase of capital, had somewhat affected certain other items in the appropriation. The Pirelli-General Cable Works were completed and had started manufacturing for certain Government contracts, but owing to conditions of labour it might be quite some time before those works could be considered as being in full swing. Their Kingsway building was conceived to increase the efficiency of their administration, as well as to give greater comfort and better service to their customers. It seemed to them wrong at this juncture to pursue any scheme which did not add to national production or efficiency, and for this reason they had suspended building operations for the moment, and, as the removal, in consequence, would be deferred, they had only placed a very small sum this year to the account for provision for removal. The state of their finances had enabled them to invest £100,000 in the first War Loan, and shareholders might be interested to learn that they had since converted that into new War Loan, and had, in addition, applied for a further £100,000 of the latter, making up their total holding to £200,000. They were justified in hoping that they would be able to hold the bulk of this stock for a number of years; some £40,000 or £50,000, however, would eventually be absorbed by their allied enterprises, and by management, staff and workpeople, to whom they had given special facilities for gradual acquisition.

Mr. E. G. Byng seconded the motion, which was carried unanimously.

The dividend resolution was passed, and the retiring directors were re-elected. A vote of thanks and appreciation was accorded to the board and staff.

Marconi International Marine Communication Co., Ltd.

Mr. Godfrey Isaacs (managing director), presiding at the annual meeting, held at the Hotel Metropole on July 7th, expressed regret that Mr. Marconi was unable to be present owing to his having joined the engineering staff of the Italian Army to superintend the organisation of its wireless communication. With regard to the balance sheet, on the debit side the debentures were reduced from 6,250 to 6,094, representing £121,880 instead of £125,000. The amount appearing to creditors was some eight to nine thousand pounds in excess of the figure of the preceding year, accounted for merely by the normal increase of business. On the credit side the plant, apparatus, furniture, and stores showed an increase of between £39,000 and £40,000, due to the additional number of telegraph stations installed on board ships during the year, after making the customary substantial allowance for depreciation upon all installations fitted in previous years. The debtor balance showed an increase of some £13,000 to £14,000 consistently with the growth of the business. In consequence of the bigger business, expenses and salaries showed an increase, but these figures had not increased in the same ratio as the increase of business. Whilst each new installation entailed additional salaries to operators, the establishment costs of the complete world-wide organisation increased but slightly. The revenue showed an increase of between £28,000 and £29,000. In consequence of the outbreak of war, the receipts from ships' telegrams and news services during the last five months of the year suffered very materially. In the circumstances, and bearing in mind that theirs was not the nature of business which derived any advantage in consequence of the war, the result of the year's operations was the more satisfactory. It showed a continuous development year by year of a sound and growing organisation. The net profit for the year of £55,668, after deducting £28,000 for depreciation and debenture interest, was highly satisfactory. Some loss had been sustained in consequence of the destruction of ships by enemy submarines, and, having regard to the fact that this method of warfare continued, the directors had thought it desirable to place £10,000 to a special reserve account to provide for any eventualities, as being the prudent course, although they contemplated that compensation would be received. An amount of £20,747 was recommended to be carried forward in order that the company should have at its disposal ample cash resources. Every week they were adding new installations entailing additional capital expenditure. but adding steadily to the growth of their revenue. The Chairman referred with regret to the deaths of General Albert Thys, of Brussels, and Major Samuel Flood Page, both of whom were associated with the company from its very earliest days. They took a considerable part in the great struggle which the company had for its existence. It was hard to appreciate to-day that an invention of this great value and an organisation of such immense utility should have required many years of very hard work and persistent canvassing before justifying its existence. They were glad that their late colleagues lived to see the great life-saving work of the company so amply demonstrated under successful commercial conditions. At no time before, perhaps, had the value of Mr. Marconi's invention and the utility of this company's organisation been more prominently emphasised than since the outbreak of war, and when peace once more obtained, an interesting chapter might be written of the part played by the 2,000 Marconi stations fitted upon the vessels of the mercantile marine under the control and management of the Marconi companies. Their thanks were due to their manager, Mr. Bradfield, and the other members of the staff, who had so ably handled their business during very difficult times; and the greatest appreciation was due to their magnificent army of telegraph operators, who had unflinchingly carried out their duties upon board ship. As an instance, he would mention the operator of the *Armenian*, whose cabin was blown to pieces by shell fire, but who stood to his duty to the end, and, he was glad to say, was saved unhurt. Again, all would probably have read of the admirable conduct of the operators on the *Lusitania*, who never left their wireless cabin until the hurricane deck alone remained above water. These incidents were merely typical of many which had occurred in the mercantile marine. Upon the outbreak of war they called upon their operators for volunteers to serve as operators both in the Navy and the Army, and there were some 400 of their men now in those services. They regretted to have to record the death of five of them who went down with their ships or were killed in action. On more than one occasion the Admiralty had expressed their satisfaction and their appreciation of the resource and courage displayed by their men.

Capt. H. R. Sankey seconded the motion, and it was carried without discussion.

It was agreed, on the motion of Capt. Sankey, seconded by Mr. H. S. Saunders, that the remuneration of the directors should be £2,000, subject to such further sum, if any, as might be determined at the next annual meeting of the company, and that in respect of the year 1914 an additional £1,000 be paid to the directors.

Singapore Electric Tramways, Ltd.

For the year ended December 31st the directors report that after charging debenture interest, depreciation, and royalty paid to the municipality of Singapore, the accounts show a loss of £236, which, deducted from the balance to the credit of the profit and loss account at December, 1913, leaves £9,149 to credit of that account. The directors consider that £7,000 of this sum should be placed to a depreciation reserve account in view of the expenditure on track maintenance which they are advised will be necessary in the next few years.

In comparison with 1913, traffic receipts show a decrease of £5,529, 1,152,590 fewer passengers being carried. Car mileage shows a reduction of 26,892. The passengers carried per car mile were 7.43, as compared with 7.90, a decrease of .47 per car mile.

The traffic receipts for 1914, down to the outbreak of war, compared favourably with the previous year. For the five months ended December, 1914, they were considerably lower. The weekly receipts are still below the corresponding period of 1914, but lately the decrease has been less marked. The sales of energy for lighting and power purposes show an increase of 7 per cent. compared with 1913. The supply of current to the Tanglin district has not yet been commenced.

Of the additional plant referred to last year, the 350-kw. Diesel engine and generator, the 125-k.v.a. motor generator, and the a.c. switchboard have been erected. The two 187-k.v.a. Diesel engines and generators are in course of erection.

The directors again wish to place on record their appreciation of the services rendered to the company by the general manager and his staff of engineers and assistants.

Sir Frank A. Swettenham, G.C.M.G., presided, on July 6th, at the annual meeting, held at 19, St. Swithin's Lane, E.C. He said that on the credit side of the balance sheet additional expenditure of £14,863 was shown, which represented about two-thirds of the cost and re-erection of additional plant. The traffic receipts from the tramways were £66,958, a decrease of £5,529. They carried 14,921,000 passengers, as against 16,074,000. The expenses of the tramway undertaking represented 56 per cent. of the receipts, while the total Singapore expenses were 54.3 per cent. of the total Singapore revenue. Those figures compared with 50.9 per cent. and 49.5 per cent. in 1913. Until the outbreak of war the traffic receipts compared favourably with the corresponding period for 1913, but the last five months showed a decrease of 19 per cent., as compared with the same period in the previous year. For the three months ended March of the present year the falling off was only 13 per cent., and the traffics for April and May had recovered considerably, the decrease being only 5 per cent. He thought, therefore, they might regard it as fortunate that the undertaking was being affected only to the extent he had mentioned. The sale of electric current, notwithstanding the war, had continued to increase, the receipts from that source being £800 more than in 1913. On the matter of depreciation and provision for track renewals, a situation had developed about which it was necessary the shareholders should be informed. They had been advised by the manager that the system of their tramway track as originally laid had proved inadequate, and that there were defects which called for renewal, and for placing the track on a new foundation. The rails also had worn to such an extent that it would be necessary to replace them in a far shorter time than might reasonably have been anticipated. The general manager had made a careful examination of the system, and had come to the conclusion that the relaying of the track and the replacement of the rails must be carried out, if possible, within the next five years. The necessary work must be paid for out of revenue, but when it was completed they were advised that the life of the track and of the rails might be estimated at about 40 and 16½ years respectively. An annually increasing sum had been placed to depreciation, but, as the renewals of the whole track and rails must be made in a far shorter time than was originally expected, the sums hitherto allotted would not bear the cost of the new work. It was, therefore, necessary not only to place to depreciation a larger sum annually, but the board had decided to create a special reserve to meet these charges, and to take £7,000 from the available balance brought forward from 1913 and place it under the heading of depreciation reserve. When they last met no one in this country had any idea that within a few months we should be engaged in the most terrible war of all times. When the war broke out the undertaking was doing so well that they confidently expected to be able to pay a dividend for the year 1914. However, the war had changed all that, and from August last the receipts had fallen off considerably and the prices of supplies had increased, so that the result of the year's working showed a loss, instead of the considerable profit they had anticipated. The question of dividend, therefore, could not be considered at the present time. Under the circumstances, he trusted the shareholders would reconcile themselves to devoting to depreciation larger sums than were felt necessary in the past. When the work of renewals had been completed they would have a line constructed on a far sounder basis than the one they now had, and the directors suggested that the cost of the work should be spread over a number of years. One result they could confidently look for from a renewal of the track and the rails was a reduction in the power and maintenance expenses.

Sir Charles Petrie, J.P., seconded the motion.

Dr. Moody said he thought the feeling of the shareholders was one of profound disappointment with the report. There was room for a very considerable reduction in expenditure. £8,286 was expended last year on maintenance of the permanent way, which was at the rate of something like £500 a mile. He was aware that some parts of Singapore were built on the mud, but he was interested in a large number of tramway concerns in many parts of the world, and he knew of no other company where the expenditure on maintenance was on such a scale. In his opinion, the board ought to have given them a dividend on the ordinary shares, even if it was only 4 or 5 per cent. He also thought that the expenses in London, which amounted to £2,000, or over 1 per cent. on the capital, could easily be reduced by half.

The Chairman, replying to Dr. Moody and other shareholders, said it was not the existing company that laid the track, and, therefore, they could not be held responsible in any way. He presumed it was laid on the advice of responsible engineers, but in practice it had not turned out to be successful, and it had not the sort of life they had a right to expect. The consequence was that it had been necessary to expend large sums of money relaying the track, and a great proportion of the money spent last year on maintenance had been expended on relaying the track on a continuous bed of concrete. In his opinion, it would not be right to replace the track and charge the cost to capital, even if there was the capital to meet the cost. In the end, if it was paid for out of revenue the shareholders would benefit. With regard to decreasing the London expenses by reducing the number of the board, the shareholders had that matter in their own hands—they could always refuse to re-elect the retiring directors if they thought it in the interests of the company to do so.

The report was then adopted.

Edmundson's Electricity Corporation, Ltd.

The annual meeting was held on July 8th at Salisbury House, E.C. Mr. P. D. Tuckett, who presided, said that the gross trading profit stood at £9,768, which was approximately the same as a year ago. The final result of the year's working was a net profit balance of £23,240, as compared with £23,125 last year. Under the circumstances, he thought they might well feel satisfied with the result realised, for during the last five months of the year, instead of doubling the substantial increases of profit earned during the first half, as under normal conditions might have been expected, a large number of the subsidiary companies actually lost more than the whole of such increases. The war effectually deprived them of what he believed would otherwise have proved to be an exceptionally prosperous year. There could be no question of any increased distribution in times like these. He had intimated how seriously the business had been affected by the war, and he very much feared that some of the adverse influences from which they were now suffering might be accentuated as the war proceeded, and even more markedly, perhaps, after the war, if it was unduly protracted. In any case, for some time to come they were unlikely to be able to raise fresh capital, and it was, therefore, incumbent on them to husband their own internal resources to the fullest extent. Having regard to the financial conditions which were likely to prevail for some time, as well as to the general uncertainties of the future, it should be a source of considerable satisfaction that they had been able so substantially to strengthen during the past seven years both their own position and that of the subsidiary companies. In addition to their own reserve, the subsidiary companies appropriated to reserve for the past year over £30,000 in excess of the provision made by them in 1908, besides showing an aggregate increase of over £13,000 in the amounts carried forward. This very marked improvement in the financial position, compared with what it was a few years ago, would, he hoped, enable them to meet successfully any strain to which the war might subject them, but these were necessarily most anxious times, and not times in which they could afford to take any chances. The balance sheet disclosed a stronger financial position than was shown a year ago; their cash resources having increased by some £20,000 and their reserve by some £16,000. Proceeding to deal with the results of the subsidiary companies, he said that the total connections during the year amounted to the equivalent of 155,285 33-watt lamps, an increase of 8 per cent., of which 32 per cent. were lighting and 68 per cent. power. The connections for the previous year, which were the largest they had ever had, represented the equivalent of 169,699 lamps, and it was probably owing only to the war that last year's connections were not still larger, for down to the time of its outbreak they considerably exceeded those for the corresponding period of the previous year. As it was, the connection was a very large one, and should go some way to counter-balance the loss of revenue which, he was afraid, they must expect from a good many of their old consumers. To enable them to supply this additional load, the subsidiary companies incurred a capital expenditure of £84,824, as compared with £96,384 in the previous year; whilst for the current year their capital expenditure would almost certainly show a considerable further reduction. The increase in the gross profits of the various undertakings was £8,377, as compared with increases of over £11,000 and £12,000 for the two previous years, but there, again, the poorer comparison was entirely due to the war, the returns to the end of July showing a steady improvement which promised to yield comparative results even better than those for the two previous years. Having referred in detail to the difficulties which the various subsidiary companies had encountered owing to the war, the Chairman said that to meet the increased costs of supply, and particularly the increased cost of coal, they had in most cases, in common with a great many other electric supply and gas undertakings, been obliged to raise their rates of charge, and they must hope that that would to a large extent compensate them for the increased costs to which they were now being put. Not the least serious loss they had sustained had been in the inevitable disorganisation of the staff consequent upon a number of their men joining the Colours. Altogether they had lost over 270 men, a number they could ill-afford to spare from their by no means over adequately staffed stations, for this was no easy time to replace skilled men trained in their service. Allowances to their dependents would involve a sum of something like £3,000 for the current year. They must not overlook the fact that an extra burden rested on those who remained and who were loyally and willingly striving by their extra efforts to minimise the loss they had sustained. They were no less discharging their duty, nor were they less entitled to receive their grateful recognition and thanks. In this connection, he desired to emphasise a feature of the situation which was not sufficiently recognised, and that was that the continued efficient running of public service undertakings such as theirs was just as essential to the successful conduct of the war as many of the activities more conspicuously connected with it, for, apart from the very real economy which they were effecting in the use of the country's coal by meeting the needs of the manifold industries of their various towns from a central station, instead of obliging each manufacturer to supply his individual needs, there were very few, if any, of their towns in which they were not supplying power for every variety of war service, including shell-making. It was most unfair to those of their men who were quite as anxious as their fellows to serve their country at this crisis, but whose clear duty required them to remain at their posts, to suggest that they were not doing their duty and serving their country in the best possible way; and yet, through failure to appreciate the nature of the work they were doing, he feared there was some tendency to throw some such reproach in their teeth. The Lancashire Power Co.'s profits increased from £23,000 to £30,000, and but for the war they would have been still better. He usually concluded his remarks by endeavouring to give them some indication of the prospects of the business for the current year. On this occasion the conditions were so altogether abnormal and uncertain that he felt it would be useless to attempt to make any forecast. At the same time, he did not want them to allow themselves to be unduly depressed by the somewhat gloomy features of the situation to which he had had to call attention. Those features existed, and were bound to affect them adversely, but how far they were likely to suffer it was impossible to foresee, for they could not yet tell how the last five months of the current year would compare with the corresponding war period of last year, nor how far their increased rates of charge might compensate them for the increased cost of supply. It largely depended on the extent to which their consumers were going to economise in the use of current, and he was inclined to think that the tendency of their part to do so was likely to be more pronounced next year than this. Be that as it might, they were doing all in their power to counteract any losses they might sustain; and, after all, there was a very considerable margin of profit both in their own accounts and in those of the subsidiary companies to meet any ordinary contingency that might arise. Moreover, he would recommend them never to lose sight of the fact that, whatever might be the vicissitudes of the immediate future, they had a thoroughly sound and stable business which had shown wonderfully steady and satisfactory progress hitherto, and would, he did not doubt, do so again, even if some temporary setback should result from the altogether abnormal times through which they were now passing.

Mr. A. A. Campbell Swinton seconded the motion.

Replying to Sir Charles Cuff, the Chairman said they exercised the strongest pressure they possibly could on the subsidiary companies in regard to economy. The trouble with Edmundson's stations, speaking generally, had not been that they were running extravagantly, but that they had been running too cheaply. Until their very large investments in ordinary shares in the Urban Electric Supply Co. and the Lancashire Power Co. became productive—which he was afraid would not be the case for several years—they had no expectation of showing any large increase in the item of dividends and interest received and accrued.

The report was then adopted.

J. Stone & Co., Ltd.—The report for 1914 states that the satisfactory condition of the company's trade which prevailed throughout 1913 continued, and showed remarkable improvement, until the outbreak of war in 1914. There is a balance to credit of profit and loss account for the year's working, after full allowance for depreciation, &c., of £198,926, to which is to be added the surplus brought forward from 1913 of £125,162, making a total of £324,089. After paying the preference dividend the directors recommend that £20,000 be placed to the reserve fund (making it £165,000), a dividend of 10 per cent. per annum, and a bonus of 3s. per share being paid on the ordinary shares, leaving £189,039 to be carried forward.

Standard Waygood Hercules, Ltd. (Australia).—At the annual meeting held in Sydney recently, Mr. J. B. Nicholson, the chairman, stated that the figures in the balance-sheet showed little difference as compared with those of the corresponding period last year. The orders in hand at that time represented £130,000; now they stood at £105,000. When the war broke out last August their business suffered for a month or two, but during the past five months the company's operations had not proved nearly as disappointing as anticipated.

Cape Town Consolidated Tramways and Land Co., Ltd.—The report for 1914 shows a debit balance for the year of £1,894, carried to the balance-sheet, making the total to debit £9,997 carried to next year. No dividends have been declared by any of the subsidiary companies during the past year.

Anglo-American Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ended June 30th, 1915, of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, less income-tax, payable on July 31st.

Dublin United Tramways Co., Ltd.—Interim dividends for the half-year ended June 30th, 1915, at the rate of 6 per cent. per annum on the preference shares, and 5 per cent. on the ordinary shares, both less income-tax.

Direct United States Cable Co., Ltd.—Interim dividend 2s. per share, less income-tax at 2s. 6d. in the £, being at the rate of 4 per cent. per annum, for the quarter ended June 30th.

Fraser & Chalmers, Ltd.—Interim dividend of 7½ per cent. on the preference shares, less income-tax.

Advertising Stamps. — The Benjamin Electric, Ltd., of Rosebery Avenue, E.C., have issued a series of three coloured poster stamps respecting their specialities.

Prices Advance.—The Sterling Telephone and Electric Co., Ltd., announce that owing to the further increase in the cost of raw material, and general expenses of production, the list prices in their ninth edition catalogue, and all current publications, are increased as from July 14th by a further 15 per cent., making an advance of 25 per cent. in all.

For Sale.—Bradford Corporation has for disposal one Pollitt & Wigzell's horizontal tandem compound condensing steam engine, one Holdsworth & Sons' steel boiler with Proctor's mechanical stoker, and a Green's fuel economiser. Particulars are given in our advertisement pages.

STOCKS AND SHARES.

Tuesday Evening.

There was a general expectation in the Stock Exchange that, after the War Loan subscription lists had closed, business would revive in all the markets. Up to the present, however, this has not come about. The public are waiting with the keenest interest to see at what price the new security will be started in the market. Until this takes place, activity in stocks and shares is not to be looked for; and, anyway, the absorption of so much capital from the investing classes is bound to make itself felt as a decided factor for some time to come. The British public have applied for the War Loan by way of permanent investment. Stagging there may have been, but, if so, it was on the smallest of scales, since everyone knew that allotments would be made in full, and that the possibility of an immediate premium on the stock was not sufficient to make application worth while from the speculative point of view.

It may now be assumed that the Treasury will consent to companies making new issues of stock, where the money is required, without insisting upon the strict conditions imposed for a month or two prior to the appearance of the War Loan. That every step should have been taken to ensure the successful launching of this colossal issue was meet and proper, so that individual hardships entailed thereby were cheerfully accepted, and nobody grumbled. The embargo, it would seem, may now be removed in so far as it relates to domestic concerns, more particularly those of the industrial world which require further capital for their business. Incidentally, it is obvious that such companies will have to offer very tempting terms in order to obtain their money; and the opportunity for investors to secure good stock at cheap prices is one that is likely to be with us for some time to come.

The influence of the War Loan will be felt in many ways, direct and indirect. We have already shown how 4 per cent. debenture stocks standing at 90 have been lowered to the neighbourhood of 80 as one first result of the issue. Should the price of the War Loan decline to a discount, other securities—more particularly those of the gilt-edged variety—will have to give way in proportion. It were well, therefore, to reiterate that security of interest payment is one of the principal things upon which stockholders should concentrate their attention. They will have to put up with depreciation of their investments. They must be prepared to hear that such-and-such a stock, though it be of the finest class, is not saleable. These things need trouble comparatively little, so long as dividends are secure. To the proprietors of debenture stocks and preference shares in first-class companies, the financial consoler may reasonably offer such points as these by way of comfort. The stock may be unsaleable, but not a whit the worse for that.

Somerset House, with the remarkable unfairness common to both the departments charged with the collection of death duties and of income tax, insists that the former shall be paid upon the nominal prices of stock officially quoted at purely artificial levels; so that it behoves everyone to live as long, and as well, as he and she can at present, from the point of view of subsequent beneficiaries, if not that of advantage to the payment of death duties to the State.

The war is costing £2,000 a minute, according to the Government calculations, so every £100 lent to the nation just now lasts for about three seconds. In that short sentence resides the kernel of the reasons why most securities are severely depreciated.

Home Railway stocks have in many cases made further progress towards recovery, and the chief one amongst electrical issues is a rise of 3 in Underground Electric income bonds. The coal controversy is again becoming acute, but the Home Railway market as a whole is enjoying subdued strength. When it is noticed that, in France, ordinary coal for furnace purposes costs something like three guineas per ton, there is a certain negative satisfaction to be drawn from the price at which coal can be bought wholesale to-day in this country.

The St. James' & Pall Mall Electric Light Co. has declared an interim dividend of 7 per cent. on its ordinary and preference shares, this comparing with 10 per cent. in the corresponding period last year. The reduction caused little or no surprise in the market, because it had been generally supposed that all the illumination companies would have to cut their distribution, in consequence of the war conditions prevailing in the streets and in the coal bills.

The list of prices shown overleaf is unaltered. South Metropolitan ordinary, after changing hands in the neighbourhood of 16s., reacted to 14s. 9d., so that apparently the people who paid 18s. 6d. for the shares a fortnight or so ago have now secured all that they wanted; in the absence of their support, the order to sell a hundred or two caused the quotation to recede. Business in the London shares is very quiet. County of London ordinary and preference are both offered at 11. The Newcastle-upon-Tyne Electric Supply Co. has postponed the question of an interim dividend on the ordinary shares, owing to the uncertainty of the situation. The preference are to receive an interim dividend of 2½ per cent.

The Marconi International Marine meeting produced an interesting speech from Mr. Godfrey Isaacs in his review of the year. He paid tribute to the magnificent army of telegraph operators who unflinchingly carried out their duties on board ship, instancing, for one, the operator on the *Armenian*, Mr. Swift, whose cabin was blown to pieces by shell fire, but who stood to his duty to the end, and who was miraculously saved unhurt. He recalled the admirable conduct of the operators on the *Lusitania*, who never left their wireless cabin until the hurricane deck alone remained above water. These instances he declared to be merely typical of many which have occurred in the mercantile marine. The Marconi group of shares has been strong, and the loss of ⅛ in the parent company's issues was more than recovered, the price at 1⅞ showing a rise of 3/16 on the week.

Telegraph issues on the whole are still depressed. Globe ordinary have reacted to their par price of 10, Eastern ordinary fell 2 to 125, and Anglo-American Telegraph preferred is now but a point above par. The relations between the United States and Germany, according to the newspapers, are once more becoming strained, though in the Stock Exchange the idea of America falling foul of Germany, so far as a rupture of diplomatic relations is concerned, continues to be scouted. The reply of the German Government to the American Note, however, has had a weakening effect upon most securities connected with the United States. British holders of Anglo-American securities sold largely during the last fortnight, in order to apply for the new War Loan, and probably the dullness noticeable in this class of stock is merely the result of a slight fit of indigestion on the part of the Wall Street Stock Exchange. The stock market in London is far more interested in the magnificent achievement of General Botha, whose triumph has done more than anything else to correct the somewhat depressing tone which certain of our newspapers have patriotically seen fit to adopt of late.

Chili Telephones remain at 6¾, undergoing no change on the issue of the report, which showed that the company lost about 900 subscribers, while it managed to maintain its gross receipts decidedly well, the net income being no more than $20,000 down on the year. The rate of exchange, however, militated against the net profit, reducing it to £48,000, which is about £9,000 less than that in the previous period. The directors decided to leave the dividend unchanged at 8 per cent.

Quite a feature of the markets within the past few days has been the swift rise in the Rio de Janeiro exchange, which caused a corresponding recovery in various issues connected with Brazil. A rise of 1½ has taken Brazil Tractions to 52. Anglo-Argentine Trams, on the other hand, are still drooping, the debenture stocks being principally affected. Mexicans exhibit no quotable change, but in view of the trouble which has broken out in Haiti, it is feared that President Wilson will feel more disinclined than ever to take any strong line in Mexico.

The Shawinigan Water & Power Co. is about to issue $1,237,500 new common stock at par; and as the current price of the shares is about 116, this will represent a substantial bonus to proprietors. Under present Treasury regulations, these proprietors will probably not be allowed to subscribe for the new issue, but they will no doubt have the opportunity for realising their rights; and application for permission to deal in these rights will be made to the Stock Exchange in due course.

The industrial group shows a good deal of steadiness, and Henleys have risen ¼ to 14¼. Telegraph Constructions, however, failed to pick up any of their sharp loss of last week. There is rather more doing in this market as a whole. Rubber shares are good, the improvement in the price of the raw material to 2s. 7½d. per lb. sufficing to sustain interest and to bring in fresh buyers. The armament group, too, is better, support for Vickers coming from Sheffield.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Blackpool-Fleetw'd	June 25	2,830	−2,007	25	11,605	− 2,218	8	..
Bristol	„ 25	39,689	− 775	25	230,081	+20,601	80·5	..
Chatham and Dist.	„ 17	5,214	+1,342	24	25,864	+ 443	..	..
Cork	July 1	2,241	− 10	26	12,638	− 209	54·25	..
Dublin	June 25	26,021	− 471	25	149,892	+ 6,983	9·89	..
Hastings	„ 24	8,914	− 648	..	..	− 1,025	19·8	..
Lancashire United	„ 30	7,540	+ 467	26	43,375	+ 675	42	..
Llandudno-Col. Bay	July 2	1,549	− 168	30	8,065	+ 766	6·5	..
Tyneside	June 23	2,904	− 751	25	14,342	− 295	11	..
Anglo-Argentine ..	July 1	198,810	−21,936	26	1,332,691	−125,048	..	..
Auckland	June 4	20,511	− 408	48	218,109	+ 798	25·42	1·06
Calcutta	„ 26	17,258	− 487	..	..	− 5,668	..	..
Kalgoorlie, W.A. ..	April	2,841	..	17	10,208	..	..	..
Madras	June 30	8,767	+ 55	26	24,855	− 187	..	..
Montevideo ..	June	24,266	−8,783	31	226,694	−30,554	..	..
Dublin-Lucan Rly.	June 30	854	− 10	26	8,718	+ 135	7	..

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price July 13, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	8¼	—	£6 1 8
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4	—	6 5 0
do. do. do. 4½ Pref. ..	4½	4	—	5 12 6
do. do. City Pref.	4½	3⅞ xd	—	5 16 2
do. 4 Deb.	4	82	—	4 17 7
Chelsea	5	4½	—	5 11 1
do. 4½ Deb.	4½	88 xd	—	4 17 10
City of London	9	13¼	—	6 15 10
do. do. 6 per cent. Pref. ..	6	12	—	5 0 0
do. do. 5 Deb.	5	105 xd	—	4 15 8
do. do. 4½ Deb.	4½	90 xd	—	5 0 0
County of London	7	11	—	6 7 3
do. do. 6 per cent. Pref. ..	6	11	—	5 9 1
do. do. 1st Deb.	4½	96 xd	—	4 13 6
do. do. 2nd Deb.	4½	90	—	5 0 0
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref. ..	6	4⅝	—	6 8 1
do. do. 4 Deb.	4	82	—	4 16 5
Metropolitan	3½	8	—	5 16 8
do. 4½ per cent. Pref. ..	4½	3¾ xd	—	6 0 0
do. 4½ Deb.	4½	90 xd	—	5 0 0
do. 3½ Deb.	3½	70 xd	—	5 0 0
St. James' and Pall Mall	10	7¼	—	6 18 0
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70 xd	—	5 0 0
South London	5	3	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7	—	6 8 7
do. 4½ Pref.	4½	4⅝	—	4 17 4
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	101	−1	5 18 10
do. Def.	1½	21¾	—	6 18 0
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8¼	—	6 1 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11¾	—	*6 16 2
do. 4 Deb.	4	82½	—	4 17 0
Eastern Tel. Ord...	7	125	−2	*6 8 0
do. 3½ Pref.	3½	72	—	4 17 3
do. 4 Deb.	4	81	—	4 18 9
Globe Tel. and T. Ord.	6	10	− ½	*6 17 0
do. Pref.	6	11¼ xd	—	5 6 8
Gt. Northern Tel.	22	34	—	6 9 5
Indo-European	65/-	52	—	6 5 0
Marconi	20	1⅞	+ 3/16	10 13 4
New York Tel. 4½..	4½	95	—	4 13 0
Oriental Telephone Ord.	10	1⅞	—	5 6 8
do. Pref.	6	1 3/16	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 8
United R. Plate Tel.	8	5¾	—	*7 19 10
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12¼	—	*6 10 6
do. 4 Deb.	4	83	—	4 16 5
Home Rails.				
Central London, Ord. Assented ..	4	73	—	5 9 7
Metropolitan	1¼	25½	—	4 18 0
do. District	Nil	18½	+ ¼	Nil
Underground Electric Ordinary ..	Nil	1⅜	+ ⅛	Nil
do. do. "A"	Nil	4/6	—	Nil
do. do. Income ..	6	75	+2	*9 3 0
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref. ..	5½	4⅛ xd	—	6 13 4
do. 2nd Pref.	5½	3⅝ xd	—	7 11 9
do. 4 Deb.	4	78 xd	−1	5 2 7
do. 4½ Deb.	4½	80 xd	—	5 12 6
do. 5 Deb.	5	78	−1	6 8 2
Brazil Tractions	6	52	+1½	11 10 10
Bombay Electric Pref.	6	10¼	—	5 16 10
do. 4½ Deb.	4½	90	—	5 0 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds ..	—	60	—	Nil
do. 6 per cent. Bonds ..	—	30	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	45	—	—
Adelaide Sup. 6 per cent. Pref. ..	6	5	—	6 0 0
do. 5 Deb.	5	98	—	5 2 0
Manufacturing Companies.				
Babcock & Wilcox	14	2¼	—	6 4 5
British Aluminium Ord.	5	1 1/16	—	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	11	—	6 13 4
do. Pref.	6	6	—	5 0 0
British Westinghouse Pref.	7½	86/-	—	8 2 2
do. 4 Deb...	4	70 xd	—	5 14 4
do. 6 p. lien	6	100	—	6 0 0
Callenders	15	11¼	—	6 13 4
do. 5 Pref...	5	4⅞	—	5 2 7
do. 4½ Deb.	4½	95	—	4 14 9
Castner-Kellner	15	8¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/6	—	Nil
do. do. fully paid	Nil	1¾	—	Nil
do. do. 4 Deb.	4	60 xd	—	6 13 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/6 xd	—	8 17 10
do. do. Pref.	7	1 xd	—	7 0 0
Gen. Elec. Pref.	6	9¾ xd	—	6 3 1
Henley	20	14¼	+ ¼	*6 0 6
do. 4½ Pref.	4½	4¾	—	4 14 9
do. 4½ Deb.	4½	95	—	4 14 9
India-Rubber	5	8¾	—	5 14 3
Telegraph Con.	20	83	—	7 5 6

* Allowance made for dividends being paid free of income-tax.

British Electric Traction Co., Ltd.—The scheme for the reduction and rearrangement of the capital of this company is now in the hands of the proprietors, and will be considered at an extraordinary general meeting to be held at the Holborn Restaurant, on Friday next, July 23rd.

NEW RUSSIAN CUSTOMS TARIFF.

(*Concluded from page* 39.)

Poud = 40 funts = 36 lb.

* Imported by sea. † Imported over European land frontier.

	Old rate. Roubles. Per poud.	New rate. Roubles. Per poud.
Machines and apparatus, complete or incomplete, fitted together or in parts :—		
1. Of cast-iron, wrought-iron or steel, with or without parts composed of other materials even in combination with copper to an extent not exceeding 25 per cent. of the total weight of the machine :—		
(*a*) All kinds not specially mentioned	2·10	2·80½* 3·36⅗†
(*b*) Gas and petrol motors, steam engines, portable engines and electro-motor wagons ...	3·20	4·01½* 4·81⅘†
(*c*) Machines for the working of metals	4·20	5·11½* 6·13⅘†
2. All kinds of machines made of copper or its alloys, or in the composition of which copper or any alloy of copper is present in a proportion exceeding 25 per cent. of the total weight of the machine	8·00	9·90* 11·88†
3. Dynamo-electrical machines and electro-motors of all kinds; electrical transformers	8·50	9·35* 11·22†
7. Parts of machines and apparatus imported separately from the machines or apparatus to which they pertain, not specially mentioned :—		
(*a*) Composed of copper or alloys of copper, or in the composition of which copper or any alloy of copper is present to an extent exceeding 25 per cent. of the total weight of each separate part	8·00	9·90* 11·88†
(*b*) Composed of cast-iron, wrought-iron, or steel, even though with parts consisting of other materials, or in combination with copper, if the copper does not exceed 25 per cent. of the weight of each separate part	4·20	5·11½* 6·13⅘†
8. Spare parts of machines or apparatus, not specially mentioned, imported with such machines, as par. 7 (*a*)	8·00	9·90* 11·88†
9. Spare parts of machines or apparatus, imported together with such machines or apparatus, composed of cast-iron, wrought-iron, or steel, even though with a combination of copper not exceeding 25 per cent. of the weight of each separate part :—		
(*a*) Imported with any of the machines enumerated in sub-division (1) (*a*) above	2·10	2·80½* 3·36⅗†
(*b*) Imported with any of the machines enumerated in sub-division (1) (*b*) above	3·20	4·01½* 4·81¾†
(*c*) Imported with any of the machines enumerated in sub-division (1) (*c*) above	4·20	5·11½* 6·13⅘†
10. Parts of dynamo-electrical machines and transformers are admitted conformably to the respective letters under sub-division (7) above, except the parts enumerated below :—		
(*a*) Induction coils	17·70	19·47 * 23·36⅖†
(*b*) Armatures and commutators ...	12·75	14·02½* 16·83 †
(*c*) Frames with parts (other than brasses) of copper...	8·50	9·35 * 11·22 †

	Old rate. Roubles. Per poud.	New rate Roubles. Per poud.
Physical, astronomical, mathematical and similar instruments and apparatus, also electrotechnical accessories :—		
1. Electrical current interrupters, commutators, safety cut-outs; holders for electrical incandescent lamps; rheostats and commutators of all kinds, fitted together or in parts; telegraphic and telephonic apparatus; electric bells and accessories for electric signalling	9·00	13·20
2. Electrotechnical measuring appliances (ammeters, wattmeters, voltmeters and calculators) ...	12·00	16·50

Note.—The rates of duty specified in subdivisions (1) and (2) of the present No. are also applicable to separate parts of the apparatus mentioned in the said subdivisions.

3. Electrical incandescent lamps with filaments of carbon covered or not with metal :—		
(*a*) Mounted	30·00	33·00
(*b*) Without mounting	60·00	66·00
4. Electrical incandescent lamps, with metal filament :—		
(*a*) Mounted	65·00	71·50
(*b*) Without mounting	90·00	99·00

Note 1.—Vessels for medical or pharmaceutical use in laboratories, composed of clay, stoneware, glass, porcelain or the like, pay duty according to the sections of the Tariff applying to those materials respectively.

Note 2.—Similarly, spare parts of electrical cells, batteries and other appliances, which wear out by use and require to be replaced by new ones, such as zinc, copper and other plates for cells, carbons for the same and for lamps, lanterns, &c., pay duty according to the respective sections of the Tariff.

AN INVESTIGATION OF DIELECTRIC LOSSES WITH THE CATHODE-RAY TUBE.*

By JOHN P. MINTON.

Careful study of insulating materials is becoming more and more important, and it is certain to become much more noticeable in the near future.

Heretofore, the electrical tests made on insulation have largely been voltage, capacity and resistance measurements. These measurements do not tell us enough, and on account of their inadequacy the measurement of the dielectric losses and power factors of insulating materials becomes of much importance. By means of such measurements one is able to study a piece of insulation up to almost the breakdown point under a variety of conditions, and over and over again. Such measurements will reveal to us more about insulation than all the three tests referred to above.

The reason why such measurements have not been carried out on a large scale before is the difficulty of securing instruments which will measure small losses at very high voltages. Prof. Ryan first suggested the use of the cathode-ray tube for this purpose, and showed how it could be used. The development of the "cyclograph," which is the name given to the cathode-ray tube wattmeter, was begun in 1911 at the Pittsfield Laboratory, and has been accomplished, so that it is a satisfactory apparatus to measure dielectric losses up to almost any desired voltage, from very small to large losses, and from low to high frequencies, so long as a continuous alternating potential is available. The cyclograph has been in continuous use in this laboratory during the past two years, and a large amount of valuable information has been gained both on cathode-ray tubes and on insulation.

Since the method of determining the dielectric losses with the cyclograph is quite different from that described by Prof. Ryan, it will be necessary to show how the apparatus is used for this purpose. The cathode ray tube, M, is an evacuated glass tube of the dimensions and shape shown in fig. 1 (p. 92). Under the proper conditions, a direct potential of about 20,000 volts, applied between the cathode C and the grounded anode, a, will cause a stream of cathode rays to originate at the cathode and travel at a very high velocity towards the other end. It is necessary to have C the negative terminal because the cathode rays consist of electrons which possess negative charges. A grounded brass diaphragm, d, intercepts all these rays with the exception of those which pass through a round hole about $\frac{1}{32}$ in. in diameter in this diaphragm. This small pencil or bundle of rays travels to the lower end of the tube, where it strikes the fluorescent screen S. This screen is usually made of calcium tungstate ($CaWO_4$), or zinc sulphide (ZnS), or some other salt which is strongly fluorescent when subjected to the bombardment of cathode rays.

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* Abstract of paper read before the American Institute of Electrical Engineers, July 2nd, 1915.

In order that the fluorescent figure on the screen may be symmetrical with respect to the centre, it is necessary in this scheme to use two pieces of similar insulation. These two pieces are represented by A and B and are placed between the test terminals in the oil-box, O, as shown in fig. 1. Suppose now a high-potential sine wave is applied to these test pieces by means of the transformer T, and that it is desired to measure the dielectric loss in them. Fig. 1 shows the diagram of connections to be used. For this purpose, a sine-wave potential, proportional to the voltage across the test terminals in the oil-box, is applied to the potential quadrants, q_2, q_2. This potential is obtained from the air potential condenser C_3, as shown in the diagram. This potential produces the deflection of the cathode-ray spot on the fluorescent screen S, as shown by b b in fig. 2. Since the cathode rays possess no appreciable inertia, it follows that this deflection is directly proportional to E.

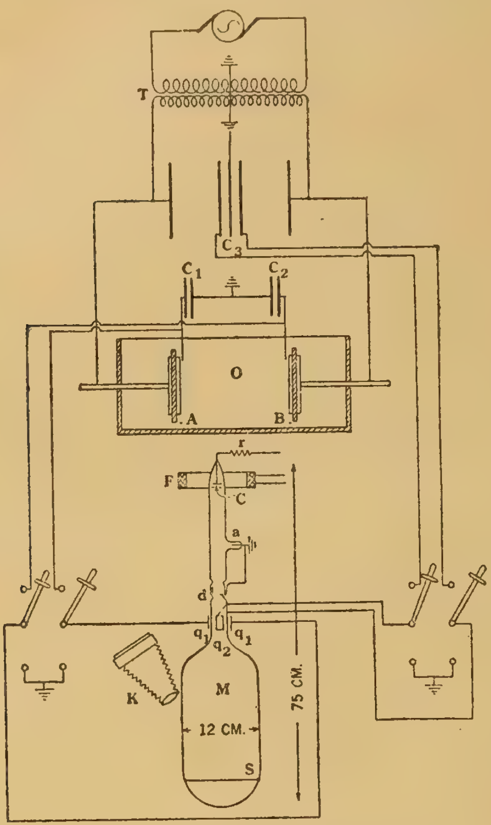


FIG. 1.—DIAGRAM OF CONNECTIONS.

To the current quadrants, q_1, q_1, is applied a potential e_1, proportional to the current passing through the insulation under test in the oil-box. This potential is obtained from the air current condensers, C_1 and C_2, as shown in fig. 1. The voltage across an air condenser is directly proportional to the current passing through it. The current that passes through these condensers is that which passes through the insulation under test. This potential e_1 produces the deflection a a of the cathode-ray spot as shown in fig. 2, proportional to e_1.

When both of these potentials act on the cathode-ray stream simultaneously, an ellipse is formed on the screen, S, by the fluorescent spot, as in fig. 2. The area A of this ellipse is proportional to the power lost in the insulation and air condensers, C_1 and C_2, and since the loss in the air condensers is negligible, we see that the area of the ellipse is proportional to the dielectric loss in the two pieces of insulation under test. Calibrations are avoided by the use of the cyclograph as a power factor meter and by measuring the currents and voltages independently. The latter quantities can be determined without trouble, and the power factors are easily obtained from photographs taken of the fluorescent figure.

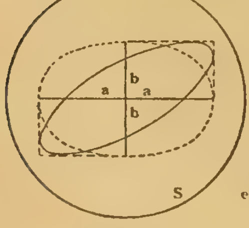


FIG. 2.

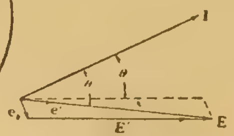


FIG. 3.

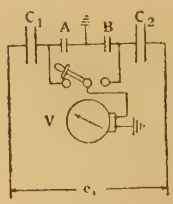


FIG. 4.

FIG. 2.—FIGURE PRODUCED ON THE SENSITIVE SCREEN S.
FIG. 3.—VECTOR DIAGRAM FOR TESTING CIRCUIT.
FIG. 4.—CONNECTIONS OF ELECTROSTATIC VOLTMETER.

If the power factor of the circuit were unity instead of cos θ, the area, A_0, of the ellipse would be represented by the dotted ellipse in fig. 2, and $A_1/A_0 = \cos\theta$. A_1 can be obtained by measuring the major and minor axes of the actual ellipse formed by the fluorescent spot on the screen; A_0 can be obtained by measuring a and b, fig. 2. Hence, cos θ can be determined. This makes it evident that it is advisable to make three exposures for each photograph, one of the ellipse, one of the deflection a, and one of the deflection b. However, one exposure, that of the ellipse, would be sufficient to determine cos θ.

This is the value of the power factor of the circuit, but one desires the power factor of the insulation which is being tested. This is obtained from fig. 3, which is the vector diagram for the circuit consisting of the two test pieces and air condensers C_1 and C_2. The voltage across this circuit is represented by E, and the current passing through it is represented by I, leading E by an angle θ. e_1 is the potential drop across the air condenser, and it is at right angles to I. E′ is the voltage drop across the insulation, and θ' is the phase angle between I and E′. The power factor of the insulation, therefore, is cos θ', which is the one sought.

Approximately,

$$\cos\theta' = \cos\theta + \sin 2\,\theta\,.\,e_1/2\,E'.$$

The current that passes through the insulation also passes through the air condensers C_1 and C_2. Under normal conditions, the current passing through any air condenser is given by $I = 2\,\pi\,f\,C\,e_1 \times 10^{-6}$ amperes,

where e_1 = potential in volts across the condenser,
C = capacity in mfd. of the condenser,
f = frequency of the applied potential.

So that this equation can be used to obtain the current passing through the insulation.

The voltage, e_1, across the air condensers has been determined with a 120-volt Kelvin electrostatic voltmeter used with two auxiliary condensers, one connected on each side of the ground between C_1 and C_2 in fig. 1. One terminal and the metallic case of the electrostatic voltmeter can be grounded, and the auxiliary condensers are sufficiently large to permit the 120-volt Kelvin meter to be connected directly across them. In fig. 4 the average of the readings across A and B is taken to represent the value of e_1 to be used; e_1 varies from 600 to 3,000 volts, depending on the conditions of test. This method is quite satisfactory, and can always be relied upon to give accurate results. The loss in these condensers introduces no appreciable error in the results.

The air capacities, C_1 and C_2, or these in series with the two auxiliary condensers A and B, range from about 0·003 to 0·015 microfarads. This range has been found sufficient. The frequency of the applied potential is measured without any difficulty. The current per sq. cm. can be obtained by dividing the total current by the area of the testing terminals; all the current values given in this paper are in milliamperes per sq. cm. The test terminals used were either 20 or 25·4 cm. in diameter, and results obtained with 10-cm. terminals were the same as those obtained with the 25·4-cm. ones, so that the edge effect was negligible.

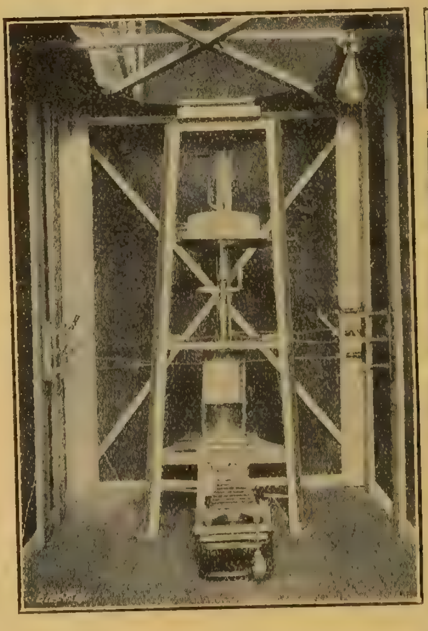


FIG. 5.—CYCLOGRAPH IN SMALL DARK ROOM.

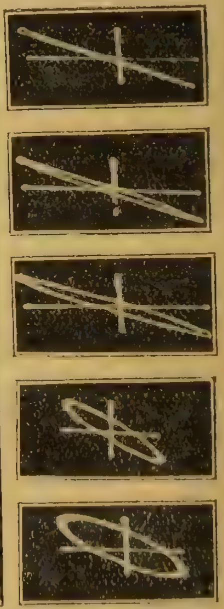


FIG. 6.—EXAMPLES OF CURVES OBTAINED.

The voltage E applied to the test terminals was obtained by reading the voltage on the low side of the testing transformer, and calculating E by the ratio of transformation. The voltage E′ across the insulation can be calculated. The watts lost in the two pieces of insulation under test are given by the equation

$W = E' I \cos\theta'$, where the potential and current are in volts and amperes respectively. Watts per cu. cm. can be obtained by dividing the total watts by the actual volume of insulation under test.

About 30 seconds are required to make the three exposures for each photograph, and about a minute more is required to obtain all the other necessary readings. In about 10 minutes we can secure data to give curves showing watts vs. voltage, current vs. voltage, and power factor vs. voltage.

An illustration of the cyclograph, as it is set up in the small dark house, is shown in fig. 5.

In the literature on cathode-ray tubes, reference is made to trouble encountered with "hardening" and "softening" effects in these tubes. The "hardening" is an increase and "softening" a decrease of the vacua. Satisfactory tubes should maintain constant vacua of the desired magnitudes under all ordinary conditions of operation. The development of such tubes was undertaken. It was finally shown that the vacuum "softened" because too much gas was adsorbed on the surface of the electrodes and glass walls. It was found that if the tubes were exhausted three or four hours at perhaps 350° C., sufficient adsorbed gases were liberated from the glass walls and electrodes to maintain constant vacua over long periods of time. One tube has now maintained a constant vacuum for almost two years, and there is no indication that it will not maintain this vacuum for a number of years, although it is used almost daily. Not one exception to this rule has been found.

Another difficulty was due to electrostatic charges which accumulated on the glass surrounding the aluminium cathodes. These charges were of a positive sign, and since the cathodes were negative, discharges would occur between the cathodes and glass as soon as the potential differences reached a sufficient magnitude to cause the discharges. Such discharges always caused the cathode ray streams to be unsteady, and frequently resulted in flash-overs within the tubes between the cathodes and anodes. The flash-overs were prevented by the use of high resistances (perhaps 100,000 ohms each) such as high-resistance lightning arrester rods, in the cathode leads. These resistances should connect immediately to the cathode terminals, as shown by r in fig. 1. These resistances not only prevent flash-overs, but they also cause the tubes to operate much more steadily. They do not, however, prevent discharges from occurring between the cathodes and the glass surrounding them.

It was noticed that tubes whose vacua "softened" during operation never gave any trouble due to these electrostatic charges. Tubes which had been exhausted several hours at a high temperature in order to eliminate vacuum changes were always unsatisfactory, because of the difficulty with the charges. Since the adsorbed gases are liberated from the glass during exhaustion at about 350° C., it would seem that the reason the charges accumulate during operation of the tubes is on account of a film of gas on the glass being necessary for conducting away the charges to the cathodes. The following scheme of exhaustion was found to eliminate all trouble of this kind. The idea was to remove a sufficient amount of the film of gas by exhausting the tubes at a high temperature, in order to allow a constant vacuum to be maintained and still leave on enough of the film to conduct away the charges which collect on the glass surfaces. After some experimenting it was found that if the tubes were exhausted at about 350° C. for, perhaps, a half-hour, the vacua would remain constant during several hours of continuous heavy operation, and no trouble would be experienced on account of charges on the glass surrounding the cathodes. Exhaustion at a high temperature for this time was sufficient to avoid vacuum changes over long periods. This method of exhaustion has been tried on a number of experimental tubes and found to be satisfactory.

Soft sodium glass has given less trouble with these static discharges than any other glass tried. This glass is also easy to work.

The deflecting quadrants can be placed outside the tubes, which greatly simplifies their construction. It also permits easy adjustment of the magnitude of the deflections, a thing which is highly desirable in this work. The quadrants are made of pieces of brass about 0·5 in. × 1 in., and they must be supported by a material which has a very high insulation resistance and does not change due to surface leakage or otherwise. Hard rubber serves this purpose nicely, and accurate results can always be obtained with it. The switches connecting the leads to the potential quadrants should have hard rubber bases with considerable leakage surface. Since the current condensers are so much larger than the potential one, it is not necessary to have such highly insulated switches.

During damp weather moisture will deposit on the surface of glass. Formerly this always happened with the cathode-ray tubes, and sometimes it was impossible even to deflect the rays, because the deposited moisture acted like a metallic shield for the rays.

It was necessary to make the tubes completely non-hygroscopic in the neighbourhood of the quadrants in order to ensure satisfactory results. Cellulose nitrate has been used for this purpose, and it has been found quite satisfactory.

The kenotron has been tried as a means of exciting the tubes; it produces a steady cathode-ray stream, and there is no apparent reason why it could not be used to good advantage in this work. The mechanical rectifier has been largely used in connection with the cyclograph for producing the cathode rays.

The focusing coil, F (fig. 1), is used for concentrating and increasing the brightness of the fluorescent lines on the screen. The focusing coil is always placed so that its plane coincides with that of the cathode.

(To be continued.)

SOCIETIES AND INSTITUTIONS.

As we are frequently asked through the post for the addresses of electrical, engineering, and scientific institutions and associations, we give below a list of these. The addresses given are those of the secretaries. We propose to republish the list about four times a year.

Associated Municipal Electrical Engineers (Greater London), Electricity Works, Squires Lane, Finchley, N.
Association of Electrical Station Engineers, 41, Warren Road, Leyton, N.E.
Association of Engineers-in-Charge, St. Bride's Institute, Bride Lane, London, E.C.
Association of Consulting Engineers, Inc., 11, Victoria Street, London, S.W.
Association of Mining Electrical Engineers, Bank Chambers, London Road, Derby.
Association of Supervising Electricians, St. Bride's Institute, Bride's Lane, London, E.C.
Batti-Wallahs' Society, 25, Victoria Street, London, S.W.
British Electrical and Allied Manufacturers' Association, Inc., King's House, Kingsway, London, W.C.
British Engineers' Association, 32, Victoria Street, London, S.W.
British Association for the Advancement of Science, Burlington House, London, W.C.
Chemical Society, Burlington House, London, W.C.
Diesel Engine Users' Association, Chelsea Electricity Supply Co., 19, Cadogan Gardens, Chelsea, S.W.
Electrical Contractors' Association., Inc., 20, Bucklersbury, London, E.C.
Electrical Trades' Benevolent Institution, 18 & 21, Park Mansions, Vauxhall Park, S. Lambeth Road, London, S.W.
Electrical Trades' Union, 137, Great Clowes Street, Broughton, Manchester.
Electro-Harmonic Society, Finsbury Pavement House, London, E.C.
Faraday Society, 82, Victoria Street, London, S.W.
Illuminating Engineering Society, 32, Victoria Street, London, S.W.
Incorporated Association of Electrical Power Companies, Caxton House, Westminster, S.W.
Incorporated Municipal Electrical Association, 28, Bedford Square, London, W.C.
Institute of Metals, Caxton House, Westminster, London, S.W.
Institution of Civil Engineers, Great George Street, Westminster, London, S.W.
Institution of Electrical Engineers, Victoria Embankment, London, W.C.
Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.
Institution of Mining Engineers, 39, Victoria Street, London, S.W.
Institution of Post Office Electrical Engineers, G.P.O. West, London, E.C.
Iron and Steel Institute, 28, Victoria Street, London, S.W.
Junior Institution of Engineers, 39, Victoria Street, London, S.W.
London Electrical Engineers, Territorial Force, 46, Regency Street, London, S.W.
Metropolitan Association of Electric Tramway Managers, Corporation Tramways Department, Croydon.
Municipal Tramways Association, Inc., Tramway Offices, 7, Hall Ings, Bradford.
Physical Society of London, Imperial College of Science, South Kensington, London, S.W.
Post Office Telephone and Telegraph Society of London, G.P.O. (North), E.C.
Röntgen Society, 7, Harley Street, London, W.
Royal Institution of Great Britain, 21, Albemarle Street, London, W.
Royal Society, Burlington House, Piccadilly, London, W.
Royal Society of Arts, 18 and 19, John Street, Adelphi, London, W.C.
Society of Engineers, Inc., 17, Victoria Street, London, S.W.
Tramways & Light Railways Association, Caxton House, London, S.W.
Wireless Society of London, 107, Hatton Garden, London, E.C.

Standardising Electrical Motor-Car Fittings in the U.S.—Elaborate studies of electrical equipment for petrol motor-cars have been made by the Electrical Equipment Division of the Standards Committee of the American Society of Automobile Engineers. A number of recommendations on such points as interchangeable bulb bases and connector plugs, the use of conduit in installations, the methods of earthing circuits, connectors, fuses and their rating and installation, and methods of battery installation in connection with electric lighting and engine starting sets have lately been made. Among the more suggestive recommendations is one that before any electrical appliance is added to the equipment of a car after it is sent out from the manufacturer's works, a description of it be sent to the car maker in order to secure his recommendation as to its suitability, and the best method of applying it to the particular car. In place of the terms "single wire" and "two-wire" systems, now generally used, the Division prefers to call them "insulated return," in the case of the latter, and "grounded return" as regards the former. Metallic conduit is preferred for protecting conductors, and rules for its construction and use are specified in considerable detail. The adoption of fuses, rated respectively at 10, 20 and 30 amperes, is recommended, while fuse ratings must be in accord with the specifications of the American National Board of Fire Underwriters. Battery installations must be so carried out, that neither acid fumes nor overflow of water or electrolyte will cause serious leakage of current. Battery hold-down bolts, if connected to metal handles or other metal parts at the top of the jars, must be insulated at one end at least. Among other matters that are under consideration is that of perfecting the standards for lamp bulb bases, connecting plugs, and receptacles. Hitherto connectors have not universally interchanged with lamp sockets, but standard plugs have now been laid down, which will fulfil this requirement. Occasional difficulty in fitting bulbs into their sockets, owing to irregularities in the manufacture of the bulbs, will also be done away with when the new standard calling for a reduction in the length of the socket of $\frac{1}{16}$ in. comes into effect. A desire has also been expressed for the reduction to standard form of certain dimensions of electric engine starting units, with the hope that the interchange of different makes of starter might thereby be facilitated. The Division has, however, not proceeded beyond the preliminary stages of its investigation, and thus far has found little to indicate that practice has settled down sufficiently to warrant the attempt at standardisation at the present time.

UNITS FROM REFUSE.

By A. J. ABRAHAM, M.I.E.E.

My excuse for writing this short article is that I have served in combined electricity and destructor stations since 1901, and my humble object is to bring this experience before more able engineers who have hitherto treated lightly the immense possibilities of town refuse.

Everyone will admit that, from the health point of view, the only way to deal with refuse is to cremate it, and that the authority which still tips this around the neighbourhood for reasons of false economy should be open to criminal prosecution—unfortunately this is not the case! My chief complaint is that even the leading destructor makers have got into a groove or, perhaps, have been pushed into this groove, and the result is that while the average destructor is excellent for the purpose of destroying refuse, justice cannot be done to the refuse from a steam raising point of view. The consequence is that in various parts of the country to-day there are electricity works hampered with the inevitable drawbacks of a destructor which is absolutely useless for steaming boilers, and the electrical engineer rightly considers that he has a millstone tied round his neck. As stated above, destructors have in the past been designed solely with a view to burning refuse, and where these have been combined with an electricity works, either all the value of the radiant heat has been allowed to go to waste in the combustion chamber, *thereby in most cases reducing the steaming efficiency of the destructor by nearly 50 per cent.*, or else the space under the boilers has not been large enough to consume all the gases and otherwise act as a perfect combustion chamber. During ordinary quiet working in the Aberdare destructor we evaporate an average of 4 lb. of water per lb. of refuse "from and at." On our peak, however, for the purpose of saving refuse, we abandon the destructor and burn refuse directly under the boilers with specially constructed furnaces, and with the latter arrangement we can evaporate considerably over this amount of water per lb. of refuse "from and at." Neither arrangement is an ideal one for obvious reasons, and had there been no Local Government Board inquiry (where one set of experts proved that our proposed scheme would be a drastic failure, and the other set proved that it would be a success), and had we known what experience has since taught us about this wonderful refuse *before the works were planned*, a combination of the present arrangement would no doubt have been installed in the destructor, and in place of our present small non-condensing units, the Consulting Engineer would have had the wherewithal to install larger condensing units. The results of such a plant would have staggered both destructor makers and electrical engineers.

Last year Aberdare Electricity Works generated 1,110,229 units. Only nine tons of coal were burnt and produced 1,827 units, whereas 13,011 tons of refuse were destroyed and 1,108,402 units were generated by refuse, or an average of over 85 units per ton of refuse for the whole year, and this figure includes all refuse used for steam raising and banking, steam for forced draught, pumps, crusher engine and the large quantity of steam which was blown off to atmosphere. These figures become more interesting when it is repeated that our engines are small units, consisting of 100 KW. and 200 KW. sets which exhaust to atmosphere, and there are no economisers installed. For fear of being laughed to scorn, I hesitate to give the amount I consider we should easily be able to increase the figure of 85 units per ton of refuse to, if we were working a destructor of an absolutely novel and proved design in combination with one fairly large turbo-generator driving both lighting and traction, and running condensing on superheated steam in conjunction with economisers. In view of our present figures anybody will, however, surely agree that the average figure of 85 units could be increased to 160 units per ton, and given a load factor of 25 per cent. up to 250 units per ton of refuse destroyed.

Thanks to refuse and the enthusiasm of the Aberdare Council and the loyalty of the staff, our tramways (also run by refuse) made a surplus last year of some £3,600, and our electricity department about £1,200, and to show that the destructor shared in the general prosperity, it may be mentioned that the portion of the destructor revenue derived from the sale of steam nearly paid for the labour cost of destroying the refuse—and this in spite of the high price of labour in this district.

There is no doubt but that the three combined schemes, namely, destructor, electricity works, and tramways are, as a whole, the most successful combination in the Kingdom.

Our electricity working costs per unit sold on an output of just over one million units are 0.72 pence, and the Aberdare people enjoy the cheapest electricity in South Wales, the average price obtained being 1.57d. per unit.

In face of the above example there is a neighbouring Council nearly adjoining Aberdare who are tipping refuse nearly as valuable as coal and buying current in bulk from a power company. Moreover, they are at present extending this short-sighted policy, although in the future they propose to lay down electric tramways. I think such an authority would be in a better position to buy electricity in bulk *after* they had made full use of their splendid refuse and dealt with it in a sanitary manner, when they could say to some company: "Our present cost of generating electricity is 0.7d. per unit sold. What is your price if we improve your load factor by generating with refuse during your peak load?"

They would also have a better case for their proposed Tramway Bill. What is going to happen in such places when the tips fill up and there is no space for either refuse *or useless destructor residue?* Would it not be better to save tipping space for destructor residue rather than fill up this available space with refuse, especially as the bulk of refuse is 75 per cent. more than the destructor residue would be?

To take the case of a neighbouring town of 40,000 inhabitants and using the experience already gained, the following extraordinary result is not a fairy tale but can be guaranteed with perfect safety to any authority in this district, within a few years after the works started a supply:—

Refuse destroyed per annum	12,000 tons.
Units sold—private supply per head of population = 20	= 800,000
Public lighting	= 100,000
Tramways	= 400,000
Total units sold	1,300,000
Total units generated ...	1,400,000
The *total* labour cost of dealing with 12,000 tons of refuse per annum	£1,400
Destructor revenue from Electricity Department—1,400,000 units at .25d.	£1,400

So that the authority, instead of either wasting the heat and paying, say, £1,000 per annum for labour in order to get rid of their refuse or sending out notices *re* killing flies, and at the same time polluting the neighbourhood and spreading disease, would be able to destroy all refuse for the maintenance and capital charges of their destructor.

The electricity department would also reap the benefit of a fuel cost of .25d. per unit generated on the low output of 1,400,000 units, and such a cost with coal could otherwise only be obtained on an output of five or six times this amount. For future comparison it could reasonably be expected that 12,000 tons of this refuse will generate up to 2,000,000 units for the same labour cost, leaving the destructor with a sum of about £166 per annum in hand for maintenance of plant, *after* the charge of .25d. to the electricity department had been reduced to .2d.

Another authority I know of have recognised the tremendous value of the refuse, and have made a bargain with a power company to exchange current. I do not know the arrangement, but if a million units have to be pumped into the company's system before a revenue of £2,000 is obtained, the arrangement appears to me to be an excellent one (for the power company), when it is borne in mind that Aberdare selling the cheapest electricity in South Wales makes a revenue of about £7,000 per million units; in the earlier days of the undertaking we should have been glad to supply our surplus heat for ½d. per unit at our switchboard, and could do with a similar arrangement at the present time *provided* that we were not bound to supply a certain number or any units after we could get a better price for them directly from our own ratepayers.

Now, between the typical refuse of South Wales and the ordinary refuse which I have used in England and Scotland, there is not so much difference as one would imagine. Although by injudicious use and the slightest attempt at forcing we can soften the firebrick lining (3,074° F.) in the Aberdare destructor, yet we find it pays us to keep a combustion chamber temperature of not more than 2,300° F., or a heat hovering between orange and white. Our heat, however, is absolutely constant. With very poor refuse in 1901, nickel could often be melted in the furnaces. In 1903 the Manchester Steam Users' Association carried out tests at the Nelson destructor and obtained furnace temperatures from 2,300° F. to 3,100° F., and destroyed an electric platinum wire resistance pyrometer when trying to take the temperature of the combustion chamber. In Cambuslang Electricity Works ten years ago, with poor Scotch residential district refuse, we ran the combustion chamber at a temperature of nearly 3,000° F. for eight hours a day and seven days a week, and did not even stock coal. So that there is not the slightest doubt but that from *any* refuse ample heat can be obtained. The difference, of course, is that, all other things being equal, in South Wales on a grate area of 25 sq. ft. you will have a job to properly destroy, without injuring the destructor, 10 cwt. of refuse per hour; whereas in average districts nearly double this quantity could be cremated for the same useful heat. With the very poorest class of refuse there is no reason why 2½ lb. of water per lb. should not be evaporated.

In 1903 a Lancashire colliery town had undoubtedly a good destructor for destroying refuse, but as a steam raising plant during the years ended March, 1906, to 1912, it appeared to be a failure. The population was in 1912 45,000, so that about 14,000 tons of refuse should have been available, and there is no doubt but that with a properly designed steam raising destructor 840,000 units could easily have been generated at a fuel cost of .25d., and a destructor labour cost of nothing or next to nothing.

As, however, the unfortunate engineer had the aforementioned mill-stone hanging round his neck, this is what happened with good refuse at this town for the year ended March, 1912:

Net deficit on electricity undertaking	£311
Units sold	819,261
Fuel cost	.43d. per unit sold.

It would be instructive to know on top of this what was the labour cost of destroying the refuse per ton, and whether all the refuse (taken at 14,000 tons) was destroyed, and what income the destructor derived from steam. Now, had it been possible at this time to take advantage of the refuse, the fuel cost would have been reduced by .16d. per unit sold, the destructor would have obtained a revenue for steam of over £850, the electricity department's deficit of £311 would have been a surplus of £235, and the ratepayers would not have had to spend £1,000 or so for coal.

During the year ended March, 1906, the units sold were 799,297; the deficit, £332. The cost of coal and coke was £1,328, *and the amount paid to the destructor for steam £150*. To-day the above appears to be a very sad result, and it is similar results all over the country which make the unfortunate engineers in charge of such plants loathe the name of destructor.

From experiments which I have carried out, and from bitter experiences with front feed, back feed, top feed, and tub feed destructors, I have come to the conclusion, if you want steam and proper combustion without undue dust:—

1. That the ashpit pressure of any destructor should not exceed 1 in. of water.
2. That the cells should be front fed and below the combustion chamber, and the latter should have a false bottom for dust.
3. That large water tube marine-type boilers with superheaters should be placed directly on top of the combustion chamber.
4. That separate steel stacks complete with dust-catcher (which can be cleared while working), economiser and fan draught at the chimney base should be provided for each boiler.
5. That turbo-generators and condensing plant should be installed on the electrical side.

And it is my humble opinion that then, and not until then, shall we begin to realise the value of the despised town refuse and stop using coal. At the same time attention will be given, as at Barnes and Dover, to economical scavenging by means of motor lorries, which will bring the refuse from collecting stations to the destructor, for surely, refuse will be worth gathering in from far and near when we know how to use it.

The War Office are just now busy relieving local authorities of their horses, and before such authorities have no horses left they should carefully consider battery refuse vans which will improve their load factor and reduce the cost of scavenging.

The Gas-Filled Lamp in Photography.—In a recent issue the *Electrical World* gave the results of a research by Dr. W. Voege on the effect of operating standard gas-filled lamps at over-voltage, so as to obtain a higher actinic output than is ordinarily available. Starting with an ordinary gas-filled incandescent lamp, normally operated at 12 volts, Dr. Voege operated it at 30 per cent. over-voltage, with the result of bringing down the specific consumption to less than a third of a watt per hefner. The candle-power under this treatment rose 150 per cent., and the actinic power a good deal more, the gain varying according to the character of the photographic paper or plate employed in the test. With a certain paper, for example, the actinic output of the lamp over-run by 30 per cent. increased about 3·75-fold; on a fast dry plate about 2·75-fold. While these figures still leave the incandescent lamp far behind the arc lamp, they show so great an increase over the results at ordinary voltage as to overcome in no small degree the difficulty hitherto felt with respect to the use of this lamp on account of the length of exposure.

Although Dr. Voege's experiments did not include orthochromatic plates, he has done quite enough to show that by raising the voltage on a gas-filled lamp it becomes a most useful auxiliary in photographic working. The subject is worth further investigation. The ELECTRICAL REVIEW drew attention to the possibilities of the tungsten lamp in this connection some years ago.

Marylebone.—COAL CONTRACTS.—In October, 1913, the Marylebone Council entered into a contract with Messrs. Cory and Sons for the supply of 20,000 tons of coal. Since the commencement of the war, considerable difficulty has been experienced by the contractors in making delivery in accordance with the contract, and various claims have from time to time been made for extras on the contract. After protracted negotiations the contractors have now agreed to fulfil their obligations.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

9,408. "Cases for ammeters and voltmeters." A. Chinn & H. Butler (trading as Central Manufacturing Co.). June 28th.

9,411. "Bell operated electrically." E. Kilner. June 28th.

9,428. "X-ray apparatus." British Thomson-Houston Co., Ltd. June 28th. (General Electric Co., United States.)

9,442. "Electric induction motors." R. F. M. Woodforde. June 28th.

9,447. "Electric hand grenade or shell."' W. J. Wilson & W. H. Wilson. June 29th.

9,476. "Wire-working apparatus." British Thomson-Houston Co., Ltd. June 29th. (General Electric Co., United States.)

9,477. "Means for cooling electrically-operated tools." Frankfurter Maschinenbau Akt. Ges. vorm, Pokorny & Wittekind. June 29th. (Convention date June 30th, 1914, Germany.) (Complete.)

9,496. "Telegraphic systems and apparatus." United Telegraph & Cable Co., and W. M. Bruce, Jun. June 29th. (Complete.)

9,509. "Electric lamp stands." Wallace Novelty Co. June 29th. (Convention date, July 13th, 1914, United States.) (Complete.)

9,514. "Incandescent electric lamps." J. J. Russell & F. L. Harrison. June 29th.

9,519. "Magneto ignition devices for internal-combustion engines." A. F. Payne. June 30th.

9,522. "Electrical water-heater." J. H. Robinson. June 30th.

9,527. "Electric clocks." W. H. Shortt. June 30th.

9,557. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. June 30th. (General Electric Co., United States.)

9,573. "Device for recording the position of an engine telegraph at any given time." R. S. O'Neil. June 30th.

9,582. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., & P. T. Bates. June 30th.

9,584. "Electric fluid heaters." G. P. Elmen, S. O. Salisbury & A. R. Talbot. June 30th. (Convention date, December 26th, 1914, United States.) (Complete.)

9,627. "Dry batteries." R. de Fortuny. July 1st. (Complete.)

9,628. "Electric welding and apparatus therefor." British Thomson-Houston Co., Ltd. July 1st. (General Electric Co., United States.)

9,635. "Transmission of power to electrically-driven machines." H. S. Cassel. July 1st. (Complete.)

9,682. "Electrically-operated change-speed gear." Oesterreichische Daimler-Motoren Akt. Ges. July 2nd. (Convention date, July 14th, 1914, Austria.) (Complete.)

9,684. "Galvanic battery cell of the mercuric-oxide type." J. N. Bronsted and Hellesens Enke & V. Ludvigsen. July 2nd. (Complete.)

9,690. "Electron discharge apparatus and method of operating the same." British Thomson-Houston Co., Ltd. July 2nd. (General Electric Co., United States)

9,706. "Spring-return mechanism for electric motor controllers and for other purposes." Electric & Ordnance Accessories Co., Ltd., N. G. Langrish and L. Hodgson. July 3rd.

9,715. "Magneto-electric machines." S. R. Cohen, B. R. Cohen, & W. Trowell. July 3rd.

9,720. "Wireless signalling systems." British Thomson-Houston Co., Ltd. July 3rd. (General Electric Co., United States.)

9,725. "Electrical transmitting apparatus." H. K. Harris. July 3rd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

19,445. High-frequency Alternating-current Dynamos. M. Breslauer. August 28th.

21,574. Mercury Vapour Electric Rectifiers. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.). September 24th.

21,959. Coil Bobbin for Electric Meters, Measuring Instruments, or the like. Allgemeine Elektricitäts Ges. September 29th. (November 28th, 1912)

23,336. Automatic Selecting Devices for Telephone Systems. Siemens and Halske Akt. Ges. October 15th. (October 17th, 1912.)

23,348. Electric Switchgear in which all Current-carrying Parts are Immersed in Oil or Embedded in an Insulated Mass. Allgemeine Elektricitäts Ges. October 15th. (October 15th, 1912.)

1914.

6,992. Electric Ignition Systems for Internal-combustion Engines. O. Heins & C. M. Wild. March 19th. (March 19th, 1913.)

7,007. Regulators for Electric Circuits. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.). March 19th.

7,200. Telegraph or Telephone Relay. C. Still. March 21st.

7,202. Method of Transmitting Sounds Electrically. C. Still. March 21st.

7,203. Microphones. C. Still. March 21st.

7,208. Number Instruments for Automatic Telephone Systems. Siemens Bros. & Co. and E. A. Petithory. March 21st. (Addition to 14,614/13.)

7,266. Electrical Burglar Alarms. A. Zehden. March 23rd. (March 25th, 1913.)

7,327. Apparatus for Supervising Telephone Exchanges Working on a Semi-automatic System. Siemens & Halske Akt. Ges. March 23rd. (March 25th, 1913.)

11,708. Arrangements for Wireless Telegraphy and Telephony. J. Schiessler. May 12th. (October 16th, 1913. Divided application on 29,447/13, December 20th.)

14,021. Electrically-driven Drilling Machine. Siemens Shuckert-Werke Ges. June 10th. (June 13th, 1913.)

14,163. Appliances for Maintaining Electric Conductivity Conduit Systems for Carrying Cables for Power, Light, or other Electrical Installations. F. J. B. Wineberg & E. T. Parker. June 12th.

14,392. Fittings for Metallic Conduit Systems of Electrical Wiring. T. Manson. June 15th.

14,469. Electrical Heating Apparatus. A. F. Berry. June 16th.

14,739. Apparatus for Disinfecting the Mouthpieces of Telephone Transmitters. H. H. Mahieu. June 19th.

14,808. Telephone Systems. R. H. Burfeind. June 19th. (June 21st, 1913.)

15,068. Nozzle Plugs for Fluid Flow Meters. British Thomson-Houston Co. (General Electric Co.). June 23rd.

15,125. Telephone Switches. T. Green. June 24th.

16,984. Electric Circuit Breakers. C. Ellison. July 17th.

19,538. Electrophones. E. W. Schneider & E. H. Stolz. September 8th.

19,679. Electric Hand Lamp. T. E. Dickinson & Optalyte, Ltd. September 11th.

19,908. Electrical Conduit Fittings. J. R. A. Hemming & A. E. Beck. Sept. 18th.

19,943. Electric Rheostats. British Thomson-Houston Co. (General Electric Co.). September 18th.

20,129. Electric Rheostats. British Thomson-Houston Co. (General Electric Co.). September 24th.

20,342. System of and Means for Signalling Electrically, especially for use in Coal Mines and the like. H. Green & W. de M. Landon. September 30th.

20,927. Electro-magnetic Switch. Robert Bosch (firm of). October 13th. (June 8th, 1914.)

21,782. Electric Starters for use on Motor-cars and the like. A. H. Midgley & C. A. Vanderveli. October 30th.

22,044. Dash pot Plungers. Electric & Ordnance Accessories Co., Ltd., and J. Etchells. November 5th.

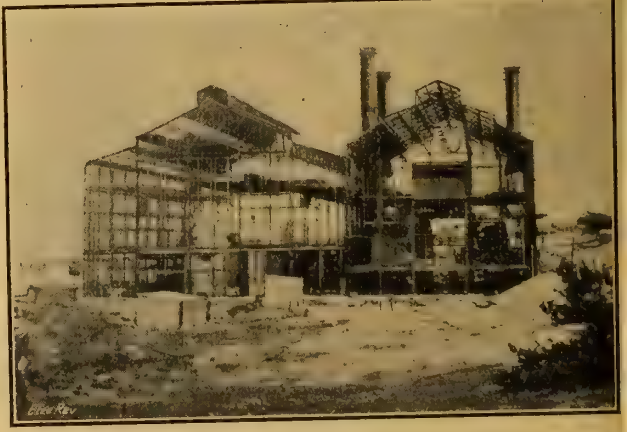
24,742. Fittings for Conduits for Electrical Conductors. A. W. Sclater. December 29th.

1915.

1,530. Electric Batteries. B. Pordes. January 30th.

4,560. Dynamo-electric Machines. British Westinghouse Electric and Manufacturing Co. March 23rd. (March 23rd, 1914.)

West Australian Government Power Station.—The accompanying illustration shows the new power station near Perth, W.A., which is being erected by the Government of Western Australia to supply the Government tramways, and to provide a bulk supply for the city of Perth and the surrounding towns and districts within a radius of 15 miles. The station will have a plant capacity of 12,000 KW., and will work at 6,000 and 20,000 volts, three-phase, 40 cycles. The city supply will be given through a ring main at 6,000 volts. We are indebted for the photograph to Mr. W. H. Taylor, formerly assistant engineer at Walthamstow, who went out in January last year to take the post of electrical superintendent of the Government tramways and power supply.



Power Station in course of Erection.

Workmen's Compensation.—It is common knowledge that in the negotiations which take place respecting compensation to workers who may have been injured in the course of their employment, the parties most intimately concerned are not the employer, and the injured person, but the insurance company and the worker. Judge Mellor, who has naturally a wide knowledge of workmen's compensation cases, and can speak with authority on things as he finds them in the Manchester County Court, declared there on Thursday of last week that his experience was that in only two per cent. of cases under the Workmen's Compensation Act were the employers directly interested. The disputes were usually between the workmen and the insurance companies, and about 50 per cent. of the workmen, being members of Trade Unions, had their interests properly safeguarded, while the other 50 per cent. (including women and children) were not in the ranks of organised labour, and were likely to stand in a very bad way unless County Court Judges looked after them. He had consulted with other judges, and had come to the conclusion that in cases of injuries to workmen declarations of liability were about the most valuable means of protecting workmen against insurance companies who tried various dodges "in order to avoid their liabilities."

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Vol. LXXVII.] CONTENTS: July 23, 1915. [No. 1,965.

Page
Science and the War 97
Copper 98
Cathode-Rays in Practice... 98
If a Bomb fell on a Generating Station ! 98
On Trading with Russia 99
The Central Power Station of the Randfontein Estates, by R. Turnbull Mawdesley (*illus.*) (*continued*) 100
The Tramways and Light Railways Association Congress, 1915 102
  Tramways during War Time, by J. W. Dugdale 102
  Battery Vehicles as an Adjunct to Tramways, by W. H. L. Watson 103
Correspondence—
  Electric Power in India 104
  Shortage of Labour 105
  American Trade 105
Legal... 106
New Electrical Devices, Fittings and Plant (*illus.*) 108
Business Notes 109
Notes 113
City Notes 116
Stocks and Shares 119
Share List of Electrical Companies 120
Market Quotations 120
Exports and Imports of Electrical Goods during June, 1915 121
The Weaverham and District Electricity Supply (*illus.*) ... 122
An Investigation of Dielectric Losses with the Cathode-Ray Tube, by John P. Minton (*illus.*) (*concluded*) 124
New Zealand's Water-Power 125
Submarine Photography by aid of Quartz Lamps (*illus.*) ... 126
War Items 127
Foreign and Colonial Tariffs on Electrical Goods 127
New Patents Applied for, 1915 128
Abstracts of Published Specifications 128
Contractors' Column ... ... Advertisement page xviii

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SCIENCE AND THE WAR.

ON Monday last the composition of the Admiralty Board of Inventions, over which Lord Fisher presides, was published; we note with satisfaction that the list contains the names of Sir J. J. Thomson, Sir C. A. Parsons, Prof. W. G. Bragg, Sir William Crookes, Mr. W. Duddell, Sir Oliver Lodge, Sir Ernest Rutherford, Mr. G. G. Stoney, and Prof. the Hon. R. J. Strutt, as well as other leading men of science—all, with one exception, Fellows of the Royal Society; it is stated also that the Royal Society will co-operate in the work of the Board, and that additions will be made to the Panel of Consultants from time to time, so that the services of specialists who are not already on the list may be utilised for the nation's benefit.

It can hardly be supposed that these eminent men will be called upon to sort out the wheat from the immense bulk of chaff that will be showered upon them by would-be inventors; that would be as wise as to use a steam-hammer to crack nuts. Presumably, therefore, a staff of assistants will be provided, to whom will be entrusted the task of considering suggestions and selecting from them those that appear worthy of the attention of the Board. Upon this staff a great responsibility will rest; it is easy, no doubt, to eliminate such propositions as the electric gun, the aerial torpedo, the magnet to repel torpedoes, and similar chimerical ideas, but there is a risk that in the preliminary sorting pearls of wisdom in rough shells may be rejected, and we trust that none but expert technical men, with alert and open minds, will be employed on this important work.

It was reported on July 9th that Mr. Lloyd George had made arrangements with the War Office and the Admiralty to take over from them the work relating to munitions and inventions connected with the Army, but no announcement has been made as to the formation of a similar Board of Inventions for his Department. It is not clear to us that a separate Board for each department is necessary; surely it would be better to organise a single central body to deal with the whole of the work, as otherwise there is certain to be overlapping in many respects.

Speaking in the House of Lords not long ago, Lord Crewe made the remarkable statement that every effort had been made to utilise scientific knowledge since the beginning of the war; if this is so, it reflects little credit upon those who made the "efforts," for their failure has been conspicuous, while scientific men of all classes, and of the highest standing, have proclaimed their inability to induce the Government to accept their services. At a meeting of the British Science Guild, on July 1st, Sir William Ramsay pointed out that immediately after the outbreak of war the French Academy of Sciences offered all its resources to the Government, and they were at once accepted. In October he had urged the organisation of the Royal, Chemical and Engineering Societies for a similar purpose, but up to the beginning of July no such organisation had been created. Others had made similar suggestions, without success. Sir William complained of the appointment of numerous small committees of men whose names were kept secret, instead of the formation of a central body of scientific men to whom the various departments of the Government should apply for advice and assistance. Despairing of Government action, he proposed that scientific men should organise themselves to combat the attempt of the Germans to obtain world-wide dominion.

Fortunately, we now see the Government, like some weary Titan slowly awakening from his slumber, painfully and sluggishly arousing itself to the realisation that this is not an ordinary war; that we are at death-grips with a powerful enemy, and that we must marshall all our forces, military and naval, scientific and industrial, to cope with the frightful peril that confronts us. As we have indicated, even now there is a lack of coherence and co-operation in the actions of the different departments of State; they seem to resent the offer of scientific assistance, while they profess to welcome it, and accept it with reluctance. How different is the attitude of the German Government—and what immense advantages it has derived from its free utilisation of scientific effort! But it should be borne in mind that the fault lies not with our Government alone, but with the whole nation, which has for over 60 years contemptuously spurned the aid of science in industry, whilst our foreign rivals have eagerly availed themselves of it, and by this means alone have been able to build up the armaments, resources and organisation which now aim at, and threaten to achieve, nothing less than the destruction of the British Empire.

Copper.

The less confident feeling which has grown up recently in connection with the copper situation appears to have been well grounded, and the price of standard metal has undergone a steady deteriorating process, until it would require an advance now of about £20 a ton to bring cash warrants into their proper relation with the prices which are asked by producers. How long the ridiculous discrepancy between these two brands of copper, the speculative medium on the one hand, and the favourite grade of consumers' copper on the other, is to last, remains to be seen, but the position which has been gradually worsening for some weeks back has now assumed preposterous proportions. The conclusion is irresistible that the foundations of the copper market have been weakened, and that a substantial decline in prices is in store for refined metal. The production of copper has been enormously stimulated by the high prices ruling, and the high prices themselves have been the outcome partly of manipulation in America, though the manipulation in this case has been less violent than that seen in spelter, while heavy demands for munitions purpose have also been an important contributory factor. There is no doubt that the way in which some of the Allied Governments have been buying munitions in the United States has directly encouraged manipulation on the part of financial and other interests across the Atlantic.

The growing output is now beginning to assert itself. Since the year opened there has been a steady development of output all over the North American continent, and mines and smelters which shut down entirely, or which reduced by 50 per cent. or more, in the autumn of last year, have steadily extended the scale of their operations, until there is no doubt that the United States production of refined copper is to-day well up to the record figures of 65,000 tons a month. Seeing how small, comparatively speaking, the American exports are, owing, of course, to Germany being cut off from the rest of the world, it must be regarded as assured that there is a growing surplus somewhere, though, no doubt, pains will be taken to conceal this until the psychological moment. An idea of what is going on may be gathered from the following. In June the United States exported only 15,000 tons, leaving a matter of 50,000 tons available for home consumption, whereas even in the halcyon days of American trade, the United States never but once returned a monthly delivery exceeding 36,000 tons. There are no definite figures available bearing upon American production or deliveries to the home trade, the publication of the monthly returns by the Copper Producers' Association having ceased at the end of June, 1914, while the Association itself was disbanded at the beginning of the present year.

Consumption generally is proceeding at a very heavy rate, but certainly the last two or three weeks have witnessed very little activity in the direction of new buying. Wherever possible, works are being put on to munitions, but the raw material for their operations appears to have been pretty well provided, and, in any event, the disappearance of Germany as a consumer releases huge quantities of copper, which are thus rendered available for countries whose supplies have not been interfered with. American trade is very active, more especially in the brass connections, but, for all this, the tendency of prices is towards ease. Speculation is dull, and it is just as well that this is the case, for the authorities here are in a mood to take fright at shadows, and any suspicion that speculation was still alive might cause drastic steps to be taken, still further interfering with what trade is left to us. All that average *bonâ fide* traders ask now is to be strictly left alone by the hordes of officials who seem to have nothing better to do than interfere with things regarding which they are sublimely, not to say appallingly, ignorant.

Cathode-Rays in Practice.

We have often drawn attention to the fact that scientific discoveries which at first are apparently of no more than academic interest, sooner or later find practical applications, and may eventually prove to be of immense value to industry. It would be incorrect to say that cathode-rays have not hitherto passed out of the category of pretty experiments, for they have been turned to account in various ways; but a recent development in which they play the leading *rôle* calls for more than passing comment, and incidentally furnishes an apt illustration of the practical utilisation of a physical phenomenon. We refer to the "cyclograph," which is described in a paper by Mr. J. P. Minton, of which an abstract is concluded in this issue.

The essential characteristic of the cathode-rays to which they owe this application is their instantaneous deflection by an electric field, and their freedom from inertia, which enable them to follow without time-lag the variations in magnitude and direction of the field. These qualities are particularly useful in the investigation of the behaviour of dielectrics under electrical stress, owing to the low power factor and small magnitude of the quantities to be measured, and Mr. Minton, following in the steps of Prof. Ryan, has evolved a practical apparatus for determining the power factor, and hence the energy losses, in dielectrics by means of the cathode-rays. It will be obvious from the description that the manipulation of the apparatus demands the skill and knowledge of an expert, in order that reliable results may be obtained; but so does the oscillograph, in common with many other instruments of the greatest practical value, and, indeed, none but an expert would be expected to pursue an investigation of this nature.

We have been able to quote but few of Mr. Minton's results, of which many are given in the paper; more are promised for publication at a future date. Enough is given, however, to show that the method yields consistent results, and throws light on that very difficult subject of which we know so little quantitatively.

It is interesting to observe that the author emphasises the extremely important influence of moisture upon the behaviour of insulating materials; he goes so far as to suggest that the materials themselves are constant in their qualities, and that the changes observed with pressure and temperature are entirely due to the moisture contained in the capillary spaces of the substance. We are at once reminded of the remarkable series of experiments described by Mr. Sydney Evershed in 1913, in his I.E.E. paper on the "Characteristics of Insulation Resistance," which led him to the same general conclusion. Mr. Evershed's research was exhaustive within its limits, but there is still a vast field open for investigation, and it is evident that the cyclograph will render valuable services in exploring it, as well as in other work for which it is suitable.

Air Raids and Generating Stations.

Although by good luck, or good guidance, those who navigate hostile aircraft have hitherto been unsuccessful in their attempts on generating stations, damage from this mode of attack is not outside the range of possibility. One high-explosive bomb successfully placed might wreck an entire station and do such damage as to prevent the supply of electricity for a very considerable time. Does failure to continue the supply in such circumstances expose a company or local authority supplying electricity to any liability?

It is provided by Clause 30 of the Schedule to the Electric Lighting Clauses Act, 1899, that whenever the undertakers make default in supplying energy in accordance with the terms of the Board of Trade regulations, they shall be liable to such penalties as may be prescribed in the regulations in that behalf.

It has been held, with reference to this clause, that in the ordinary case of company and consumer the consumer's only remedy for failure of supply is to proceed for penalties. He cannot bring suit for damages unless he has a special contract with the company (see Clegg, Parkinson & Co. *v.* Earby Gas Co. (1896) I.Q.B. 592). It may be stated with some assurance, therefore, that undertakers could not be exposed to numerous actions for damages as a result of an aerial raid.

But there is something else. It does not even appear that they would be liable to penalties. The clause above referred to contains the following important proviso:—"Provided that the penalties to be inflicted on the undertakers under this section shall in no case exceed in the aggregate in respect of any defaults not being wilful defaults on the part of the undertakers, the sum of fifty pounds for any one day, and provided also that in no case shall any penalty be inflicted in respect of any default if the Court are of opinion that the default was caused by inevitable accident or *force majeure*, or was of so slight or unimportant a character as not materially to affect the value of the supply."

Although it is not likely that the Legislature had the possibility of damage from hostile aircraft in mind when they framed this statute, it is obvious that the proviso affords complete protection to the company or local authority supplying electricity. Of course it is needless to say that there is no case directly in point, because, fortunately for us, this kind of war risk has never had to be considered by the Court. The only reported case on the proviso makes it plain, however, that no penalties could attach. Thus in Sun Insurance Co. *v.* Dublin Corporation, which was decided in 1899, a cable laid down proved to be defective, and the supply of energy thus broke down. This was held to be "inevitable accident," so as to excuse those who were supplying electricity from having to pay penalties.

On Trading with Russia.

In the series of very interesting articles that Mr. John Foster Fraser is writing for the *Standard*, under the title, "In the Land of the Czar," he deals in considerable detail with the question of future trade relations between England and Russia. Article No. 6 (July 16th) is devoted almost entirely to a statement of the views of M. Timiriazeff, President of the Russo-British Chamber of Commerce, as expressed by him in an hour's conversation. The peace-time efforts made by M. Timiriazeff to extend trading operations between the two countries are well known to readers of the Electrical Review, but it may be of value to the electrical and engineering trade to know the workings of his experienced commercial mind in these days when Russia is engaged in deadly struggle with the nation which has supplied her with so many manufactures in the past. M. Timiriazeff expresses the hope that England, with the other Allies, will derive commercial benefit from the war, but he considers that "Tariff advantages would be an impossibility; it would be continuing the war against Germany in another field and would lead to much uncomfortableness. Germany will be allowed to come into our markets on an equality with other nations, and will undoubtedly put forth tremendous efforts to regain her lost position." The antagonism will take years to subside, rendering possible a renewal of the "easy relationship between Russians and Germans" which existed before the war. Russia will be more inclined to trade with her friends: "We want English goods; we prefer them; and it is with your manufacturers to decide whether we shall have them." M. Timiriazeff is strongly of opinion that when a treaty of peace comes to be signed there will be inserted a provision prohibiting Germany from imposing differential tariffs. He is very anxious that when peace is signed Germany shall be "deprived of the power to enforce new commercial conventions, to run for 10 years, and to be abrogated on a year's notice, causing much worry to our trading community." "We can have no tariff directed specially against Germany." It is wrong, in this expert's opinion, for us to imagine that England's comparative failure has been due to her producing dear and excellent things, whilst Germany made cheap and nasty ones. "We know the fine things England makes, but in thousands of cases we buy German goods not because they are cheap, but because British goods cannot be obtained anywhere." Furthermore, Germany supplies goods that England has never attempted to supply. M. Timiriazeff is greatly impressed with Germany's intelligence service for securing reliable information respecting the standing of local Russian firms and the credit that it is safe to give them—its thoroughness is only equalled by that of the military and naval spy system of Germany—it is upon such information that the long-credit system is built up. In the slump that follows the war in all manufacturing countries, manufacturers will be looking round to discover scope for their energies; Russia needs the assistance of outside nations; if the British want to reap trading benefit from the friendship between the Allies, they have got to move now! He says that we need to study what Russia wants, to have representatives there who will speak Russian, and to conform to the Russian habit of long credit.

So much for the outlook as seen by M. Timiriazeff, and the lessons which need to be taken to heart by us. But there are shortcomings on the Russian side too, and such weaknesses, with some of which we have dealt briefly on several occasions, are plainly stated by Mr. Foster Fraser in his eighth article (July 19th). "Russia is the land of officials"—"every little Russian born has a glow in his heart that he may be an official"; and those who wear uniform "have a superiority towards trade." Every official has a superior official over him, and it is the first rule of self-preservation to say "No" to every application lest the official should get into trouble from someone above him. If one wants to start a business in Russia, says the author, the way is long and tedious. "You have to get permission to start a company, and there are half-a-dozen departments to be consulted, every one of which is antagonistic, and has to be overcome." Englishmen have complained that the official attitude of Russia is to discourage commerce instead of facilitating it. Then in regard to "palm-oil," that not very wholesome lubricant, in regard to which we are not always above reproach at home, the practice in Russia "is so common that it may be described as a national institution for everybody to make 'a bit on the quiet' before he does his duty." Municipal obstruction and other similar matters are also touched upon, and Mr. Fraser says: "If you bring any of your English nonsense with you about going ahead on straight business lines . . . . . you will find you are checkmated." He agrees that there are honourable and unbribable officials in Russia, but in the foregoing, and in more like it, he says that he has reflected the invariable story told by Englishmen resident in Russia, some of them for a quarter of a century and more. The author, writing as a sincere friend of Russia, aware of the cordial feeling toward Britain which exists in the country, fully admitting that it is the duty of English manufacturers to be adaptable to the Russian market, adds that the business adaptability should be reciprocal, "and that the powers that be in Russia would do well if they endeavoured to purge their country of a practice which no Russian defends, though he may be clever in finding excuses." Russia wants foreign capital; its prolonged credit system, generally described as a national custom, is really an admission of shortness of capital. British capital and enterprise will be there, says the writer, if Russia simplifies and consolidates her commercial laws.

The Odessa Branch of the Russo-British Chamber of Commerce is actively developing a programme of work designed to assist British trade. A Russo-British trade conference is suggested. At Petrograd, too, there is a similar movement, and the display of British manufactures at the Nijni Novgorod Fair is advocated.

THE CENTRAL POWER STATION OF THE RANDFONTEIN ESTATES.

By R. TURNBULL MAWDESLEY.

(Continued from page 83.)

The alternators are all designed to deliver three-phase current at a frequency of 50 cycles and at a pressure of 6,600 volts between phases. All have revolving fields, the 6,000-KW. sets having the cylindrical type, and the smaller units salient poles. The generators are designed to give the full output at ·7 power factor, but actually the average power factor is higher than this, as will be shown.

The exciters are shunt wound, with compensating windings, the pressure being 125 volts. The excitation current is led to common bus-bars, and the exciters may be run in parallel, or individually—an arrangement which allows an alternator to be run without its own exciter if necessary.

The whole of the switchgear was supplied by the British Westinghouse Electric and Manufacturing Co., Ltd.

The smaller machine switches and all feeder switches are remotely controlled and mechanically operated, while the main switches of the three 6,000-KW. alternators are electrically operated. A view of the main board is given in fig. 6 (p. 82); and in fig. 9 the auxiliary power board is shown, with a partial view above of the feeder panels, and, in the rear, the concrete and brick structure containing all high-tension apparatus.

This structure runs parallel with the operating platform, and contains two sets of bus-bars. Selector switches allow any feeder or any generator to be connected to either top or bottom bars, and the current and pressure transformers are, as usual, placed in cubicles, each phase in its own chamber.

A bus-bar coupling switch, mechanically operated, allows of the bars being paralleled, and feeders may be changed over in this manner.

The generators are protected by overload relays, the trip circuits being actuated by direct current from a small battery of accumulators, which is charged by a small induction motor-generator. The feeders are protected by overload relays with inverse time limits; and also by a Merz-Price balanced system, the trip circuits being as above. Each generator panel is provided with three ammeters, a voltmeter, a power factor indicator, and an indicating wattmeter, besides the ordinary integrating wattmeter and a recording ammeter. The feeder panels are provided with three ammeters only, the integrating watt-hour meters originally installed now being disconnected.

The generator windings are star-connected, but the neutral is not earthed, although series transformers and meters have been inserted in each phase, in case such a procedure should become advisable.

The synchronising is accomplished by means of three synchroscopes, all in parallel, one being of a large size, visible to the drivers from all machines—the two smaller ones, which are more accurate, being used actually for paralleling.

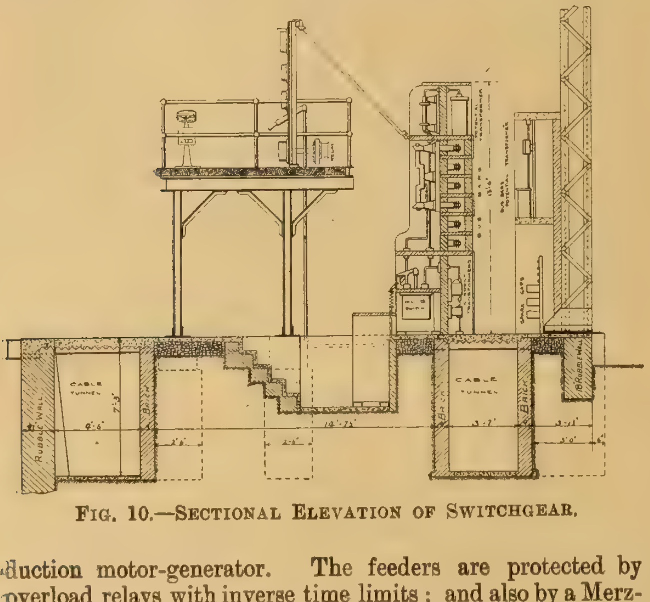


FIG. 10.—SECTIONAL ELEVATION OF SWITCHGEAR.

British Westinghouse spark-gaps, with series and shunt resistances, are connected to each set of bus-bars to relieve any undue pressure rise, and static ground detectors, for each set of bus-bars, are placed on the switchboard operating panels. These detectors are connected to condensers inserted in each bus-bar, and they form the sole H.T. apparatus on the operating platform.

A section of the cubicles and operating platform is given in fig. 10.

The station auxiliaries are supplied from a bank of transformers placed in a sub-station at the eastern end of the engine room. This bank consists of three 500-KW. single-phase transformers which reduce the pressure to 550 volts, at which pressure all station motors are operated. Station lighting and the lighting for the married and bachelor quarters is provided for by a further reduction to 120 volts.

All the station, switchboard, and boiler-house lighting circuits are provided with change-over switches, so that in case of a shut-down the battery supplying the trip-circuits may be utilised. The auxiliaries, including artesian-well pumps, are, with the exception of the crane motors, driven in every case by induction motors, and represent an installed capacity of 2,000 KW. The crane motors are direct current, supplied from the small induction motor-generator or the battery.

Referring now to the boiler plant, the general lay-out will be seen from fig. 11. There are 24 boilers in all, of the Babcock & Wilcox standard "Land" type, with integral superheaters, and with mechanical chain grate stokers. The 12 economisers are of the well-known Green make, and the induced-draught plants are by Messrs. Davidson & Co., Belfast.

Each boiler has 4,780 sq. ft. heating surface, and is capable of evaporating 17,000 lb. of water, from and at 212° F. The boilers are arranged two in a battery, and two batteries form a unit, which unit constitutes a self-contained boiler plant, consisting of four boilers, two economisers, feed-pumps, induced-draught plant and stack.

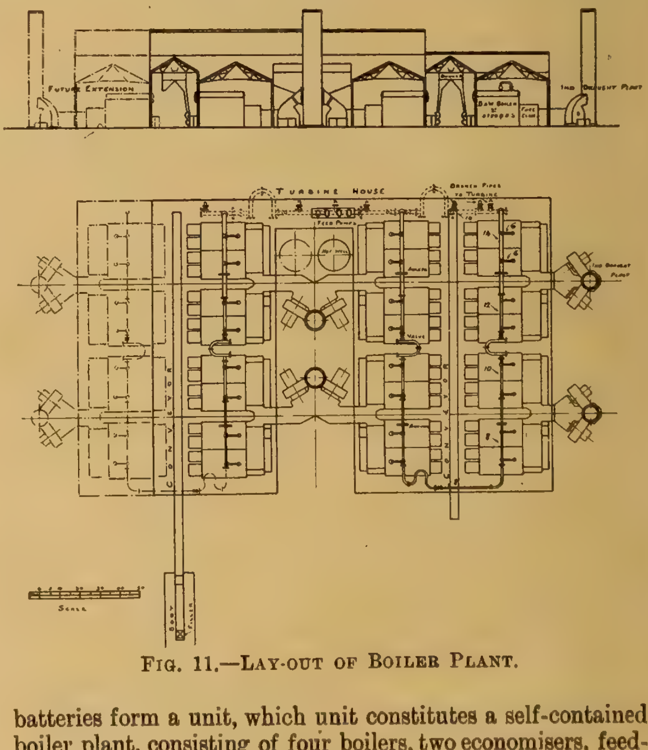


FIG. 11.—LAY-OUT OF BOILER PLANT.

This design was adopted by Mr. T. P. E. Butt, the consulting engineer, when the original plant was laid down, and when it was not known even approximately what the ultimate capacity of the station would be.

There can be no doubt that this arrangement, and the placing of the boiler houses at right angles to the engine-room, has proved an excellent one, as much for the original plant as for the large extensions that were necessary.

As will be seen from the general arrangement of the boiler-house, where two lines of boilers are placed back to back, the two stacks and induced-draught plants are replaced by one. The working pressure of the boilers is 160 lb. per sq. in.

Each superheater has 900 sq. ft. of heating surface per boiler, and raises the steam temperature to 500° F.

"Mixing" valves are provided, to vary the proportions of saturated and superheated steam, until the desired temperature is obtained.

The chain grates, two per boiler, each grate 5 ft. by 12 ft., provide 120 sq. ft. per boiler, a ratio of heating to grate surface of approximately 40 : 1. The grates are driven through the usual gear boxes, having four speeds, which allow the grate to travel between 5 ft. and 31 ft. per hour.

The fire thickness can be varied from 2 in. to 8 in., and motion is given to the grates through worm reduction gear boxes, one for each four boilers. The reduction gears are driven by 6-H.P. induction motors.

Ash tunnels run under each row of boilers, with rails and trucks for the reception of ash and clinker deposited from the chutes below the backs of the grates. From this point the ashes are conveyed by mechanical haulage to a dump.

The economisers are placed immediately to the rear of the boilers on the same floor level. There are 320 tubes for each battery of two boilers, equivalent to 1,600 sq. ft. of economiser surface per boiler. The usual by-pass flues are arranged under the economisers, in such a manner that the boilers may be in service while the economisers are laid off. The scraper gears are driven by 2-H.P. motors.

Referring to the induced-draught plants, the outside, or smaller units, consist of two 55-in. Sirocco fans, one steam driven, the other electrically by a 60-H.P. variable-speed induction motor. These fans are capable of exhausting 120,000 cb. ft. of gases per hour, at a difference of pressure of 1 in. water gauge, the stacks being 7 ft. in diameter by 60 ft. high. The larger, or inner, units consist of two 75-in. Sirocco fans of 230,000 cb. ft. capacity, one coupled to a Belliss engine and the other to a 120-H.P. variable-speed induction motor. The general appearance of No. 2 boiler house was shown in fig. 8.

Under normal conditions the steam fans, which exhaust to atmosphere, are not used, it being, of course, a more economical procedure to run the electric fans, the speeds of which are controlled through tramway-type controllers and metallic resistances inserted in the rotors.

The feed pumps, consisting of six of the Weir type, and one steam turbine pump, constitute the only auxiliaries which are permanently steam driven. These pumps are coupled to a duplicate system of steel piping, one going to the boilers by way of the economisers, the other being a direct "cold" feed.

The boiler feed water is obtained from three artesian wells sunk in the vicinity of the power station. The water from these is delivered into two reserve tanks of 80,000 gallons capacity, placed immediately outside the station. Connections are taken from these tanks to two feed tanks situated inside the boiler houses, and also to the feed pumps direct, to allow of cleaning the feed tanks when necessary. The exhaust steam from the feed pumps passes through pipes submerged in these tanks, as usual.

Further connections for feed water "make-up" are provided for emergencies—one connection being to the Rand Water Board's system, and the other to the condenser circulating pipes.

The normal load of the station is carried by 16 or 18 boilers, which allows at least four boilers (*i.e.*, one boiler unit) to be laid off for tube cleaning and general repair.

There are two main exterior coal bunkers, each of 1,000 tons capacity, and, in addition, each boiler house is provided with an overhead bunker of 270 tons capacity. Coal is delivered to the overhead bunkers by means of two bucket elevators, capable of raising 40 tons per hour. These elevators are fed from the main bunkers by belt conveyors operated by a 20-H.P. motor. The elevators are driven each by a 10-H.P. motor situated above the overhead bunkers, the coal gravitating from these bunkers through chutes leading into the grate-hoppers.

Transvaal and Delagoa Bay "dross" coal is used, having a calorific value of about 11,000 B.TH.U. The sustained load is sufficiently constant to obviate the necessity of forcing the boilers under steam, and the result is a *practically smokeless combustion*, as will be seen by reference to fig. 3.

It should be noted that the two slender stacks, 120 ft. high, shown in this view, form no part of the boiler house equipment. These are the remains of the original steam hoisting plant for the shaft, whose headgear is visible in the view.

The sub-stations, 10 in number, are of two standard capacities, viz., 6,000 KW. and 3,000 KW., the transformer units being in each case 500 KW. single-phase, having two ratios, 6,600 v. to 2,200 v., and 6,600 to 550 volts. The connections on both H.T. and L.T. sides are in mesh, and allow two transformers to furnish a temporary supply of 80 per cent. of the capacity of the balance, in case of one transformer failing. The switchgear in the sub-stations is on a level with the concrete and brick cubicles containing the H.T. apparatus, and except that the oil switches are mechanically operated, all apparatus and arrangements are identical with the power station switchgear. The whole of the transformers and switchgear were supplied by the British Westinghouse Electric and Manufacturing Co., Ltd.

All H.T. feeders are three-core, paper-insulated, with lead covering and steel tape armouring. The method of laying is burying direct in the ground at a depth of 2½ ft. Joint boxes are not used, the conductors being connected by double telescope joints, which, when insulated, are covered with a lead sleeve, and the whole sealed by a plumber's wiped joint.

Trifurcating boxes are used at the terminals. A layer of rock from the mine waste dumps is laid above the cable routes to minimise the danger of mechanical damage due to pick holes, &c. These cable routes are, of course, wholly upon the company's property; and so effective has been this method that no mechanical damage has yet resulted in seven years.

The cable route, from one end of the Estates to the other, forms practically a straight line, and the method of dealing with this arrangement has been to allow the bus-bars in each sub-station to form part of the transmission line.

All sub-stations contain two sets of bus-bars, the cables being led into each sub-station, and connected to either set of bus-bars. The incoming cables connect to one end of the bus-bars, and the outgoing feeders to the other end, the local supply being tapped off between these points. Section pillars are inserted in the line at distances of approximately 500 yd., in order to sectionalise the cables for fault localisation and testing; and all cables entering and leaving sub-stations are protected by the Merz Price balanced system.

Distribution from all sub-stations is made by underground cable at either 2,000 volts or 550 volts, so that transformers are protected from lightning troubles on both sides. Lighting is provided for by overhead lines from special transformer kiosks at 120 volts.

Unlike the V.F.P. Co.'s system, no trouble whatever from lightning is experienced, as the whole of the H.T. transmission is carried out underground.

The capital cost, excluding the recent extensions to the buildings, the installation of the 6,000-KW. Westinghouse set, and sub-station extensions, was £303,000, made up as follows:—

Boiler plant	£121,000
Cooling towers, piping, &c.	13,000
Generator and condensing plant	97,000
Sub-stations and transmission cables ...	45,000
Building	11,000
Workshops, artesian wells, &c.	16,000
	£303,000

To this must be added the cost of the open-spray cooling pond, additions to steam plant, as above, and the extensions to sub-stations and transmission cables, &c., bringing up the total capital expenditure to slightly over £500,000.

The working costs for the month of March, 1915, are given below. These costs are steadily falling as the load increases, and form a fair average at the time of writing:—

Units delivered to consumers	9,019,923
Units dispatched from switchboard ...	9,580,540
Cost per unit dispatched	·1904d.
Operating costs, including coal	·1527d.
Steam generating plant maintenance ...	·0185d.
Electric plant maintenance costs	·0087d.
Workshop and buildings maintenance costs	·0031d.
Main switchboard control costs	·0074d.
Total per unit ...	·1904d.

The cost of coal at the pit mouth is 2s. 9d. per ton, and the cost delivered at the power station is 9s. per ton, so that railway freightage forms the most expensive item in production.

(*To be concluded.*)

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION CONGRESS, 1915.

The seventh annual congress of this Association was held on Friday last in London. The proceedings were naturally severely curtailed owing to the war; the members met at the Institution of Civil Engineers, where three papers, by Mr. A. V. Mason (South Metropolitan Electric Tramways and Lighting Co.) on "Glimpses into the Obvious," Mr. J. W. Dugdale (Oldham) on "Tramways during War Time," and by Mr. W. H. L. Watson on "Electric battery vehicles as adjuncts to Tramways," were read and discussed, and in the evening an informal dinner was held at the Trocadero Restaurant. The Chairman, the Hon. Arthur Stanley, in opening the proceedings, extended a hearty welcome to the visitors, and dealt briefly with the report and accounts, from which it appeared that, due to unforeseen and exceptional expenditure, the year's working had resulted in a very small deficit; the Association, however, has a surplus of some £300 in hand which has been invested in the War Loan. He referred sympathetically to the loss of three of the Association's earliest members, Messrs. Holliday, Gordon and Tresilian. They had several committees sitting, and had recently had an opportunity of giving evidence before the Local Government Board on questions relating to maintenance of tramway tracks, and were hopeful that some official effect would be given to some of their recommendations. During the year a special committee submitted a useful report on tramcar controllers, and at the present time they were in communication with tramway managers and others on the subject of supplies during war time. The question of approaching the Munitions Department is being considered with a view to ensuring a sufficient supply of materials for stock, in order to prevent curtailment or stoppage of tramway services, and the Council had passed a resolution requesting the Minister of Munitions to receive a deputation at an early date in order to urge their case.

Six members of the Council retired by rotation: Messrs. Coutts, Edwardes, Fell, Parshall, Thom and Tegetmeier, and a seventh vacancy was caused by the death of Mr. Tresilian; to replace them, the names of Mr. J. B. Tippetts (B.E.T.), Mr. Ernest Hatton (Newcastle-on-Tyne), Mr. H. L. White (Great Grimsby), Mr. C. D. Stanley (St. Helens), Mr. W. G. Verdon-Smith (Bristol), Mr. James Devonshire (Metropolitan and London United Tramways), and Mr. W. T. Robson (Southampton), were put forward and subsequently elected, the report and accounts also being adopted.

Mr. A. V. Mason's paper dealt very largely with small details of traffic working, more particularly as affecting the staff, and contained but little of a technical character, the author very truthfully describing it as a "ramble." However, amongst a number of "tips" with which the paper concludes, we note one or two suggestions which may appeal to technical readers. The author suggested that trolley wire guards should be placed on open deck cars, made of bent iron painted with aluminium and earthed; these could carry the lights for the top, and save people from being hurt by dropping trolley poles or falling trolley wires. He also said he would not waste time over meters, and has latterly tried a bonus system, paying 1s. a week to every motorman who keeps below the prescribed limit, with so far satisfactory results. An account in the aggregate of total units allowed per day per type of equipment was kept of each day with a daily plus or minus, so that if the driver had one unit in hand he received his bonus. The author also suggested the utility of an illuminated sign where a car terminus is hidden from view, to show intending passengers whether it is worth while to "hustle," and advanced the opinion that the present gaudily-painted cars and semi-military uniforms could profitably be replaced by cars in natural colour woods, stained and varnished, and plain uniforms. In reviewing his paper he expressed a dislike for the collection of fares on top decks, and to passengers ringing to stop cars as being a cause of accidents. He regarded tramways as being very poor advertisers of their own wares, and considered that high speed was everything.

In the discussion which followed, Mr. Ernest Hatton disagreed that the bell punch gave sufficient information to be useful as a running check. Inspectors were a necessary evil, and it was better to obtain them from some other system, while as to spare men, working part time, they must have a reasonable living wage. He agreed that illuminated signs at stopping places were a good thing if they did not cost too much.

Mr. C. D. Stanley agreed that high speeds were desirable, but they led to increased car maintenance.

Mr. Dugdale said a plan for interchange of inspectors would be desirable. He was not an advocate of the P.A.Y.E. system, but thought that fares could often be collected on the platform by a man who knew his business. In his opinion, every passenger should have a ticket, even if it were a free one, and spare list men should have a living wage.

Mr. White said he had an arrangement by which he exchanged inspectors with a neighbouring system for short periods. The bell punch was not suitable as a running check. He believed the author's suggestion to use a bamboo pole instead of a rope for shifting the trolley pole was being generally adopted.

Mr. Edwardes disagreed as to the utility of the registering bell punch, especially when there were transfer tickets, etc. Often those who had them never looked at the register. By regulating duty, spare men could be given fairly full employment. As a strange inspector became known to the men after a week or two, there was not much point in passing over their own men.

Mr. Howley emphasised the fact that the tramways were out to cater for the public, and therefore high speed was required, and it was not possible to prevent passengers from ringing bells. At Gateshead the P.A.Y.E. system was adopted on some routes and worked well on single-deck cars, the fare being a uniform penny one; but at the terminus in rush times they had trouble with change. They found that platform accidents were decreased owing to the conductor being always there. The driver's seat suggested by the author was possible with power brakes, and he was rather of opinion that all heavy cars would have to be fitted with power brakes.

Mr. T. B. Goodyer upheld the value of the bell punch; his view on the matter of cheap fares was that all fares should be made as low as possible and preferential treatment eliminated; the early worker who gave up early had no more right to cheap fares than the late starter who worked till late.

Mr. C. J. Spencer said his practice at Bradford was to promote inspectors from his own staff, but it depended on the size of the staff, and might not be easy with a small one. The spare list was the "gateway" to the undertaking and should attract good men, and it was possible so to arrange it, from known staff data, that there would be little dead time. Mr. Spencer then dealt with the question of official recognition of the staff, and said he had succeeded in getting from the Munitions Department a recognition that tramways carrying munition workers should be kept going, and it was possible that badges would be given to men engaged in such services.

Mr. Harry England (who took the chair, owing to Mr. Stanley being called away), in closing the discussion, said he thought it would be possible to save a good deal in the painting of cars and yet not render them less attractive.

Tramways during War Time.

Abstract of paper by J. W. DUGDALE.

It is known to all heads of tramways that the total capital expenditure of the undertakings in the United Kingdom amounts to £80,977,838. It is, therefore, a transparent fact that the systems are a great asset to the nation, especially when the rateable value and the upkeep of the roadway are taken into consideration.

The number of tramway employés who have given their services for this great European war reaches a total of 18,057, which is an average of about 30 per cent. of the total number of men employed on tramway undertakings. Every man has gone away with the comforting assurance that his dependents would be looked after, and that were he spared to come back his situation would be open for him. The cost to the departments mentioned for allowances or grants per week at the present time is very high, viz., London County Council, £1,568, Glasgow £1,000, Liverpool £520, and Manchester £1,360.

The granting of payments to dependents, I think, ought to have been a subject for discussion between representatives of municipal and company-owned tramways at a conference. This would have been the means of a more uniform rate of pay being adopted. I am of opinion it would have been a much better arrangement if this burden of expenditure could have been, by some means, divided amongst all the departments of the corporations, either equally or on some *pro rata* basis.

A number of undertakings are experimenting with female labour on the cars, and in the near future this is bound to extend to other work in the department. I am not very much in favour of employing women conductors, unless it becomes absolutely essential, especially on tramways running early workmen's cars (which are generally overcrowded); and, again, I do not think that a woman is physically strong enough to bear the strain of ascending and descending the steps of double-deck cars for any length of time, neither is she capable of carrying out the heavy parts of the work of a guard. Of course, the conditions of each tramway differ considerably.

I find in Oldham that the hasty training of men to fill the motormen's positions has been the means of increasing my electric energy bill as much as £20 per week for considerably less mileage. I have to pay 1½d. per unit for energy, which is very costly.

The question of paying a war bonus to tramway and other corporation employés has occupied the attention of the majority of committees during the past few months. Personally, I think that the corporation employé (who is, in a great number of instances, in a much better financial position than an employé of a private firm, and who has regular hours, no short time, etc.) ought not to be granted this concession. It amounts to an additional tax upon the ratepayers, more particularly in rate-aided departments of a corporation; and perhaps a ratepayer earning, say, £1 per week, will have to bear his share in paying a much better wage and war bonus to a man engaged in his own class of work in the employ of a municipality.

There is, without doubt, a great scarcity of skilled men in every tramway workshop, owing to them having been drafted into private workshops engaged in manufacturing munitions of war, and tramway concerns are now handicapped in obtaining quick deliveries of material, such as car wheels, axles, tires, etc., owing to the makers not being able to execute orders promptly on account of pressing Government work. The same applies to fittings for motor vehicles. I would state that a recent order I have placed for tramcar tires has been given at an increased price of 50 per cent. over what was paid twelve months ago, and have been waiting three months for the delivery of an engine crankshaft.

There will be a great rush for tram rails in the very near future, as the life of those laid in the year 1900 on many systems will become exhausted. This is a very important factor, which will have to be closely watched, as the prices per ton will increase considerably. Already tram rails have advanced in price to £9 5s. per ton.

A large number of tramways have granted free riding facilities to soldiers in training, wounded soldiers going to and from hospital, refugee children going to and from school, etc., and this concession has cost the Oldham Tramways Committee as much as £50 per week. To be able to ascertain the cost of this privilege I have issued tickets for these free riding facilities.

In the majority of towns the tramways revenue has fallen very much below that of normal times, and this, coupled with the concessions granted, hits tramways rather hard. On the other hand, certain undertakings have benefited during "Pastimes" by reason of the public not travelling far from their homes on account of economy and the curtailment of railway excursions generally.

In the discussion which followed, Mr. C. D. Stanley questioned whether repairs to the track could be left over, as a bad track meant bad cars. In Lancashire the tramways had to be kept going as workpeople were often dependent on them for getting to work.

Mr. Tegetmeier considered that with the treatment given to employés on the author's system, the dependents were much better off than in peace time, which was inequitable.

Mr. Edwardes said small repair shops could assist in munitions work, and in his area the skilled mill mechanics volunteered to assist in the work. If tramway mechanics were engaged in this way there was no reason why they should lose them by enlistment, etc. It would have been better if some general understanding had been come to as to payment of war allowances.

Mr. Robson felt that it was too late to open the question of allowances, but the pressing need was to secure the delivery of tramway material.

Mr. Harry England said the Council of the Association had decided to ask for war badges for skilled men, power-house and sub-station attendants, etc., who, it was considered, should be exempt from service. In his own undertaking 50 per cent. of the sub-station attendants, who were naval reservists, left on the first day of war.

Mr. Jas. Devonshire emphasised the necessity of keeping the skilled men; if they went at a greater rate it would be necessary to shut down some undertakings. The men should be enrolled as munitions workers and certified as such, so that attempts to draw them away would cease. In a certain case a big tramway repair shop had been given up for Government work, the car repairs being turned over to the repair staff of an allied undertaking; he contended that the latter staff were just as much entitled to recognition as war workers as the former, who were directly employed on such work. The motormen and conductors were another matter, but it was hoped that a percentage of these men would be recognised.

Another speaker suggested that a conference might be called to settle the conditions of labour of female tramway workers.

Mr. Harry England having intimated that the Council of the Association would like to have the opinion of the meeting as to the claim for exemption from service being restricted to skilled labour, power and sub-station attendants, etc., a vote was taken agreeing to this.

Battery Vehicles as an Adjunct to Tramways.

Abstract of paper by W. H. L. WATSON.

The writer's experience during the past three years with many types of battery vehicles has been so satisfactory that he feels justified in an endeavour to direct the attention of tramway authorities to the virtues of this method of propulsion. The past difficulty has been to provide a means of storing electricity; the accumulators put into service were solely of the lead-acid type, which, owing to its great weight and inability to withstand not only high rates of charge and discharge, but also vibration, soon proved commercially unsound. Briefly reviewing the batteries now available, we still have the original flat-plate battery, for which the makers claim great improvement in their method of formation. We also have a new type of lead battery, called the Ironclad-Exide, which differs in many respects from the older type, and which the writer believes to be the best of lead accumulators. Both of these types of batteries have the inherent troubles of all lead accumulators, but by careful maintenance and strict adherence to the manufacturers' instructions a good case can be made in their favour for certain classes of work. Another type of battery which is finding much favour in this country is the Edison nickel-iron cell, the introduction of which has opened to the battery vehicle a sphere of usefulness in which no other battery can successfully compete. This accumulator is built throughout of nickel and steel, the electrolyte being a solution of potash and lithium. The time available will not permit me to detail the differences of the three batteries named, beyond showing in mileage and money the performance to be expected with each type. The following table will show the desired information, and it will be for those interested to decide whether it is better to pay a smaller initial cost with a heavy maintenance charge or a heavier sum with a proportionate saving in these later expenses.

Comparison between three different types of batteries of 150/165 ampere-hour capacity.

150 A.H. Flat-plate	11-12 KW.H. ...	List price, £85
150 A.H. Ironclad-Exide ...	11-12 KW.H. ...	,, ,, £150
150 A.H. Edison Nickel-Iron	11-12 KW.H. ...	,, ,, £216

Total cost of operation over 60,000 miles service.

	Lead.	Iron-Exide.	Edison.
Guaranteed mileage ...	nil.	18,000 to 20,000	60,000
Plate maintenance ...	1½d. per mile.	—	—
Fair mileage to expect	6,000	20,000	150,000
Original cost	£85	£150	£216
Plate maintenance for 54,000 miles at 1½d.	£337 10s.	—	—
Renewal of plates at 70 per cent. of original cost (£105) × 2, representing 40,000 miles	—	£210	—
Plate maintenance ...	—	—	nil.
Total cost of battery at completion of 60,000 miles	£422 10s.	£360	£216

In towns such as Morecambe, Lancashire, where the conduit system is barred owing to the possibility of interference with the service by incursion of the sea, not to mention the high cost of such an installation, and where the overhead system is regarded as a menace to the scenic surroundings, the battery tram will be of great service. Horse trams have operated successfully for many years. With the advance of time electric traction has been seriously discussed, with the result that a scheme for installing battery-driven trams was considered, whereby a capital expenditure of, approximately, £18,000 was involved for the installation of twelve fifty-six-passenger, double-deck trams, and the necessary depôt complete with charging equipment and the extension of mains. The running costs were guaranteed not to exceed 5½d. per car mile, covering write-off of capital, labour, and all running charges. If this installation is made it will be the first of its kind in this country, but there are existing trams working on this principle in the United States. It is interesting to note that battery rail cars, capable of carrying forty passengers with a total weight of fifteen tons, average a current consumption of 600 watt-hours per car mile; maximum speed thirty miles per hour; miles per charge of battery 100.

The battery omnibus will probably prove to be the more popular method of building up routes, prior to the extension of a full tramway service, owing to its cheaper installation and greater mobility. These 'buses are already installed in Southend, South Shields, York, West Bromwich, and Loughborough. In the first three instances the results have been very gratifying, the vehicles not only having given a highly satisfactory service, but the low running costs expected having been proved conclusively. At Southend-on-Sea, where one battery-driven 'bus was installed to run on equal terms with a fleet of petrol and petrol-electric 'buses, a saving of 2d. per mile, plus halfpenny profit to the electricity department, making a net saving of 2½d. per mile, has been shown in favour of the battery vehicle.

At South Shields I find that the current consumption per mile varies between 1.63 and 2.10 units, the variation being specially noticeable owing to the road surface conditions encountered and variable weather. The maintenance charges have proved very slight, and with such a low average weekly revenue as 5.92d. the service covers expenses.

At York Mr. Hame announces that the four Edison 'buses have run 13,600 miles with an overall energy consumption of 1.1 units per mile.

The installation of 'buses at West Bromwich and Loughborough has only recently been made, consequently running costs are not yet available. They will be of special interest, as they are to cover routes previously occupied by petrol-driven chassis.

The ideal method of employing these vehicles is to fix a terminus at which point the vehicle awaits passengers for a few minutes. Here current can be taken at a high rate of input. The time taken to replace sufficient current (at six times the normal rate) to cover one mile of even road surface is one and a half minutes. Therefore, a stay of four and a half minutes will in many cases replace sufficient current to cover the major part of a journey. At Southend-on-Sea it is no infrequent occurrence for the battery 'bus to return to its garage at night with no more than 40 ampere-hours used out of a total capacity of 300 ampere-hours after a day's journey of 100 miles. Where "boosting" facilities cannot be arranged, a larger size battery may be necessary; but a mileage per day of 45 to 50 miles could easily be accomplished, provided the district is not of an extremely hilly nature. Upon hills the vehicle proceeds at a reduced pace, and where considerable gradients are met this is sometimes reduced to little more than a crawl. It should be appreciated, however, that it is possible to run 'buses under these conditions at a running cost which will render light services profitable, or at least self-supporting, whereas either petrol or petrol-electric 'buses would prove uncommercial.

It must not be assumed that the battery vehicle is incapable of speed; speed can be accelerated provided the current supply is in proportion to the distance to be traversed. The "electric" has been developed to travel at a useful speed under the most economical conditions. It is a peculiarity of the vehicle that when under way it appears to be journeying at a much slower speed than the mileage really registered. Including stops, it has been found capable of averaging a speed of 7½ miles per hour. This compares very favourably with the London 'bus, whose average rate of travel is approximately eight miles per hour. It seems unwise to develop a new route under speed conditions, which can only result in a short life owing to the high running costs. The service will be much better appreciated if it is run upon conditions which the route can afford, thereby ensuring permanency.

Where the district is so scattered that a vehicle becomes a matter of necessity to the manager when doing his round of inspection, an electric roadster or coupé seems an ideal car to suit his purpose.

But for the condition of the country during the past year a new vehicle would have been placed upon the market suited for the conveyance of members of the staff on their duties. This vehicle is designed on very light lines similar to the petrol-cycle cars, which have become so popular. It is believed that such a vehicle would find much favour as a means of conveying inspectors, also for the collection of coppers, distribution of tickets, etc., etc. This vehicle it is hoped will not exceed a cost of £300. Upon a similar chassis will be mounted a trade body of the box variety. This has been specially designed for the use of tramway departments in connection with their parcel delivery service. Here, again, low price has been given the utmost consideration—initial cost will be approximately £270. So great will be the advantage of such a vehicle to parcel delivery services that it seems likely a number will be employed once the low running costs have been suitably demonstrated. Assuming that an average mileage of 30 miles per day is accomplished during 300 days per annum, and current can be obtained at 1d. per unit, including current, maintenance, tires, insurance, depreciation (seven years), and interest at an average rate of 5 per cent., the total running costs will not exceed 2½d. per mile.

The tramway departments of Ilford, Derby, and Belfast employ battery-driven tower wagons, each of which amply satisfies their requirements. These vehicles have a speed of from 11 to 12 miles per hour, which is generally found sufficient for the traffic to be negotiated. When out of service the opportunity is seized to revive the battery. The mileage available per charge is from 40 to 45 miles, which has proved more than sufficient for a day's work.

The battery will provide current for operating electric drills, saws, and riveters for bonding, and any other small tools in which either power or heat is required. It will be easily realised what an immense advantage it is to the testing engineer to have a large capacity battery at 70 volts available at any section or feeder pillar for testing purposes during times when the network is dead.

For maintenance of the track and road repairs a vehicle of two or three tons carrying capacity would be of great general utility. For carrying materials such as pillars, setts, and other weighty equipment required on permanent tracks or extensions this vehicle will do all that is required, and by provision of an interchangeable tank body of 500 gallons capacity a further field of usefulness will be provided for watering at any time when current is not available. This same vehicle has been utilised for carrying cables and drawing them into the ducts. It may sometimes be found useful for removing cars from a section where a breakdown has occurred, thus releasing the vehicles to proceed on their journey.

In the short discussion which followed Mr. **Watson's** résumé of the paper, Mr. W. T. **Robson** mentioned his satisfactory experience of the working of battery 'buses at South Shields. Such a 'bus would mount a short steep gradient as quickly as a petrol 'bus, but on long steady gradients its speed fell off seriously, and this would have to be altered. It was excellent for service on flat roads, such as those round York, and the passengers liked it. The Shields battery 'buses gave no trouble in maintenance, and were charged at night by unskilled labour. The only maintenance work was the cleaning of controller contacts and filling up the batteries once a week. The design was very good indeed, and he asked whether it would not be possible to overcome the speed difficulty by the introduction of an arrangement for switching extra cells in on hills. The cost of the battery 'bus, however, was very much too high, and, unless it was reduced, petrol 'buses would be adopted in preference.

Mr. **Harvey** recommended every tramway manager to get a battery tower wagon. The one used on his own undertaking cost about £675, and had a speed of some 10 to 12 miles an hour. In addition to its normal work, it would lift a 60 ft. tramway rail; it had given no trouble in service.

Mr. **Wyld** referred to the tests carried out at Hampstead with electric dust vans and to the considerable saving in cost experienced over horse traction.

Mr. **Watson**, in reply, said experiments were being made to overcome the speed difficulty referred to by using change-speed gear. He suggested that extra cells would introduce difficulties in the charging, etc. He agreed that high first cost was an obstacle, but those who paid the price did not seem to be dissatisfied with the result. In conclusion, he mentioned that the Derby tramways were now using an electric tower wagon and were considering the purchase of battery-driven 'buses.

Mr. **England**, in closing the meeting, said, in reference to the prevailing difficulty in obtaining tramway material, that some concerns were very short, and as an Association they must press the Government to facilitate delivery of such material. Further, in order to save expense, etc., it was intended to ask the Board of Trade to incorporate any proposals for extension of time for carrying out Provisional Orders, etc., in one Act.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electric Power in India.

I note that the columns of your issue of May 28th contain an abstract of the paper written by Mr. H. R. Speyer on "Electric Power in India."

This paper contains so many statements which are likely to mislead your readers that I think it is the duty of British manufacturers to draw attention to these statements and to the author's interest in German-made plant.

For several years prior to the date of Mr. Speyer's paper, he represented in India the interests of the Lahmeyer Electric Co., and latterly, on the amalgamation of this company with the A.E.G. Co., the interests of the combined concern, which was known under the joint name of the "A.E.G. Lahmeyer Co." During this period Mr. Speyer acted in a dual capacity as consulting engineer and also as representative of the above concern, and claims to have imported from Germany electrical plant aggregating about 20,000 h.p. for various customers, whom, presumably, he was advising in his capacity as a consulting engineer.

One would imagine from reading Mr. Speyer's paper that Germany and the Continent had supplied the great bulk of the electrical machinery which has been installed in India during recent years. He states that a very large portion of the electrical plant installed in India has been supplied from the Continent, and goes on to give figures in regard to a few of the generating stations in India showing where this plant has been installed. A reference to the official Government publications in regard to machinery imports throws a very different light on the state of affairs.

During 1908-09 the total value of electrical machinery imported into India was approximately 36 lacs, and of this amount Germany's portion was Rs. 69,000/-; that is to say, under 2 per cent.

In the following year the figures were approximately 32 lacs total, and one lac from Germany, *i.e.*, a little over 3 per cent.

In 1910-11 the total was 42 lacs, of which Germany's portion amounted to seven lacs; and in the following year the total was 42 lacs, of which Germany supplied 4½ lacs.

It will thus be seen that the amount of electrical machinery imported from Germany during the above years averaged considerably less than 10 per cent., and during the same period Great Britain supplied between 80 and 90 per cent. of the electrical machinery sent into India.

It is interesting to note, comparing the official figures with statements which have been made by Mr. Speyer of the amount of business that he himself had done for the A.E.G. Lahmeyer Co., that he must have been responsible for importing at least nine-tenths of the Continental machinery which came into India.

After making misleading statements as to the position of British Trade in India in electrical machinery, Mr. Speyer proceeds to make a wholesale condemnation of British methods of business, British designs and workmanship, and British enterprise.

To leave such statements as he makes uncontroverted would, in my opinion, harm the interest of British trade in India, as the average purchaser reading this paper would certainly obtain the impression that he would be much better served in every respect by obtaining machinery from the Continent.

It is not possible to get official figures in regard to the respective character of British and German machinery in the same way as it is of respective amounts of machinery imported, but those of us who have a knowledge of the electrical business in this country are aware of several cases of bad breakdowns of German machinery and of several cases of equally bad design of plant installed in some mills, and I do not hesitate to say that the proportion of failures to the amount of machinery imported is considerably higher in the case of Continental machinery than in the case of British-made goods.

German machinery has been imported into this country mainly, if not entirely, by price-cutting. The largest electrical generators in India are, unfortunately, of German make, and a serious breakdown has occurred on one, at least, of these machines such as would have made any British manufacturer ashamed of his firm's work.

We all welcome candid criticism and a straightforward statement of manufacturers' mistakes; such, for instance, as is given in the paper which you recently published by Mr. J. H. Rider is welcomed, as it leads to a general advance in the science of electrical engineering.

Mr. Speyer's paper contains little useful information. I have shown how erroneous some of his published figures are, and the remainder of his paper also contains a number of quite misleading statements regarding the position and prospects of electrical business in this country.

I will not take up more of your space by further detail in regard to these points, but hope that you will give this letter space so that those ignorant on the subject may not be misled by the contents of Mr. Speyer's paper, and may take note to obtain confirmation of any statements made therein before accepting them as accurate.

Accuracy.

Calcutta, *June 24th*, 1915.

In your issue of May 28th you publish the first portion of the paper on the above subject written by Mr. H. R. Speyer, and recently published in the *Journal* of the Institution of Electrical Engineers. When the particular issue of the *Journal* in which the paper appeared was received by members of the Institution in India it caused a great deal of indignation, owing to the entirely erroneous impression which the author conveyed therein as to the state of the electrical business in India, and generally to the numerous mis-statements of facts made by him. A meeting of the Calcutta Local Section of the Institution was at once held in order to discuss the paper, and a report of the proceedings has been transmitted to the Secretary in London, together with a request that before papers on matters concerning India are accepted for reading or publication at home, members in India may have an opportunity of expressing an opinion upon them.

Mr. H. R. Speyer, the author of the paper under reference, was the agent in India for the A.E.G. and Lahmeyer companies until shortly before he wrote the paper, and he is still the distributing agent in India for an American-made motor car (the "Hubmobile"), so that it is a little difficult to see at first sight—but at first sight only—why he now poses as a patriotic Englishman, urging *British* manufacturers to wake up, and, presumably, to appoint *him* as their agent in India. This, also, although he now describes himself as a "consulting engineer."

It is not possible in the confined space of a letter to report fully regarding the meeting held in Calcutta, but practically every statement in the paper was refuted and proved to be wrong; and, in view of the extended publicity which you have given to the paper by publishing it, I trust that you will also find space for this letter, indicating the true state of affairs. I enclose my card and remain, Sirs,

British Representative.

Calcutta, *June 24th*, 1915.

I note in your issue to hand by this mail (dated May 28th) that you have published a first instalment of the paper written for the I.E.E. by Mr. H. R. Speyer.

Everyone connected with the electrical business here is surprised that the Institution should have published under present conditions a paper emanating from one who is looked on here as an alien enemy. The author for some years represented two of the large German firms here, and even now finds his chief employment in selling American automobiles, so, to put it mildly, it is the height of presumption for him to pretend any personal interest in the welfare of British trade in India.

Had the paper any real merit there might have been some excuse for its publication, but it is full of inaccuracies, and gives an absolutely false impression of the real state of things out here.

Many of the false statements were recorded in a discussion of the paper at the local centre of the I.E.E., and it is hoped that the proceedings of this meeting will be published in the *I.E.E. Journal*. If this is done, I trust that, as you have published the original paper, you will also find space for a digest of the discussion on it in order to give your readers a chance of finding out what local members think of Mr. Speyer's paper.

"A Ditcher."

Calcutta, *June 24th*, 1915.

Shortage of Labour.

In view of the great need of men for industries in England, permit me to point out that there are thousands of genuine unemployed here in Australia, and a great many of these would, I am sure, be pleased to accept work in England. Many of these men would be in a position to pay their own fare by steamer, and I would suggest that some of the leading firms in the United Kingdom should form a committee to deal with the subject.

If advertisements were inserted in the leading daily papers in Australia, I am convinced that plenty of suitable men would reply. I enclose a cutting from a Sydney daily paper which deals with this subject.

London Lad.

[The cutting shows that the percentage of unemployment, according to Trade Union returns, rose from 5.9 in February, 1914, to 12 in February, 1915, and the latter figure takes no account of men who were working short time or were out of work for less than three days during the last full working week of the month.—Eds. Elec. Rev.]

American Trade.

I shall be glad if you will give the following remarks space in your publication, as I am sure they will lead to a better understanding between American manufacturers of insulated wire and prospective British consumers.

The present abnormal position of affairs has placed the British manufacturers where they must back up their Government with every ounce of assistance, and, therefore, the commercial demands, both their own and European neutrals', must go by the board. Consequently, those suffering from the want of such supplies must turn to probably the only source they can get them from, and that is the United States. Business here for the last year has not been any too good, and therefore American factories welcome such inquiries with a certain amount of enthusiasm. These inquiries are beginning to pour in rapidly, and it is at this point that I wish to point out a way to smooth over the discrepancies arising from the differences in nomenclature between the two countries.

Old England is a very conservative country in its preference for its own standards, but so also is New England, and if the latter is to be of any assistance to the former, and that for probably only a temporary period, it will be necessary to consider to some extent how the latter is fixed in its machinery and equipment. Thus, for instance, the Brown and Sharpe (B. & S.) gauge is universal on copper wire, and sectional area is considered in terms of the "circular mil," and not the square inch. We prefer to strand regularly, namely 7 wires, 19, 37, 61, 91, 127, 169, and so on, or, where extra flexibility is required, use these figures and units of 3 wires, 7, or 19. Paper over strands are made by some concerns, although there are many who do not like it. Only one class of wire ever uses a compound as rich as 40 per cent. pure Para rubber for covering purposes, and that is for the United States Government specifications, the navy, and some of the army departments; railway signal wires take 30 per cent., and twenty years' experience in this line has shown this proportion to be as good as any, for, to the writer's knowledge, there are many stretches of hundreds of miles of signal wires exposed to all weathers along railroad tracks in this country which are still giving good service, with no sign of deterioration, and which have been up for a longer period than that. The grade known as "National Code," which is used for house wiring, is supposed to contain 20 per cent., but judging from the prices paid at present it would be difficult to understand how it would be possible to put any in at all and be able to sell at the prevailing rate. Recovered tire stock is practically the base, with the necessary fillers and vulcanising mediums. Anyhow, the stuff stands, so what is the use of bettering it? I am enclosing two copies of the "Code" rules governing the manufacture in case any of your readers care to look over them.

Bitumen compound has not obtained a foothold in this country, but paper is used on almost all underground feeder work, and, in fact, anywhere where lead-encased cables are possible. Rubber is rather too expensive, although there are some who use it. There are cases of varnished cambric, but this style of insulation is not called for very much. Multiphase cable of all kinds and "split insulation" are used as in Europe. There are some factories which can make the steel taped type of cable, among the larger ones.

Insulations are what are known as "solid"; that is, there is very little call for "cored" cable, with an inside of Para pure, and another of vulcanised rubber, and as for the triple cover, as per the British Navy standard, there is no such thing. We used to have fads of this kind, white core, red core, and others, but these have died out now, with the exception of some in the Government specifications, and this is only in the case of a pure rubber core next the conductor, which is supposed to prevent the sulphur from attacking the copper. This bugaboo has long since died a natural death, for no compounder puts more sulphur into his mixture than is necessary to vulcanise the mass, so there cannot be any left to do any harm, except in the smallest of conductors.

I am sending under separate cover other specifications, such as those for railway signals, and some of the traction companies, so that any of your readers who are contemplating purchases from us will be able to look them over and make them fit in with what they want. And as long as they can do this without complicating their demands with what are, to us, "unknown quantities," I am sure all of the manufacturers will be glad to sell as much as possible. Keep to the B. & S. gauge and the circular mil, and don't complicate with the mm. under any circumstances, and all will go well.

There are several reliable testing bureaux which are competent to see that orders are O.K. before they leave this country, and the use of them is somewhat necessary, because Americans do not care to do export business except on the terms of "Cash with bill of lading," New York (or other convenient) bank.

Prospective British customers will find the prices very moderate, as there are a great number of factories on this side, more than 50, in fact, and 75 per cent. of these are on or near the Atlantic seaboard. Prices are, therefore, on a very competitive basis, and consequently companies are keen on getting all the business they can at a low margin of profit.

I have made this letter somewhat longer than I intended, but I wish to make myself as clear as possible; and in case there is anything I can do to help a prospective purchaser out, you are quite at liberty to give my address to him and I will do all I can.

E. W. Stevenson.

Brooklyn, N.Y., *July 9th*, 1915.

LEGAL.

Osram Lamp Litigation.

(Concluded from page 70.)

Judgment was delivered in the Chancery Division in this action on Tuesday, July 20th. In the course of his judgment, Mr. Justice Joyce said: This is an action for an alleged infringement of a patent, No. 23,899 of 1904. This patent, among others, was judicially considered by Mr. Justice Warrington in the action of Osram Lamp Works, Ltd. *v.* the "Z" Electric Co.; the defendants in that case were entirely different from the defendants in the present case, and were held to have infringed. The validity of the patent, which was disputed, was upon the evidence there upheld as against those defendants. There was no appeal from the decision of Mr. Justice Warrington, as I understand, the case being settled, as is not infrequent, by the defendants taking a licence. The present case, I am warned, is to go to the House of Lords. The patent in the present case is for "Improvements relating to the manufacture of incandescent electric lamps." To a great extent it is what I may call a chemical patent; and I at once state that I am not bound to be an expert in chemistry, or in anything else, for the matter of that. The Court acts on the opinion of experts whose qualifications can be tested by cross-examination, and weighs the evidence so given and tested. Premising that, I may say there are two claims by this patentee. The first claim, I think, is for the product, and then the second claim is really for the process of making the product. But this patent, according to my reading of it, if and so far as valid at all, is only valid as a patent for the manufacture of tungsten filaments by the method or process or series of processes particularly described in the specification. The patent is not merely for making a tungsten filament, but it is for making by the method or processes specified in the specification, and in my opinion, for nothing else. It appears by the evidence that the usual manner of forming filaments there referred to, as I understand, was to make the materials into—hardly a paste, but a compound of the consistency of thick treacle, and to squirt this through a glass nozzle into alcohol, whereupon the liquid coming from the nozzle into the alcohol becomes set as a firm jelly, and, having stood for a short time, is hardened and tenacious and capable of being handled. Then the patent proceeds:—"And they are then carbonised, in some cases after denitration has previously been effected." I do not think those words "after denitration has previously been effected" are very material. Then follows a paragraph beginning at the 13th line on page 3, it really begins two lines earlier; and this, to my mind, is a very important part of this specification: "The filaments so produced and consisting of tungsten and carbon are then submitted to the following further treatment. First of all the carbon, which has only served as a binding medium, is removed, by subjecting the filaments to the passage of current in an atmosphere of steam and hydrogen and thus raising it"—which in my opinion must be the atmosphere—"to a high temperature. By this process the carbon is completely oxidised so as to form carbonic oxide and a filament of tungsten is left. These filaments are then rendered uniform in a manner similar to that employed in the treatment of the usual carbon filaments, by submitting them to the action of current in an atmosphere of volatile tungsten compounds in the presence of a large quantity of hydrogen, whereby the tungsten deposited equalises the filaments." Then there is a sentence not very important, I think: "The filaments which have been rendered uniform in this way are then sealed in glass bulbs in the usual manner."

The validity of the patent in this action has been questioned on three or, possibly, four grounds: want of subject matter, insufficiency of the directions as to the way in which the invention is to be carried out, and also want of utility of the process, or whatever it is that is patented.

What is it that the defendants do? Of the materials they use they make a paste much stiffer than a mixture of the viscosity of treacle, which paste is used in the manner of making carbon filaments, and this, if it can be called squirting, is squirted as described by Mr. Ballantyne. There are other processes after the mixing, but the stuff is then rolled up and put into a chamber with a hydraulic press capable of exerting a very high pressure. A die is used consisting of a diamond finely perforated, and the stuff is forced through the die by the press so as to make a filament, and is directly received on a card. Then they are dealt with in a certain received on a card. Then it is dealt with in a certain way. That, again, is from the evidence of Mr. Ballantyne.

With reference to the carbonisation of the filament that is produced by thus pressing it at enormous hydraulic pressure, as to whether it is carbonised or not according to the defendants' process in the usual manner there is some dispute. I am not going to involve myself in a chemical discussion as to whether it be carbonised in the usual manner or not; but it is denied, I think with some show of reason, that the defendants do carbonise in the usual manner. I have some doubt as to whether they do or not in the manner indicated or intended to be indicated by the specification. But upon the question whether the defendants take or use the series of processes described in the twelve lines, beginning on page 3, line 10, "The filaments so produced and consisting of tungsten and carbon are then submitted to the following further treatment," or, indeed, whether they take any of them, I do not feel much doubt. Rightly or wrongly, I do not think they use any one of them. They certainly do not pass current through the filaments; they are not subjected to the passage of current in an atmosphere of steam and hydrogen. In my opinion they do not use an atmosphere of steam and hydrogen in the sense in which that phrase is used in the specification or is intended by the patentee. Nor, indeed, in my opinion, do they use steam at all in the ordinary sense of that word.

The hydrogen the defendants use is dry, but it is said, if I understand the matter rightly, that though no steam or water vapour is introduced, an infinitesimal amount of water vapour, or, rather, of the ingredients, or some of the ingredients, which together with hydrogen will make water vapour or steam in the true or scientific sense—not the popular sense condition of the materials necessarily use, to form the filament in the process the defendants use, and in the then condition of the materials necessarily use, to form the filament. This may be so, but this is certainly not, in my opinion, subjecting the filament to the passage of current in an atmosphere of steam and hydrogen as described or indicated in the specification; nor in my opinion is it an equivalent process in the sense in which that phrase is used in patent law; nor do the defendants employ any of the treatment which comes under the head of equalising.

In the circumstances, seeing how many and which of the series of processes or steps prescribed by the specification are omitted from, or not to be found in, the method pursued by the defendants and alleged to constitute infringement, bearing in mind what I have said before as to what the only patented invention here is, I am unable to bring myself to the conclusion that the patent has been infringed by the defendants, the onus being on the plaintiffs; and I hold that it has not been infringed and that this action must be dismissed.

As to the validity, if it were necessary for me to go into the matter I have serious doubts not only as to the subject matter, bearing in mind what the patent is for, but also upon the sufficiency of the instructions in the specification.

With reference to this, I understand that upon more than one point Mr. Justice Warrington relied upon the evidence of Dr. Oberlander. I think I must say that I was not favourably impressed with the manner in which he gave his evidence. If I am to consider him as appearing in the witness-box in the character of an impartial scientific expert, he did not appear to me to be unbiased or as candid as I should have wished, and I am glad that it is not necessary for me to base my decision in this case upon what I might consider to be the result of his evidence.

As to want of utility, it was not much insisted upon, but I do not understand that this patent has ever been worked commercially.

Upon the whole, I consider that the methods and series of processes used by the defendants are so different from those particularised in the specification that there is no infringement, and this action must be dismissed with the usual consequences.

Costs were granted on the higher scale. It is understood that notice of appeal will be given without delay.

Hamilton *v.* Marconi's Wireless Telegraph Co, Ltd.

(*Continued from p.* 69.)

The hearing was resumed on Tuesday, July 13th, when Mr. Hamilton, the plaintiff, was further examined by Mr. Eustace Hills upon the agreements for the formation of the new Australian company. There was, he said, first a provisional agreement dated 1912, out of which the agreement of 1913 resulted. By the agreement the price was to be £41,000, in £1 shares, plus a sale of apparatus; the apparatus was subsequently reduced into money, so that together the price might, in round figures, be stated at £55,000, and he claimed commission on that transaction as well as upon a number of ship installations and upon certain apparatus sold to the new company, who took over existing stations and purchased plant for new installations from the defendant company. Witness gave details of a number of ships which had been fitted with wireless by the company during the period of his agreement of service with them upon which he claimed, he said, £10 per ship for the installation and 5 per cent. of the royalty subsidy from ships fitted with defendants' installation through orders secured by him. As to certain ships the defendants' had brought money into Court, and about them there was no dispute. His claim was really under two heads—first, as to lines as to which defendants had not made payments, and secondly, for certain additional ships on lines from which they admitted payment was due for some ships. There was also a claim for an out-and-out sale of an installation for a ship, upon which he claimed a percentage.

In cross-examination by Mr. Pollock, K.C., the witness said he claimed for any business done by the Marconi Co. within his territory at any time.

Asked what was the limit of time over which he would continue his claim, Witness replied that he should think during the whole of his life, as when he joined the Marconi Co. he took over to them all his business and all his friends. It must not be forgotten that wireless telegraphy was not an ordinary thing that could be picked up anywhere.

On July 14th Mr. Hamilton was further cross-examined by Mr. Pollock. He was unable to say whether an installation set up, which was within the Admiralty agreement of 1903, would come within his agreement, as the question was one which had yet to be decided. The Australian fleet belonged to Australia; but the New Zealand ships became a branch of the British Navy. It depended upon the agreement made between the Marconi Co. and the Admiralty whether they got something beyond the agreement of 1903 as regards royalties. He would expect to be paid on the value of the apparatus supplied. For seven years before his agreement with the Marconi Co. the British Admiralty was fitting up ships with wireless installations, but at that time there was no Australian navy, and he claimed to have been instrumental in introducing wireless telegraphy to the Australian Government, and the negotiations in regard to it extended over a long time.

Mr. Pollock, K.C, opening the case for the defendant company, said that from the plaintiff's documents his claim now reached something over £13,000, but it might be that some other sums had to be added to that, so that very heavy liabilities on the part of the defendants were involved. The defendants had been found by the jury in the King's Bench to have committed a breach of their agreement with the plaintiff, and he (plaintiff) had been awarded damages in respect thereof. But his story now was that in addition to the two or three thousand pounds awarded by the verdict of the jury, he was entitled to ask for a further sum of something over £13,000 under the agreement. The work which the plaintiff did within the territorial area specified by the agreement was confined to the period between August, 1910, and March 1911, and he said that during that period the work he did for the company entitled him to the sum of £13,000 beyond the amount awarded by the jury, and that he was further entitled for the rest of his natural life to receive commission upon payments made to the company for work done by them within his territorial area. Commenting upon the terms of the agreement, counsel said the first point was what right did the contract give plaintiff to be paid commission on sales effected by the company for the rest of his natural life. It was argued for the plaintiff that there was no time limit, and that it was, therefore, for the term of the plaintiff's life. For the defence, he (counsel) argued that it was quite unnecessary to introduce a time limit because the agreement contained a margin of time in regard to other matters, and it was for that time alone that the defendants were liable to the plaintiff. In consideration of his services to the company and his devoting the whole of his time exclusively to the benefit of the company, it was agreed that the defendant should receive 5 per cent. on the gross value of the sales effected by the company within the area specified, but the agreement said only so long as he devoted himself to the benefits of the company. The period of the contracts for the installation of ships was 10 years. The system was to hire to the shipping companies the Marconi apparatus, in return for which a subsidy of £250 per annum was paid in most cases for 10 years, and in respect of each ship fitted the plaintiff was to receive £10 and 5 per cent. on the subsidy. That could only be meant to last for the period during which the contract was running. It was not always ten years; in some of the earlier cases it was for three years only. It was necessary to put a time limit in the case of ships, but it was not necessary in the case of the other business. The plaintiff, however, said that he was to receive payment for ever and ever because he had rendered services for a certain period. The agreement ran from May 2nd, 1910, and it was alleged at the trial that from July, 1912, the defendants had not properly treated the plaintiff by giving him information, and that they dismissed him for causes that were inadequate. The agreement said that it was to last for three years, but it was understood that it should be for a further term of three years in the event of the business being satisfactory. The jury had answered the question as to the damage the plaintiff had sustained by giving him £640 up to May, 1913, and for his chance of a renewal £1,700. The jury had estimated the value of the pecuniary benefit from January to May, and the plaintiff was not entitled to say that he could go beyond that verdict and ask the Referee to say that he could exercise the function of a jury and assume that they should have awarded some other figure. As to the second period of three years, the jury had awarded £1,700 as the value of plaintiff's chance of a renewal of the agreement.

In reply to the Referee, Counsel said that the Judge did not put it to the jury whether plaintiff was entitled to commission during his life. The point had not been raised, nor was it argued at the trial.

Mr. Eustace Hills said that it was more than once stated in the course of the trial that matters of construction except in one instance were to be left to the Referee.

Mr. Stuart Bevan said that the question of a life-long agreement was never raised.

Mr. Pollock, continuing, said that the Judge did consider the possibility of a renewal. According to the plaintiff's case, it seemed that they were now only at the beginning of things. The claim to-day was for £13,000, and it was proposed to add all the years of Mr. Hamilton's life to it. If that were allowed he did not know where the company would be when Mr. Hamilton died. It was not, he contended, possible for Mr. Hamilton to substantiate his claim of £2,751 as commission upon the amalgamation of the German company with the Australian company. The claim was made in respect of what plaintiff called a sale to the company, but the transaction referred to was only a taking over. The amalgamated company took over the interests of the Marconi Co. in Australia and those of the German company. That was not like a sale effected. It was simply the formation of a new company to take over the interests of both companies, and so bring together two competing companies in the interests of both. It was a domestic method of handling the business of both, but the plaintiff claimed £2,751 as his commission on that transaction, although he said that by his agreement he was to get £1,200 a year from it as managing director. As there was no security of tenure with regard to that appointment, the jury had been asked to say what was the value of the plaintiff's expectations in that direction, and they answered the question by saying that it should be £1,700. Dealing with the several heads of claim, Counsel said that the plaintiff's view seemed to be that until he came on the scene in 1910, Australia, so far as wireless was concerned, might be said to be a dark continent. The true position of things was that a contract was made in 1903 between the Admiralty and the Marconi Co., seven years before the coming of Mr. Hamilton. The Admiralty had an agreement under which they paid a sum of £5,000 a year and £20 down, for which they had the right to fit up Marconi wireless on payment for the installation. The Admiralty was aware of the importance of Marconi's wireless telegraphy in 1903, and they made an agreement which lasted for 11 years. The Admiralty had the right to provide and make their own apparatus. There was an item in the claim of £9,600 for the high power stations, and that was a claim which Mr. Hamilton said he made because the company wrongfully withdrew from the contract which they had made with the Postmaster-General with regard to the Imperial wireless chain. Under the agreement, which was made on July 19th, 1912, the sum of £60,000 was to be paid for the installation, and, in addition, a royalty was to be paid. What that would amount to it was impossible for anyone to say. It was not alleged that any stations under the agreement had been built, but it was said that they had the chance of holding the Postmaster-General to the contract, and if they had been built they would have got their money at some time.

Plaintiff said that he was, therefore, entitled to claim the £9,000 for the two stations which would have been within his area, and 10 per cent. on the gross receipts which he (plaintiff) put at £2,000 per annum for each station. Why it was put at that figure he (counsel) did not know, as there was a Treasury minute to the effect that no accurate forecast could be made of the probable receipts. There never was a contract which started upon such stormy waters as this Marconi contract. It was started on July 19th and had to be ratified by the House of Commons. A considerably controversy arose upon the money vote, and there was a long delay. On January 15th the Marconi Co. claimed to be allowed to withdraw from the contract. They said that prices had gone up, and for that and other reasons they asked to be allowed to withdraw from the contract. It was nevertheless alleged that £9,000 was due upon the price of the stations, which would have been sold had the contract been carried out. The words of the agreement were, however, that he was to receive 5 per cent. on all sales effected by the company, and these sales were not effected. After a Committee had been sitting a long time Mr. Herbert Samuel, the Postmaster-General, as he then was, on July 2nd announced that he did not intend to enforce the contract with the Marconi Co., but Mr. Hamilton wanted to say that a sale was effected nevertheless. His right to commission was only when payment was received by the company. A more favourable contract was entered into on July 30th, 1913, and ratified by the House of Commons, but in December, 1914, the Postmaster-General abandoned the whole thing and no stations had been built and no money had been paid. The whole scheme of the Imperial chain, in fact, broke down, and there was no ground for saying that any portion of the £9,600 could be payable by the defendants.

The Referee said that the reference to him was as to payments found due, but a payment upon certain things which had not happened could not be said to be due. It could not be contended that the money had been received by the company, and therefore the money could not be due.

Mr. Eustace Hills argued that the commission was due, although the money might not have been received by the principal.

On Thursday, July 15th, Mr. Pollock, resuming his speech, said in regard to the amalgamated company, in respect of which the plaintiff claimed 5 per cent. on £45,000 and £10,000, that the amalgamation was not a sale at all, but merely a rearrangement of the business. It was only the old business under a rearrangement, so that the two rival companies might be able, instead of cutting the rates, to join forces and bring into the common stock the business which had hitherto been done by the two. It did not involve any new business undertaken for the benefit of the old company.

Mr. Arthur Cappalare, the defendants' accountant, gave evidence as to the various transactions in which the plaintiff had been engaged for the Marconi Co., and produced books to show what was owing to him in respect of those transactions, particularly in relation to the shipping installations, and witnesses were called from the various shipping companies to prove that plaintiff's claim in respect of the installations was not always justified, after which the hearing was again adjourned.

On July 16th Mr. Cappalare was recalled and further examined on the accounts of the company relating to the plaintiff's work during the term of his agreement with the company, and the payments made to him in respect of that work.

The hearing was adjourned until Thursday, July 22nd.

THE ELECTRICAL AND INDUSTRIAL INVESTMENT CO., LTD.

In the Chancery Division, Mr. Justice Younger, on Tuesday, July 19th, sanctioned a reduction of the capital of this company, in accordance with resolutions passed by the various classes of shareholders.

Poster Stamps.—Messrs. W. T. Henley's Telegraph Works Co., Ltd., of Blomfield Street, London Wall, E.C., have issued a set of half-a-dozen large poster stamps, effectively illustrating in colour a number of their manufactures—namely, street pillars, terminal boxes, joint-box compounds, colliery boxes and service cut-outs.

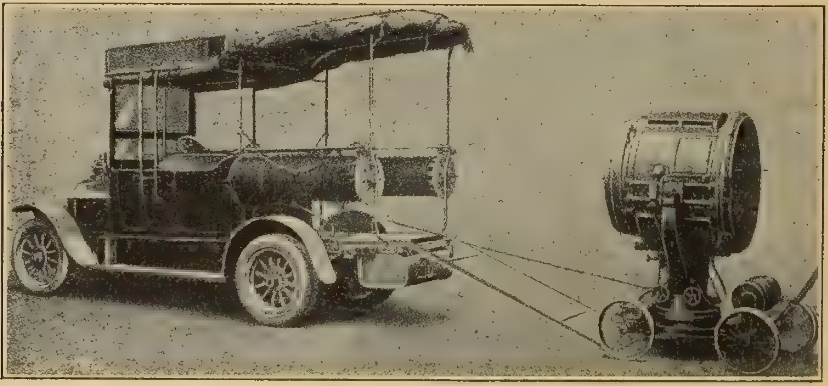


Fig. 1.—Italian Motor Searchlight Plant.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

An Italian Motor Searchlight.

We have already illustrated one of the motor searchlight plants used by the French military authorities and also one of British construction supplied to our own Government. The following particulars of a similar vehicle, built by the Fiat Co., of Turin, for the Italian military authorities may also be of interest. The vehicle, which is fitted with a 35-H.P. petrol engine, is designed for a useful load of 3 tons and for a maximum speed of 20 miles per hour. The engine is so arranged that when the lorry is not travelling, it can be coupled up to a continuous-current dynamo, giving 100 amperes at 80 volts. The searchlight, which is carried on a light four-wheeled truck, has a diameter of 90 centimetres; it is so arranged that it can be quickly removed from the wagon, a length of cable carried on a couple of reels enabling the searchlight to be used at a distance of about 130 yards from the current-generating wagon. Fig. 1 illustrates the outfit.

A feature of the details of the plant is the provision of a magnetically-operated regulator, which acts upon the engine carburettor in such a way as to prevent variations in the engine speed when the current is switched on and off the searchlight. The wagon is provided with pneumatic tires, "twins" being fitted at the rear; the searchlight trolley has small wheels of the cycle type.

Circulator for Economiser.

The National Boiler and General Insurance Co., Ltd., of National Buildings, St. Mary's Parsonage, Manchester, have introduced a device for preventing the corrosion of the pipes at the inlet end of an economiser, by circulating a proportion of the hot water from the top branch pipe with the incoming cold water, thus raising the temperature of the pipes above 100° F. It consists of a gun-metal nozzle inserted in the course of the inlet from the pump, at the throat of a coned pipe connected also with the top branch pipe, and acts after the manner of an injector, as shown in the accompanying section. The nozzle can be removed at any time by taking off the bolted cover. It is stated that experiments have shown that the temperature of the feed inlet can thus be raised to 120-140° F. without causing a reduction of the temperature of the outlet water—the latter, in fact, being generally higher than before the installation of the circulator—and sweating and wasting of the pipes is prevented; there is also less tendency for soot to collect on the economiser pipes. The circulator is made in three sizes.

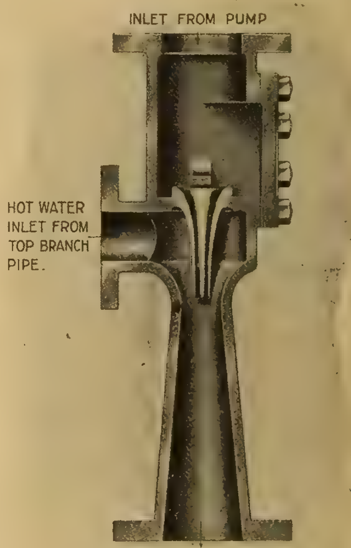


Fig. 2.—Section of Circulator.

Impermeability Tester.

The *Génie Civil* reports a note submitted to the Académie des Sciences recently by Mr. Ch. Moureu, describing an apparatus for testing the non-permeability to water of textile fabrics, especially of cloth intended for military uniforms. The device is called the "Impermeabilimeter," and consists of a glass cylinder A, fig. 4, open at both ends, graduated in depth in centimetres, and provided with a flanged brass collar, to which the sample of cloth F to be tested is secured by means of a brass ring B and bolts C. A tripod G with a stem jointed at G_1, and an insulating portion G_2, carries a gilt-brass disk H, upon which is laid a disk of thin paper I which has been soaked in a solution of potassium sulphate and dried, and waxed for a width of 1 cm. round the perimeter. Upon the paper a disk, J, of very thin wire gauze, of platinum or gilt copper, is placed, and H and J are connected to the poles of a battery with a relay R in circuit, which, when the circuit is closed, actuates the style of a recording chronograph, immediately afterwards breaking the circuit and ringing a bell.

In the case of a fabric waterproofed with india-rubber, the disk

F is placed directly on J; if rubber is not used, a space of 5 mm. is left between F and J. Distilled water is poured into the vessel A up to a known depth, the electric circuit is closed and the chronograph is started. When—if at all—the water penetrates the fabric, it moistens the paper and completes the circuit, actuating the relay. If artificial rain is to be used for the test, A is turned upside down on the table, the top of which is set on a slope by means of the joint G_1, and a jet of water from a capillary orifice is allowed to fall from a known height upon the cloth, the water trickling off the latter. Penetration is announced automatically as above described. Thus, it is claimed, the waterproof qualities of cloths can be measured under standardised conditions.

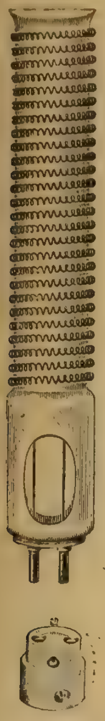


FIG. 3.—"VESPER" HEATING PILLAR.

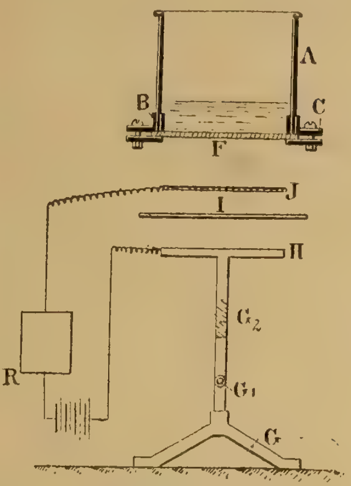


FIG. 4.—THE IMPERMEABILIMETER.

"Vesper" Heating Pillar.

MESSRS. STURGE & BAKER, of Premier Works, Sheepcote Street, Birmingham, have introduced a handy substitute for the radiator amp, by which the lamp type of radiator can be easily turned into an electric fire with red, glowing heating units.

The method consists in substituting for the lamp a "Vesper" heating pillar, which is wound with the usual wire spiral, and has two contact pins at the lower end for insertion in the socket, which akes the place of the lampholder, as shown in fig. 3.

The pillars take about 500 watts, and quartz cylinders and caps are supplied to slip over them with a view to improving their appearance. The makers suggest as a good plan to replace only part of the lamps, and thus obtain a dual heating system.

Simplified Method for Calculating Illumination.

Methods of figuring illumination are ordinarily so technical that they are not understandable by many contractors, and hence little care, other than "rule of thumb" methods, is taken with the maller illumination problems.

The accompanying chart can be easily and quickly employed to etermine the proper number of lamps to use in lighting a given ea. When it is used in connection with the table of average tensities given below, any ordinary problem can be accurately lved. This chart and table are supplied to the canvassers of the xas Power and Light Co., Dallas, Tex. Attention should be ven to spacing units so as to secure uniform distribution. The mp size should be chosen so as to obtain as nearly as possible a number of squares, in no case less than 10 ft. on a side, one lamp being used in the centre of each square.

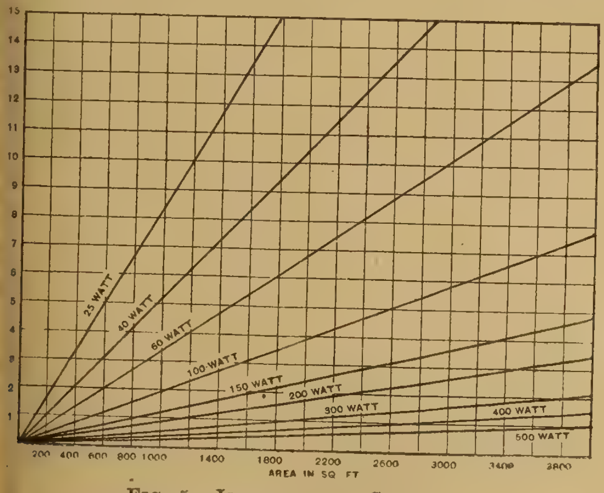


FIG. 5.—ILLUMINATION CHART.

In order to get the best results, lamps should be hung at distances above the plane to be lighted as indicated below, D representing the distance between two lamps, which, in the case of the square arrangement, will equal the side of a square.

Type of reflector.	Height above plane.
Extensive	0·5D
Intensive	0·8D
Focusing	1·3D
Concentrating	2·0D

VALUES OF "A"—INTENSITIES IN FOOT-CANDLES RECOMMENDED FOR VARIOUS SERVICES.

Auditoriums	2·0	Residences—hall ...	0·7
Ball rooms	2·0	Reception room ...	1·0
Banks—general ...	3·0	Dining room	1·5
Banks—desks	5·0	Kitchen	2·0
Bar rooms	3·5	Bedroom	1·5
Barbers' shops	4·0	Bathroom	2·0
Billiard halls—tables...	6·0	Show window	20·0
Café	3·0	Stores—Clothing ...	3·0
Church	2·0	Drug	3·0
Court rooms	2·5	Grocery	3·0
Drafting room... ...	8 0	Hardware	3 0
Library—reading room	3·0	Jewellery	5·0
Offices—general ...	6·0	Shoe	3·0
Postal service	7·0	General merchandise ...	3·0
Pool tables	6·0		

—*Electrical Review and W. Electrician.*

BUSINESS NOTES.

Consular Notes.—FRANCE.—The American Consul at Havre, in a recent report, states that Havre maintained in 1914 its rank as the most important copper market in France. The total imports into Havre in 1914 amounted to 63,905 tons, as against 74,869 tons in 1913. The total exports were 8,352 tons in 1914, against 11,425 tons in 1913. The Havre copper market, which was established at the beginning of 1912, has developed steadily and it transacted a large import business in 1914. It is certain that the stock in the Havre warehouses would have reached a record-breaking figure if the war had not occurred to disorganise business. The local copper market, however, was able to render the country an important service by supplying the requirements of the industries engaged in manufacturing for the national defence at a time when, by reason of the difficulties arising from the war, the supply of copper for this purpose would otherwise have failed.

The Consul also reports that the Société Westinghouse, of Havre, was well provided with orders of various kinds during 1914. As regards electrical material, the most important orders related to large engines for steel mills, including the forges of Audincourt and Wendel and large generating plant for the mines at Lens, the Société de l'Acetylene, the gas works of Clermont Ferrand, &c. Numerous transformers for electro-metallurgical and other installations were constructed during the year. The electric traction department of the Havre plant was also favoured with important orders, notably for the electrical material in high power electric locomotives for use by the Midi Railway in the South of France, electric traction engines and other material for the equipment of the French State Railways.

COLOMBIA.—The American Consul at Cartagena reports that American manufacturers furnish about 57 per cent. of the total imports of electric motors, materials and pumps entering Colombia through the port of Cartagena.

The following table shows the imports of motors and parts, electrical materials, and electric pumps at the port of Cartagena during the calendar year 1914, and the principal countries of origin:—

	Motors and parts.	Electrical materials.	Electric pumps.
France	$830	$68	—
Germany	1,188	9,425	$514
United Kingdom	9,641	1,627	—
United States	19,282	12,398	157
All other countries	98	161	869
Total ..	$31,039	$23 679	$1,010

The only possible user of electro-hydraulic valves is the Cartagena Waterworks, Ltd. The electric light plant, now about 19 years old, is owned and operated by the municipality. This plant has given excellent service, but the equipment will need replacing in the near future, and the attention of American manufacturers of dynamos, boilers for wood fuel, and other equipment, is called to this prospective trade opportunity. The local telephone company is a private concern. All correspondence and printed matter should be in the Spanish language. Specifications as to measurements should be converted into the metric system. Prices may be quoted c.i.f. or f.o.b. in American currency. Inasmuch as the import duties are specific, and are levied on the gross weight, the the tare on shipments should be reduced as much as possible, and the net and gross weights should be set forth in kilos. It is suggested that in the absence of a well organised export department, it would be better to transact business through one of the commission houses, because those houses already control a large part of the import trade, and have adequate banking facilities and accurate credit information.

In this connection it is interesting to note that the American Consul at Barranquilla reports :—

> This Consulate again feels it necessary to call the attention of manufacturers and exporters to the fallacy of a policy that would require the customer in Colombia to pay commission tribute to a general agent in Buenos Ayres. This holds good with regard to Colombia, Venezuela, the Guianas, Ecuador, Peru, and the West Indies. In fact, the writer is convinced that the establishment of exclusive general agencies in any one Republic of South America with a view to doing business therefrom even with neighbouring Republics is an error. Such action reduces the house's business radius to that small district within easy reach of the exclusive general agent's local place of business. It virtually destroys any chance the house might have to do business with others of the 20 Republics of the continent. Each country feels itself sufficientfy important to merit the establishment of a general agency within its own borders, or to have its field left open to do business direct with its natural trade-connection point, which, in the case of Colombia, would be New York, New Orleans, &c.
>
> Before establishing agencies in any part of South America every house should carefully study the map of the country where the agent is to be located, and grant him the field which by natural routes and for natural reasons he can cover, and nothing more.
>
> No New York exporter would establish a general agency at Bombay to supply tools and implements and cotton goods to Yokohama, yet the distance from Bombay to Yokohama is probably a little less than from Barranquilla to Buenos Ayres. Moreover, there are regular lines of steamers between Bombay and Yokohama.
>
> Americans must discriminate between South America as a whole and the various Republics of South America. This is an important point in American trade propaganda and should be driven home to every merchant and manufacturer of the United States.

CHINA.—The American Consul at Canton reports that since the declaration of war in Europe there have been several electric light plants established in various cities and towns within the Canton district, and it is interesting to note that in most cases the orders for the electric end of the various plants have been sent to the United States. The orders for engines, however, were sent to England. The following is the list of orders :—

At Kingmoon, a treaty port in the Canton Delta, there has just been delivered a 75-KW. one-phase alternator complete, with suction gas plant. An order has been secured for a second 75-KW. set complete with air compressor. The value of the two orders amounts to about £3,800.

At Mengtsze, Yun-nan Province, a contract has been entered into for one 75-KW. three-phase steam-driven alternator, complete plant, valued at about £3,500.

Sainam, near the treaty port of Samshui, two 40-KW. three-phase alternators and plant, valued at about £1,800.

Tai Lang, one 40-KW. three-phase alternator and suction gas plant, valued at about £800.

Shek Loing, a large town on the Canton Koulom Railway, one 40-KW. three-phase alternator and suction gas plant, valued at about £800.

Chan Tsuen, one 30-KW. three-phase alternator and suction gas plant, valued at about £650.

Nanning, the capital of the Kwangsi Province, one 75-KW. and two 40-KW. three-phase alternators and switchboard complete, valued at about £1,200.

Dissolution.—BIRCH & HARRIS, cycle manufacturers and electrical engineers, Nuneaton.—Messrs. E. H. Birch and J. Harris have dissolved partnership. Mr. Birch will attend to debts and continue the business.

Grand Trunk Railway.—Those interested in and familiar with Canada are aware of the important part of the great railways of that country play in its colonisation and development, and they will no doubt be more than interested in the cable news just to hand from the Canadian headquarters of the Grand Trunk railway system to the effect that commencing Tuesday, July 13th, an up-to-date through passenger service—Toronto to Winnipeg and Winnipeg to Toronto *via* Cochrane and the new Trans-Continental route, operating thrice weekly, has been inaugurated. This new service will consist of the latest designs in standard and tourist sleepers, dining car coaches and colonist cars. Besides the important fact that this now affords the G.T. Railway an unbroken service from the Atlantic to Prince Rupert on the Pacific Coast with steamship connection to Vancouver and Victoria, B.C., Seattle and California points, U.S.A., through all the well-known commercial and tourist centres, including the finest scenery in the Canadian Rockies, it is opening up to the settler and tourist new fields rich in agricultural, mineral and scenic wealth. It is anticipated that this latest development will strongly appeal to visitors to Canada from Great Britain.

Catalogues and Lists. — CRYPTO ELECTRICAL CO., Acton Lane, Willesden, N.W.—Twenty-two-page illustrated catalogue containing some general notes regarding their alternating-current motors, and tabulated horse-powers, speeds, prices, weights, &c., of single, two and three-phase motors for various periods, also prices of no-volt and overload releases, speed reduction gear, and polishing motors. The smallest motor included is a ⅛ H.P. and the largest 25 H.P. A table gives information relating to the power required to drive various classes of machinery.

MESSRS. STURGE & BAKER, Premier Works, Sheepcote Street, Birmingham.—Illustrated and priced leaflets relating to cord absorbers ; "Vesper" pillars and sockets for electric fires ; "trolley lights" (domestic and factory patterns of fittings with swinging arms and extensible devices) ; and "Premier" switches.

EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., Ponder's End.—A new illustrated postcard has been prepared, copies of which are being supplied, over-printed, to their customers. The design shows a Royal Ediswan drawn-wire lamp, and suggests its use as an aid to economy in keeping the "Bills" down, the "Bills" in this particular case being the Supreme War Lord and his devoted son, the Clown Prince.

GENERAL ELECTRIC CO., LTD.; 67, Queen Victoria Street, London, E.C.—Bulletin No. 10 (36 pages) containing a detailed description, excellently illustrated, of the condenser system of protection against surges.

Book Notices.—*The A.B.C. of Electricity.* By W. H. Meadowcroft. New York : Harper & Brothers. Price 2s.—This book, which is written in the "popular" style (many of the paragraphs beginning with "Now," or "Well") has been enlarged and reset. It makes no pretentious claims, and is couched in simple language ; as it is now in its third edition, it evidently fills a want.

"*Proceedings* of the Rugby Engineering Society, 1913-14." Vol. XI. Rugby : The Society. Price 10s. 6d.

"*Bulletin* de la Société Internationale des Electriciens." Vol. V, No. 43. June, 1915. Paris : Gauthier-Villars. Price 3 fr.

"*The Beama Journal.*" July. No. 3. London : British Electrical and Allied Manufacturers' Association. Price 1s.

National Physical Laboratory Collected Researches. Vol. XII. 1915. London : Harrison & Sons. Price 12s.

"The Manual of Electrical Undertakings and Directory of Officials, 1915-16." By E. Garcke. Vol. XIX. Electrical Press, Ltd. Price 21s. net.

Trade Announcement.—MESSRS. HANDLEY & ROBINSON, LTD., of Dublin, have opened another branch office at 42, Great Charles Street, Birmingham, for the purpose of extending their electrical contracting business, and they will be pleased to receive price lists and catalogues from manufacturers.

Bankruptcy Proceedings.—JOHN BOULT & JOHN HUGH BOLT (trading together in co-partnership under the style or firm of John Boult), electricians, 3, Grosvenor Street, Chester.—The first meeting of creditors was held at Chester on July 14th, when the statement of affairs showed liabilities amounting to £603, and assets valued at £578, the estate disclosing a deficiency of £25. The failure of the debtors was due to insufficient capital, costs of actions taken against the firm, and the effects of the war upon the cash sales. The separate estate of John Boult disclosed liabilities of £1,487 and assets of £801. It was decided to appoint Mr. Parkin S. Booth, accountant, 2, Bixteth Street, Liverpool, trustee.

VERNON GEO. COBB, electrical engineer (trading as Longdon and Cobb), Nottingham.—Application for debtor's discharge to be heard August 19th, at Nottingham.

LIGHTING and POWER NOTES.

Argentina.—The Compania Transatlantica de Electricidad recently applied to the Municipality of Buenos Ayres for authorisation to extend its services to suburban districts where population is relatively scarce, by means of overhead cables, as the installation of subterranean cables would be too expensive to be justified by the revenue therefrom. The Itendencia has now issued a decree conceding the authorisation asked for with a stipulation that when the consumption exceeds a specified quantity, the overhead cables shall be replaced by underground ones.

The correspondent of *La Nacion* at Lincoln (Buenos Ayres) says : "A contract is about to be signed between the municipal authorities of this district and an important German firm in the Federal Capital whereby the latter take over the lease of the electric light and power, and water supply services belonging to the former. The completion of this arrangement would imply the rescission of the contracts now existing between the municipality and the company at present exploiting these services."—*Review of the River Plate.*

Australia.—A company has been formed to supply Toora and Foster (Victoria) with electric current generated by water power.—*Tenders.*

Aylesbury.—The U.D.C. has decided to adopt the following arrangement for supply to showroom premises :—That each consumer be charged 100 units per annum at 6d. per unit, to be paid quarterly, winter 30 units per quarter, and summer 20, after which consumption is to be charged for on the power sliding scale. The Market Theatre Co. is to be supplied at a flat rate of 3d. per unit.

Barnes.—ELECTRIC COOKING.—Following his report in February last, the electrical engineer has submitted an additional report on the question of installing electric cookers in certain property belonging to the Council. He recommends installing, to commence with, 12 cookers, costing £4 each, and estimates the average consumption of energy per cooker at 624 units per annum, taking 18 units a week in the summer and 6 units a week in the winter. An extra charge of ¼d. per unit would, on this basis, return 13s. per annum, which would cover interest, redemption and maintenance. These figures have been obtained from observation with two experimental cookers. It is, therefore, proposed to charge 1d. per unit, being ¼d. for the Public Health Committee to cover its outlay, and ¾d. for the supply of energy including metering. The Gas Co.'s charges are a connecting fee of 10s., plus 1s. 6d. a quarter meter rent and 6d. a quarter stove rent, with gas at 2s. 4d. per 1,000 cb. ft. The Public Health Committee recommended that the proposed scheme be carried out.

Barnsley.—L.G.B. Inquiry.—The Corporation has decided to proceed, if permission be granted, with part of the electricity extension scheme, and a L.G.B. inquiry was held last week into an application for power to borrow £21,850.

In response to communications from the Home Office and military authorities, the Corporation has resolved to suspend public lighting of the streets except on Saturday evenings, and the area to be lighted, &c., is left to the discretion of the chairman of the Electricity and Lighting Committee.

Bath.—Price Increase.—The E.L. Committee of the T.C. has recommended that the price of current be advanced to 5½d. per unit as from September 29th, an increase of 10 per cent.

Bury St. Edmunds.—Year's Working.—According to the *East Anglian Times*, for the past year the electricity department's working cost, including £800 for new plant, amounted to £4,138; interest amounted to £1,039, and sinking fund to £975, making a total of £6,152. Some 404,000 units were sold representing £5,679. Due to exceptional causes the works costs were heavier than previously; 75 motors of 420 h.p. are now connected to the supply, and it is reported that the experimental free wiring scheme, under which current is supplied at 6d. per unit through prepayment meters, has been very well received and some 40 applications are now in hand.

Continental.—Russia.—The "Petrograd Waterfall Power Distributing Co." has petitioned the Veaborg Government for permission to construct the necessary works at the Rouchial Waterfall, which the company desires to exploit. It is intended to construct the barrage and works on land belonging to the company at the Korvankosky Waterfall, about 3 km. further down than the Rouchial Falls. According to the Finland Hydrographical Bureau 1,200 cb. metres of water per second pass Vdobea, and it is contemplated to install nine groups of machines, each of 10,000 h.p. The total power to be generated by the station is estimated at 80,000 h.p.

Italy.—An important hydroelectric scheme, which has been under consideration since the year 1900, has just received Government authorisation. It consists in linking the international station at the Simplon Tunnel with Lake Maggiore by means of a navigable canal utilising a part of the navigable course of the River Toce. It will provide hydraulic power equal to from 7 to 15,000 kw. for the generation of electricity, and its cost is estimated at 7,771,770 lire. The canal consists of four sections, fed from the Toce by as many intakes, and involving the creation of a number of falls of varying power, each capable of being used for the generation of electricity.—*Revista Técnica d' Elettricità.*

Darwen.—Year's Working.—At the beginning of the year there was a balance of net profit of £1,191 on the electricity undertaking, of which £500 was transferred to the rates; the result of last year's working showed a net profit of £279, and the disposable balance to carry forward was therefore £970. No contribution is to be made in aid of the rates during the current year, owing to the necessity of raising the working balance of the department. Since the commencement of the works in 1899, £3,270 has been contributed to the rates, and £1,991 received from the rates. The units generated during the past year totalled 2,484,297; private consumers took 1,566,053, and tramways and public lighting accounted for 576,960. The cost of generating averaged ·59d. per unit, against ·60d. in the previous year.

Glass Houghton.—E.L. Supply.—The Pontefract R.D.C. has decided to raise no objection to the proposal of the Yorkshire Electric Power Co. to lay cables in the principal roads and in Carr Lane.

Holmfirth.—School Lighting.—The Education Committee has decided to request the West Riding County Council to provide electric lighting at the Holmfirth School; during the discussion by the Committee, a member stated that no end of trouble and accidents had attended the present system of gas lighting, and it was thought that public buildings should be lighted by electricity as an example to the public.

Hurst.—Proposed E.L.—The D.C. has been asked by the Ashton Corporation if it would be prepared to consider the question of taking a supply of electricity in bulk from the Corporation for the use of persons in the Hurst district.

Hythe (Kent).—Electric Pumping.—The T.C. has accepted the offer of the Folkestone Electricity Supply Co. to pump water at the Saltwood reservoir at 3d. per 1,000 gallons, provided a temporary plant is installed to see if the well will yield 40,000 gallons per day, the Council to pay the expense if that quantity is not produced.

India.—The Sigua (Jherria) Electric Supply Co. is the name of a new undertaking which has lately been formed in Calcutta, with a capital of 1,200,000 rupees.

Kilkeel (Co. Down).—Street Lighting.—An agreement between the District Council and the Irish Towns Electric Light and Power Co., for the lighting of streets and roads, provides for the erection and maintenance of 60 lamps at an annual rent of £65 15s., which involves a rate of 4d. in the £ on the area of charge.

King's Lynn.—Price Increase.—The T.C. has decided, owing to the increased cost of fuel, &c., to raise the price of current for lighting from 4d. to 4½d. per unit, and the charges for power by 5 per cent. all round.

London.—St. Pancras.—As a result of further consideration of the question of deferring boiler extensions at the King's Road station, the Electricity Committee recommends the B.C. to agree to the installation of two of the four proposed boilers and the carrying out of certain necessary constructural work, at a cost of £24,265, thus deferring some £25,000 expenditure, being the additional amount required to complete the scheme.

The accounts of the electricity undertaking for the year ended March last show that 10,649,000 units were sold, as against 11,100,000 in the previous year. The revenue amounted to £87,052 as compared with £93,483; and the net profit to £6,620, as against £12,413 in the previous year.

Shoreditch.—The B.C. has been recommended, at the request of the L.C.C., to limit the expenditure under the order sanctioning the borrowing of £500 for the purchase of electricity meters, during the duration of the war, to the provision of meters for consumers doing work for the Government.

New Zealand.—The Te Kuiti electric light duplication scheme is to be commenced shortly, the cost is estimated at £4,000. —*Tenders.*

Portsmouth.—Year's Working.—The accounts of the electricity undertaking for the year ended March last show that 3,779,600 units were sold, the total revenue, £51,608, being less than that of the previous year. The total working costs, including some £600 for grants to employés with the Forces, were only £100 in excess of those of 1913-14, but due to the falling off in revenue, the net balance on the year's working was only £386, as compared with £3,342 in the previous year. The department possesses an insurance fund of £7,052, and a reserve fund balance of £30,724.

Stamford.—Price Increase.—The Urban Electricity Supply Co. has informed the B. of G. that, owing to the increase in the cost of production, the price of current for all purposes had been advanced 10 per cent. as from July 1st.

Stratford-on-Avon.—The T.C. has decided not to allow the Electricity Co. to vary the terms of the agreements for the supply of current entered into with the company. The application was for an increased price per unit to be charged.

Swansea.—Proposed Showroom.—The E.L. Committee proposes to establish a showroom in Wind Street in connection with the electricity undertaking.

Swinton and Pendlebury.—The U.D.C. has given permission, under the agreement which exists between the Council and the Lancs. E.P. Co., for the company to supply electricity for power purposes to Bridgewater Mill, Pendlebury. Extensions to the electrical equipment of Messrs. Matthews & Yates's works are in contemplation.

Tasmania.—The Hydro-electric Power and Metallurgical Co., Ltd., is entering into a contract with the Tasmanian Government for a bulk supply of power for use in its proposed works. The initial quantity of power required will be 3,500 h.p.—*Tenders.*

Thornley (Durham).—The Weardale Coal and Iron Co. has offered a reduction of 25 per cent. of the total amount of the account for electric lighting, and the Parish Council has agreed to accept this offer.

Walkden.—Two electric pumps installed in the "Seven Feet" mine at the Ellesmere Colliery, Walkden, to work alternately, are capable of lifting to a considerable height 1,100 and 900 gallons per minute, and in consequence of their use it has been decided to dispense with the old Roughfield pumping pit, a quarter of a mile away.

West Yorks.—Prov. Order.—In regard to the decision of the Electrical Distribution of Yorks., Ltd., to apply for powers for lighting in different areas of the West Riding, the Featherstone U.D.C. and the Penistone U.D.C. have decided to interview the company's engineer, and the Rawdon D.C. has decided to deal with the matter in Committee. The Midgley D.C. has declined to agree to the company's proposal.

Wetherby.—Prov. Order.—The R.D.C. has decided to make application for a provisional order to enable the Council to provide electric lighting at Boston Spa.

Winchester.—Year's Working.—For the year ended March 31st last, 955,622 units were sold, as compared with 739,529 in the previous year. The maximum load was 639 kw., and the connected load 2,294 kw., of which 1,506 kw. was lighting. The coal used per unit sold amounted to 5·12 lb., costing ·415d., and the total working costs were 1½d. per unit. The gross revenue for the year was £14,649; the gross profit £6,601, and after meeting interest and sinking fund charges, and sundry charges (£269) the net surplus was £1,317, as against £404 in the previous year. During the year power and heating units increased by over 50 per cent., and heating cooking connections at March totalled 410 kw.

TRAMWAY and RAILWAY NOTES.

Ashton-under-Lyne.—The rather complicated ticket system on the cars between Ashton and Hurst has been abolished, and an agreement has been arrived at between the two authorities whereby all receipts on the Hurst section up to £3,600 per annum will be divided as follows:—Ashton 62 per cent., Hurst 38 per cent., with an equal division of all receipts over £3,600.

Australia.—It has been officially announced that the electrification of the Melbourne suburban railways is still being blocked by delays in delivery of equipment, and a further delay of six months is now announced; the probable date for commencing to run the first electrified section is given as December, 1916. This is the Sandringham to Essenden line, after which the Melbourne to Williamstown line, including the racecourse, will be dealt with.

The latest report on transport and communication issued by the Commonwealth statistician shows that the total length of electric tramways line in Australia open for traffic at June 30th, 1914, was 357¼ route-miles, of which 145¾ miles are in New South Wales and 62 miles in Victoria. The capital cost amounted to £10,544 235, excluding the North Melbourne tramway and 34½ miles in Queensland.—*Tenders.*

Blackpool.—Year's Working.—The annual report of Mr. Charles Furness, the general manager, on the working of the Corporation tramways shows that the department has been hard hit by the war. The gross profit was £31,255, a drop of £10,000 compared with the previous year, and the net profit fell off by a similar amount. However, £12,000 was given to the rates, and the balance of £1,736 placed to reserve. The passengers carried, 13,624,000, were some 665,000 less, while the car-miles run increased by 9,700. The report draws attention to the rapid increase in the number of contract ticket-holders, who now number 1,466, bringing in £4,146 in revenue. Mr. Furness points out that these passengers are being carried for less than the average operating expense per passenger ('79d.), and, in fact, that they are being subsidised to the extent of ½d. per journey. A recent census showed that contract journeys were one-fifth of the total. It is noteworthy that the promenade route contributes 45 per cent. of the revenue, which last year reached 16'65d. per car-mile. The department has a reserve fund of £4,401, and a permanent way renewal fund of £14,381; its total allocations since 1896 have reached £16,810 to reserve, £56,161 to permanent way and other renewals, and, in addition, £77,497 to the rates.

Continental.—Russia.—Extensive public works are in course of execution in Perm, including the construction of tramways, the length of which will be 16 versts—10½ miles; the electrical station is being extended correspondingly. All large public concerns will belong to the town, and no concessions are being granted; deficits are quite expected in the operations of the first one or two years. The money, 3½ million roubles, was raised in England, but owing to increased cost of materials and labour since the estimates were made, a further loan of 1 to 1½ million roubles will have to be issued.

Darwen.—Year's Working.—The result of the year's working of the Corporation tramways was a loss of £729—£172 on the Darwen section, and £557 on the Hoddlesden section. The total car-mileage was 267,670, an increase of 758; and the decrease in fares amounted to £987. On the Darwen section the receipts averaged 14'2d. per mile, the total working expenses were 10'8d., the interest and sinking fund charges 3'6d., and the resulting loss was '17d. per mile run. On the Hoddlesden section the receipts were 12'5d. per mile, working expenses 11'3d., interest and sinking fund charges 4'9d., and the loss 3'67d. per mile.

London.—L.C.C.—The award of the Conciliation Board, which has been considering the demands of the tramway employés, is adverse to the men on practically all points, except the war bonus of 3s. a week, which it is proposed to extend to men earning 40s. a week and under. About a third of the men object to the award, and it is proposed to take a ballot with a view to the matter going to arbitration. The Finance Committee considers that the effect of the award will be to increase the deficiency on the working of the Council's tramways to such an extent that the general reserve fund will not be able to meet it.

Rawtenstall.—It has been decided that £400 from the renewal and reserve funds of the tramways undertaking, and £1,500 from the renewal and reserve funds of the electricity undertaking be invested in the war loan.

Swanscombe.—The P.C. has decided not to consent to the application of the Dartford and District Tramways Co. for an extension of time for constructing the tramways in the parish.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Adelaide.—August 25th. Dry cells, earth clips, recording counters, and various other instruments and apparatus, for the P.M.G. See "Official Notices" July 9th.

September 1st. Condensers, testing sets, rheostats, Morse sounders, and Wheatstone transmitters, for the P.M.G.* See "Official Notices" to-day.

Perth.—August 11th. Measuring instruments, for the P.M G. See "Official Notices" July 16th.

August 25th. P.M.G. One ton of crushed salammoniac, and 1½ tons of steel galvanised wire. See "Official Notices" to-day.

Sydney.—September 13th. Council. A.C. and D.C. electric motors. Specification (10s. 6d.) from E.L. Department, Town Hall.*

September 6th. Metropolitan Board of Water Supply and Sewerage. Centrifugal pumps and electric motors at Richmond pumping station.* Acting Secretary, 341, Pitt Street, Sydney.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

Aylesbury.—July 28th. Electric motor and pump capable of lifting 5,000 gallons of sewage per hour, with lift 19 ft. 3 in., &c., for the U.D.C. Mr. W. H. Taylor, Engineer and Surveyor, Town Hall.

Bradford.—Electric lighting of five through houses and workrooms adjoining, in Arncliffe Terrace and Woodhead Road, now in course of erection. Specifications, &c., may be seen on the works on application to Mr. T. P. Cowling. Tenders to be delivered to 93, Horton Road, Bradford.

Bristol.—August 23rd. Corporation. One 6,000-KW. three-phase steam turbo-alternator with condensing plant. See "Official Notices" to-day.

Dublin.—July 26th. Corporation. High and low-pressure cables and accessories, transformers, transformer pillars and electricity meters. See "Official Notices" July 16th.

Guildford.—Motor-driven fan, for the Guildford Electricity Supply Co. See "Official Notices" to-day.

Leith.—July 26th. Corporation. Twelve or six months' supply of washed pearls (9,000 or 6,000 tons) for the Electricity Department. Specifications from the Burgh Electrical Engineer.

London.—L.C.C.—Tenders are to be invited for installation of electric light at the new West Norwood fire station.

Middleton.—August 10th. Corporation. Coal for the electricity works. Particulars from Mr. S. Pauls, Electrical Engineer.

Morecambe.—July 24th. Corporation Electricity Department. 2,000 tons of coal or slack. See "Official Notices" July 2nd.

Rotherham.—July 24th. Corporation. 10,000 tons smudge and pea nuts; single vulcanised bitumen-covered cable, H.T. cable, rubber-insulated cable, trolley wire; ampere-hour meters. See "Official Notices" July 16th.

Salford.—July 26th. Corporation Electricity Department. Steam piping and separator, and cast-iron water piping. Borough Electrical Engineer, Frederick Road, Pendleton.

Sheffield.—July 30th. Water service conduit screen chamber, penstocks, valves, piping, &c., for the Electric Supply Committee. Mr. S. E. Fedden, General Manager and Engineer.

South Africa.—Beaufort West (Cape).—September 14th. Municipality. Suction gas engines, dynamo, booster, switchboard, battery, &c.; also poles, copper wire, insulators, street lamps, service connections, meters, &c. Specifications, on deposit of five guineas (returnable), from Mr. Chas. G. Trevett, A.M.I.E.E., 70, Fletcher's Chambers, Cape Town. Tenders to Town Clerk, Beaufort West.

CLOSED.

Australia.—The following contracts have been placed:—

Victorian (State) Coal Mine.—
  H.D. bare copper wire, 7/14, 7/16, 7/18; £41, £27 and £15 per mile.—B.I. and Helsby Cables.
Shire of Demboola (Vic.).—
  52-B.H.P. gas engine, suction gas plant, &c., £958.—R. Hornsby & Sons.
  Generator booster spares, fuses, and testing sets, £826.—Edison & Swan U.E.L. Co., Ltd.
  Battery (D.P.), £717.—T. K. Steancs.
  Switchboard and erection of power-house equipment, £247.—Edison and Swan U.E.L. Co., Ltd.
  Poles and outside equipment, £350.—M. W. Clements.
  Aluminium cables, £272.—W. G. Watson & Co. —*Tenders.*

Ashton-under-Lyne.—The Electricity Committee has accepted the tender of Mr. B. Evans for 1,000 tons of Kiveton Park slack coal. The Market Lighting, &c., Committee has accepted the Lancashire Electrical Engineering Co.'s tender for substituting half-watt lamps for the remaining arc lamps in the market.

Barnsley.—The Guardians have accepted the tender of Messrs. Henry R. Levenson & Co., of Leeds, for the wiring for electric lighting of the able-bodied men's block and the workhouse workshop for £12, the infants' bungalow at £7 10s., and the nurses' home at £22.

Chesterfield.—The T.C. has provisionally accepted the tender of the Brush Electrical Engineering Co., Ltd., for a transformer, at £266; and that of the British Westinghouse Co., Ltd., for switchgear extensions, at £500.

Doncaster.—The Corporation has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for a new water-tube boiler for the electricity works.

Heywood.—The Town Council has sealed the following contracts:—

D.C. switchboard at the electricity works.—Bertram Thomas.
600-KW. booster rotary, &c.—B.W. Electric & Manufacturing Co., Ltd.
Reversible battery booster.—Phœnix Dynamo Mfg. Co., Ltd.
Overhead single E.H.T. line.—B.I. & Helsby Cables, Ltd.
Temporary building at the electricity works.—Blakeley & Wild.

Government Contracts.—List of new contracts for June, 1915:—

War Office.

Cables and wire.—B.I. & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Connolly Bros., Ltd.; Craigpark Electric Cable Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph & I.R. Works, Ltd.; Johnson and Phillips, Ltd.; Johnson, Matthey & Co., Ltd.; Liverpool Electric Cable Co., Ltd.; Macintosh Cable Co., Ltd.; Midland Electric Wire Co., Ltd.; St. Helens Cable & Rubber Co., Ltd.; Siemens Bros. & Co., Ltd.; Ward & Goldstone, Ltd.; Western Electric Co., Ltd.
Conduits and fittings.—General Electric Co., Ltd.
Motor-converters.—Bruce Peebles & Co., Ltd.
Electric lamps.—Edison & Swan U.E.L. Co., Ltd.; Eli Griffiths & Sons; A. Lyons & Wrench, Ltd.
Electric motors.—Elec. Construction Co., Ltd.
Works services.—Batteries at Scott's House and Whitley Bay: Siemens Bros. & Co., Ltd. Electric generating set, Didcot: Drake & Gorham, Ltd. Electric lighting, Ford House, Devonport: Corse & Co.

India Office Store Department.

Wireless apparatus.—Marconi Wireless Telegraph Co.
Dynamos.—Lancashire Dynamo Co.
Morse keys.—Siemens Bros. & Co.
Lighting spares.—J. Stone & Co.
Standards.—Siemens Bros. & Co.
Telephone sets.—General Electric Co.

Crown Agents for the Colonies.

Telegraph apparatus.—Marconi Wireless Telegraph Co., Ltd.

Post Office.

Telegraphic apparatus.—I.R., G.P. & Telegraph Works Co., Ltd.
Telephonic apparatus.—Western Electric Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telephone cable.—W. T. Henley's Telegraph Works Co., Ltd.; I.R., G.P. and Telegraph Works Co., Ltd.; New Gutta-Percha Co., Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.; B.I. & Helsby Cables, Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Copper wire.—T. Bolton & Sons; B.I. & Helsby Cables, Ltd.; Elliott's Metal Co.; Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.).
Copper wire, covered.—London Electric Wire Co. & Smiths, Ltd.
Laying ducts.—City & South London Railway diversion, Southwark section: J. A. Ewart, Ltd.
Laying ducts and pipes.—City & South London Railway diversion, City section: J. A. Ewart, Ltd.
Lifts.—Superintending Engineer's headquarters, Denman Street: Waygood-Otis, Ltd.
Modification of existing "A" and "B" positions at Dublin Telephone Exchange.—Western Electric Co., Ltd.

H.M. Office of Works.

Supply of switchboard fire extinguishers to March 31st, 1918.—British Fire Appliances Co., Ltd.

Ledbury.—The B. of G. has accepted the tender of Messrs. F. C. Swift & Co. for the installation of electric bells at the vagrant wards.

London.—L.C.C.—The Highways Committee reports that arrangements have been made for only one of the two 8 000-KW. turbo-generators required for the Greenwich generating station to be constructed at the present moment. The Council is to retain the option, up to six months after the termination of the war, of ordering the second machine at the price included in the company's tender adjusted to correspond with any increase or decrease in the cost of materials and labour prevailing at the time of ordering the machine, compared with the cost of materials and labour prevailing at the date of the tender.

In view of the exceptional circumstances prevailing, the Committee has authorised the purchase, for use at the Greenwich generating station, of coal as and when it can be obtained. Under this authority about 16,223 tons of coal have been purchased under contract, at a cost of about £14,980, and about 15,295 tons out of contract, at a cost of approximately £21,120, during the quarter ended June 30th, 1915.

Bethnal Green.—The Electricity Committee has accepted the following tenders:—

Meters.—British Westinghouse Co.
Demand indicators.—Reason Manufacturing Co.
Time switches.—Venner & Co.

None of the firms invited to tender for house-service fuses replied, and the matter was deferred, as it may be arranged through the Stepney B.C.

Merthyr Tydfil.—The T.C. has accepted the tender of Messrs. Lucy & Co., Ltd., for 90 brackets for electric lamps at Dowlais, at 17s. 6d. each.

Oldham.—The Tramways Committee recommends the purchase of a Ford motor-van for the parcels delivery department.

Plymouth.—The T.C. has accepted the tender of Messrs. Cory Bros. & Co., Ltd., for 13,500 tons of coal for the electricity works, at £1 9s. 6d. per ton.

Sunderland.—The T.C. has accepted the following tenders:—

B.I. & Helsby Cables, Ltd.—House-service boxes, box compound.
Dussek Bitumen Co.—Box compound.
Steel & Co.—Cable ducts.
British Westinghouse Co., Ltd.—Instruments and switchgear for booster panel.
British Thomson-Houston Co., Ltd.—Reactance coils for traction motor-generator.
B.I. & Helsby Cables, Ltd., and Callender's Cable and Construction Co., Ltd.—Cable.
T. Bolton & Sons, Ltd.—Copper strip.

Tasmania.—The following contracts have been accepted:

Wynyard electric lighting.—
Suction gas plant, £1,069.—R. Hornsby & Sons.
Electrical plant and power house, £1,940.—Sutherland & Ashman.
Copper cables and line equipment, £453.—B.I. & Helsby Cables.
Insulators and fuses, £263.—Grant & Vincent.
Line erection work, £355.—Sutherland & Ashman.

NOTES.

The Electric Light.—In the course of a paper read at Chicago, Mr. S. E. Doane stated that the incandescent lamp as a current-consuming device must be accorded a high place, for probably there were 150,000,000 in service in the United States, which in the course of a year consumed more than 5,000,000,000 KW.-hours. The 25, 40 and 60-watt tungsten lamps were now operating at 1·05, 1·03 and 1·00 w.p.c. respectively, compared with 1·23 w.p.c. five years ago for the 40 and 60-watt, and 1·31 w.p.c. for the 25-watt, and were giving the same useful life as before. This improvement in efficiency had been made possible principally through the adoption of drawn-wire filaments, modifications of the structure supporting the filament, and the introduction of various chemicals within the bulb, which had allowed the operating temperature to be increased without increasing the rate of candle-power depreciation. Their mechanical strength had also been increased and their prices greatly reduced. The 40-watt lamp had come down from 90 c. in 1909 to 30 c. in 1914. The increase in efficiency of about 20 per cent. had done as much to decrease the cost of light to the consumer as the reduction in lamp price from 90 c. to 30 c.

Field Telephones.—At the Royal Society of Arts, John Street, Adelphi, W.C., on Wednesday next (July 28th) at 4.30 o'clock, a special war lecture on "Field Telephones," with experimental illustrations, will be delivered by Mr. C. R. Darling, A.R.C.Sc.I., F.I.C.

Appointments Vacant.—Charge engineer and switchboard attendant (40s. and 25s.), for Gloucester electricity department; shift engineer for Stretford (40s.); junior charge engineer for York (£91); see our advertisement pages to-day.

Volunteer Notes.—Engineering Institutions' Volunteer Training Corps.

Drill Centre.—By kind permission of Lieut.-Colonel A. E. Le Rossignol, head-quarters of London Electrical Engineers, 46, Regency Street, London, S.W.

Company Orders.—By Lieut.-Colonel C. B. Clay, V.D., Commandant, for week ending July 31st, 1915:—Monday, Wednesday, and Friday, Drills, 6 30 and 7.30.

Applications for Enrolment.—All applications for enrolment should be sent to the Commandant, Marconi House, Strand, from whom all particulars can be obtained.

E. G. Fleming,
Company Commander and Acting Adjutant.

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, July 22nd, 1915:—

Week-end Parades.—Saturday.—The Battalion will parade at Baker Street Station at 2.30 p.m., and proceed by train to Wembley Park. Detailed instructions will be issued to the Officer Commanding on that day.

Sunday.—Inspection of the Central London Regiment (Volunteers) by Brigadier-General Bridgman, in Regent's Park. The Battalion will fall in on the Green, N.E. of York Gate, Regent's Park, at 2.30 p.m. sharp. Recruits and men told off to keep Ground, &c., will parade under Company Sergeant-Major Brettargh at 2.25 p.m., at Cumberland Gate, Regent's Park. *Dress*—(except in the case of Recruits who have no uniform)—Drill Order with rifles and sidearms, but without haversacks and pouches.

There will be no Parades at Wembley Camp on Sunday.

Musketry.—Bisley.—The Musketry Staff will receive names of men who have not previously shot their course at Bisley, and who wish to shoot on Saturday next, the 24th inst. These men should report themselves to Sergeant Cotter at the Barrier of No. 9 Platform, Waterloo Station, not later than 12 55 p.m.

Acton Range.—"B" Company will shoot at Acton on Saturday next, the 24th inst.

First Team to parade at 10 a.m. at Acton.

Second Team to parade at 2.30 p.m. at Acton.

Men to be in uniform and to produce their efficiency badges on the Range, otherwise they will not be permitted to shoot.

Brassards.—Members are warned that those who have not yet obtained their Brassards must do so before Sunday's Parade. They can obtain them either by personal application to Headquarters, or by sending a stamped-addressed envelope to Headquarters.

A. G. Joiner, *Captain and Adjutant.*

Fibrox.—At the annual meeting of the American Electrochemical Society a new heat-insulating material called "fibrox" was described by Dr. E. Weintraub, of the General Electric Co., of Lynn, Mass. This materal has chemically the constitution of silicon oxycarbide, and its most remarkable feature is its fibrous structure. The diameter of the fibres is of the order of 0·6 micron to 0·3 micron. That is much smaller than the diameter of thin hair. Fibrox is a soft, resilient fibrous material, and can be cut into plates, sheets and rings which are self-supporting. The apparent density of the material, while varying with the circumstances, is usually between 0·0025 and 0·0030. In other words, it weighs only from about 2·5 grammes to 3 grammes per litre. As it consists of from 99·5 to 99·9 per cent. of air (in the pores) and only from 0·5 to 0·1 per cent. of solid material, it is the very best heat insulator known, and in view of this it is very peculiar that it is a relatively good electrical conductor with a conductivity comparable to that of electrolytic solutions.

Indian Notes.—Our special correspondent in India writes:—

Jammu, Kashmir.—This enterprising city—the second in Kashmir—is very actively engaged in improving its electrical power plant. It boasts of a fair sized hydroelectric installation, which, however, is a dwarf in comparison with the hydro-installation at Baramulla, which supplies the capital city, Srinagar, with light and power, and which, in addition, supplies power for a very elaborate and powerful dredging plant for the river. The Jammu plant supplies current for the city lighting and for the Maharagas palaces, and a further scheme is under contemplation—in fact, the specifications have been sent out—for an increase of the electric pumping plant. The electrical system in Jammu is controlled by a very capable and energetic engineer, who knows what he wants and sees that he gets it.

Jubbulpore.—The electrical inspector to Government, Mr. Mersh, is in the market for an electric installation for the New Arts College, Jubbulpore. He specifies Tudor accumulators, and either Robey, Hornsby, or Blackstone crude oil engines, and leaves the other items open to any reliable make which will comply with his specification. This habit of specifying a particular make of machine, whether engine, dynamo, or battery, is growing among Government engineers in India, and has its obvious disadvantages. It should be sufficient to issue a binding specification and ask only contractors of repute to quote, and then insist that whoever eventually gets the order should scrupulously comply with the conditions, and then there would be no cause of complaint subsequently. As things are, there is a good deal of complaining going on over irregularities, such as are referred to above.

Madras.—The Government of Madras has obtained the loan of the services of Mr. Meares, the electrical adviser to Imperial Government, to advise on several hydroelectric schemes which are under consideration. One is for Ootacamund, the summer capital of Madras. This scheme was prepared by Messrs. Walker & Co., of Colombo, for the Ootacamund municipality, and proposes a method of obtaining power from the Kemdah River, nine miles from Ooty. A much more comprehensive scheme is that proposed for supplying electrical energy to Ootacamund, Coonoor, and Wellington from the Pykira Falls. Rough estimates have also been worked out for what is known as the Siruvani project in Cormbatore District, and indications show that the project is fairly promising, and that electrical energy of considerable magnitude could be developed with a fairly reasonable chance of showing profit. If Mr. Meares's reports are favourable there is every hope that some at least of the projects will materialise in due course.

Correction.—With reference to the Hyderabad note appearing on page 778 of our May 28th issue, a correspondent in India sends one or two corrections. He says that one of the outlying palaces of H.H. the Nizam was fitted with a private plant about ten years ago, but this has no connection whatever with the public supply, which was commenced about 4½ years. ago. No public supply was given in Hyderabad previous to that date. The new turbine sets are of 1,000-KW. capacity each, not 1,500. The current is used for ordinary supply purposes, and for a very considerable quantity of industrial work, including some 150 KW. for the constructional machinery used at the building of the big dam mentioned, which, unfortunately, owing to its having practically no head, could by no possibility be used as a source of energy for the production of electricity.

Germany's Reserve of Copper.—In a recent issue of the *Génie Civil* M. F. Loppé has an interesting article on the reserves of copper available to the German Government in the form of cables used for the transmission and distribution of electricity. He draws attention in this connection to the rather precipitate decision of the municipality of Berlin to purchase the electricity supply undertakings within its area, at a cost of 288 million marks; the question of purchase had been under consideration for a long time, and its speedy settlement at this time suggests that the motive underlying the transaction is the desire to replace the copper mains with steel cables. The author recalls the fact that before the end of 1914 the German Electrotechnical Society had instructed its general secretary, Herr Dettmar, to draw up rules for the use of iron in place of copper in electric networks, and points out that, as no important new installations can be in contemplation, the object in view must have been the substitution of copper for iron in existing networks.

With a view to ascertain the extent of these reserves of copper, M. Loppé has made calculations which lead to the conclusion that in the case of lighting and tramway undertakings on the average about 20 kg. of copper will probably be in use per kilowatt of plant connected, and in the case of power systems 7 kg. per kilowatt. Published statistics show that in Germany there were probably at the beginning of the war 4½ million KW. installed —1·7 millions for lighting, requiring 34,000 tons of copper, 2·3 millions for power and heating, requiring 16,000 tons of copper, and 220,000 KW. for traction, requiring 4,400 tons of copper—the total weight of copper available being therefore 54,400 tons. The author considers that by basing his calculations on the consuming plant installed and not upon the power of the generating plant, which is generally 60 per cent. of the former, he has obtained a result which is certainly greater than the true value.

How far the copper could be replaced by iron is an extremely difficult question, especially in the case of A.C. distribution. Heavy aerial cables would have to be replaced by iron cables so weighty and exposing so large a surface to wind pressure that it would be almost impossible to strengthen the insulators and poles sufficiently to carry them. It is also doubtful whether iron cables of adequate section could be drawn into underground conduits designed for copper cables. Hence the author concludes that the figure of 54,400 tons is certainly far greater than the amount that could actually be availed of, and puts it forward only with a view to fixing ideas as to the order of magnitude of the copper reserves in Germany's cables.

Coal Supplies.—A Bill was introduced on July 13th by the President of the Board of Trade which embodies the recommendations of the Parliamentary Committee which has been considering the question of coal supplies. In present form the recommendations are:—

1. That during the continuance of the war the maximum price of coal at the pithead for consumption at home and by our Allies should be fixed on the basis of the prices charged for substantial quantities of each class of coal sold during the 12 months preceding the war, with the addition of 4s. 3d. a ton, or such other sum as may be prescribed, to cover the increased cost owing to the existence of the war.

2. That the rate for coasting steamers employed in the coal trade be fixed on the basis of the rate charged for freight during the 12 months preceding the war, with an addition of such sum as will reasonably cover the increased cost owing to the existence of the war, and that the Government be urged to assign a further number of the interned steamers for the use of the coal trade.

The *Morning Post* says that the colliery proprietors objected to the sum named as being insufficient, but the Bill will, it is believed, carry out generally these recommendations. The fixing of prices will be undertaken by local Committees, because prices vary in a marked fashion, not only as between districts but even as between pits.

The same paper mentions the report of the manager of a group of pits that during June weekly absence rose from 3 to 9 per cent., representing a total output lost of well over 3,000 tons of coal, and quotes his opinion that the war bonus for men earning over £2 a week has been simply an inducement to idleness.

He further mentions the case of a man who wanted a loan of 30s., although during the previous two weeks he had earned £6 15s. and been absent nearly two days.

The Electrolytic Insulation of Aluminium Wire.—In the course of a paper read before the American Electrochemical Society, Messrs. C. E. Skinner and L. W. Chubb described a process by means of which they are able to produce an insulating film of high dielectric resistance on the surface of aluminium wire. Electrolysis plays an essential part in the process, on the principle of the aluminium rectifier; the best electrolytes are solutions of borax, borate of aluminium, and, above all, sodium silicate. Economical results are attained by the use of a high current density and high voltage. According to the gauge of wire, the speed of treatment ranges from 12 to 45 m. of wire per minute, and the energy expended from 0·15 to 0·80 watt-hour per sq. in. of surface treated. The white pellicle obtained with silicate of soda at a pressure of about 425 volts is rather soft to the touch, but so firm that it cuts and wears the hand when one winds the wire on bobbins. Its dielectric resistance is much greater than that of the coating of oxide obtained by other processes; two wires so treated and tightly twisted together withstand a pressure of 200 to 500 volts. The thickness of the film varies between 0·00025 and 0·001 cm.; it is very flexible, and does not flake off or appreciably weaken when the wire is bent at an acute angle. The wire can also be stretched 30 per cent. without injuring the insulation. Two wires at a potential difference of 250 volts can be crossed and crushed together to the thickness of a single wire without metallic contact, so long as there is no rubbing motion between them; but the least movement of one of them cuts through the insulation and produces a short-circuit.

Sewer Gas for Generating Electricity.—The *Sydney Morning Herald* reports an interesting demonstration at the Parramatta sewage pumping station of the possibilities of sewer gas for commercial purposes. The patentee of the sewer gas system (Mr. H. Walshaw, sanitary engineer for Parramatta municipality) stated that with a 15-H.P. engine he was now able to do all the pumping required in connection with the sewerage system, and dispense with any night supervision whatever. He estimated that the work absorbed 250 cb. ft. of sewer gas per 24 hours, whilst he had 1,700 cb. ft. per 24 hours available. He was convinced that the value of sewer gas was such that, with the potential resources at the outfall of the Bondi sewer, sufficient power could be generated by the gas to light electrically the city of Sydney, and also run the metropolitan tramway system.

Educational.—City and Guilds of London Institute.—The report of the Council for 1914 states that the number of students attending the City and Guilds (Engineering) College in July last was 411, as compared with 429 in the previous session, the decrease being due to the transfer of the Chemical Department to the Royal College of Science; at the Technical College, Finsbury, there were 194 day students, as against 177 in the previous session, and 140 in the one before that. But the outbreak of war had a very marked effect on the entries for the current session. About 224 students enlisted or were called to the Colours, and the total for the two Colleges in March, 1915, was 402, compared with 605 in the previous year. The main decrease was in second and third year students, the entry of new students who are under military age being well maintained. Of the staff, 32 teachers and workmen are serving with the Forces. On the declaration of war, arrangements were made to ensure that the positions and prospects of students and employés who went on active service should not be prejudiced.

The Roll of Honour includes the names of 633 past and present members of the staff and students of the City and Guilds (Eng.) College (341 officers, 292 men), and 206 from the Technical College, Finsbury—total, 839. During the past three years the number of students attending the Electrical Engineering Course at the City and Guilds (Engineering) College has been practically constant at an average of 77; at Finsbury there were 63. The total income for 1914 was £29,467, and the expenditure £29,558.

The programme of the Technical College, Finsbury, for the session 1915-16 was recently issued; it contains a number of views of the new mechanical, engineering and hydraulic laboratories, as well as of the dynamo and generating rooms, the calibrating room, the magnetic and electrical laboratories, &c. Dr. S. P. Thompson, F.R.S., the principal, is professor of applied physics and electrical engineering, assisted by Mr. J. K. Catterson-Smith, Mr. C. R. Darling, Mr. R. P. Howgrave-Graham, and others.

Particulars of the Day Courses at the City and Guilds Technical College, Finsbury, appear in our advertisement pages to-day.

Imperial College of Science and Technology, South Kensington, S.W.—City and Guilds (Engineering) College.—Particulars of courses in mechanical, civil and electrical engineering, mechanics and mathematics are obtainable from the Registrar, Imperial College of Science and Technology, South Kensington, S.W. See also our advertisement pages to-day.

U.S. Trade Relations with Latin America.—As a result of the Pan-American Financial Conference, the Secretary of the Treasury has appointed a number of prominent business men and financiers of the United States to act on Committees which are to promote closer trade and other relations between the United States and Latin America. Ten members, including Secretary McAdoo, will constitute an International High Commission, authorised by the conference to deal with uniformity of legislation in Pan-American countries, including laws on trademarks, patents, and copyrights; bills of exchange, commercial paper, and bills of lading; uniform classification of merchandise, Customs regulations, port charges, &c. It has been suggested that the International High Commission meet in Buenos Ayres on November 1st, 1915.

Female Kinematograph Operators.—The Theatre and Music Halls Committee of the London County Council, having considered a suggestion with regard to the employment of women operators in kinematograph halls, with a view to releasing men for military service, recently drew the attention of the Home Secretary to the matter, and informed him that women had hitherto only been employed in London in two cases; the operator must possess some electrical knowledge, and in practice was generally responsible for the maintenance of the electrical equipment of the hall and the execution of minor repairs, but there did not appear to the Council to be any reason why women should not be able to acquire the requisite degree of knowledge and skill; and in the circumstances, the Council was of opinion that no objection should be raised to the employment of competent women as kinematograph operators.

Admiralty Board of Inventions.—The Admiralty has announced that the arrangements for the organisation of the Board have now been completed. It will comprise a Central Committee and a Panel of Consultants, composed of scientific experts, who will advise the main Committee on questions referred to them.

The Central Committee will consist of:—Lord Fisher of Kilverstone (President); Sir J. J. Thomson, Hon. Sir C. A. Parsons, and Mr. G. T. Beilby.

The Consulting Panel will comprise the following list, which will be added to from time to time as necessary:—Prof. H. B. Baker, Prof. W. G. Bragg, Prof. H. C. H. Carpenter, Sir William Crookes, Mr. W. Duddell, Prof. Percy Frankland, Prof. Bertram Hopkinson, Sir Oliver Lodge, Prof. W. J. Pope, Sir Ernest Rutherford, Mr. G. Gerald Stoney, and Prof. the Hon. R. J. Strutt.

Communications should be addressed to the Secretary, Board of Invention and Research.

The Belgian military authorities have established at 21, City Road, E.C., a branch office of the Belgian Service of Military Inventions, which has its headquarters in Paris. Like the French Army, which has a permanent commission for the study of technical inventions connected with each arm, the Belgian Army has organised a technical Commission of Inventions, whose delegates are accredited to the various departments of the French Commission. The Bureau now opened in London will inform the Belgian War Minister of all new military inventions likely to be of use in the war. The officers in charge of this office will be glad to receive details of military inventions, especially from British firms engaged in the manufacture of munitions and arms for the Allied Armies.

Mr. T. A. Edison has accepted the invitation of the Secretary for the U.S. Navy to head the Advisory Board of Civilian Inventors for the Bureau of Invention, a development which the Navy Department is about to create in order to secure the inventive genius of the country to meet new problems arising from the European war, especially in connection with submarines.

Professional Etiquette.—The application of Mr. J. S. E. de Vesian for an injunction against the Council of the Institution of Civil Engineers, to restrain it from interfering with his rights as a member, which was refused by Mr. Justice Neville, has been allowed by the Court of Appeal. The Master of the Rolls pointed out that the appellant only sought an injunction until the trial of the action; it would not hurt the defendants, and would prevent injury to the plaintiff pending the decision of the case.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Hackney B.C. is recommended to appoint Mr. P. M. Shears, canvasser of the electricity department, to be sales department foreman, at a salary of £190 during the period of the war.

The salary of Mr. W. A. H. Parker, assistant manager of the Heywood Corporation electricity works, has been advanced by £13 per annum, and the salary of Mr. W. A. Ireland, meter inspector, by £6 10s. per annum.

Mr. Harry Davies, public lighting superintendent to the Swansea electricity department, has accepted a commission in the Army.

Whitby U.D.C. has deferred until the end of the war the question of increasing the salary of the electrical engineer, Mr. Piggott.

Mr. A. J. Howard, borough electrical engineer at Taunton, has been presented on his marriage with a silver salver, by the members and officials of the Corporation.

General.—Mr. G. R. G. Conway, chief engineer of the British Columbia Electric Railway Co., Ltd., has resigned his post, which he has held for 4½ years, and has been appointed consulting engineer to the company. He will carry on general consulting practice in a wider field, and is opening an office in Toronto this month. Mr. Conway went to British Columbia in December, 1910, as consulting engineer in connection with the construction of Coquitlam Dam for the Vancouver Power Co., and in January, 1911, was appointed chief engineer to the British Columbia Electric Railway and its various subsidiary companies. During his period as chief engineer he has been responsible for the design and construction of all the company's large works, which have involved a capital expenditure of between 17 and 18 million dollars. Prior to going to Vancouver Mr. Conway represented Messrs. Mackenzie & Mann in Mexico as their chief engineer for the Monterey Railway, Light and Power Co. Mr. Conway was educated at the Hartley University College, Southampton. In 1898 he entered the service of the City of Aberdeen as its resident engineer, and he left there after eight years to carry out the works in Monterey, Mexico. Mr. Conway has taken an active part in the work of the Vancouver Branch of the Canadian Society of Civil Engineers, having been its chairman for the past two years and a half. Mr. Conway is a member of the Council of the Canadian Society of Civil Engineers, a member of the Institution of Civil Engineers, and he holds the Telford gold medal of that Institution; he also represents the Council as a member of their Advisory Committee for Canada.

The Perth (W.A.) City Council recently met to consider the appointment of a general manager of the electricity and gas departments. According to the *Commonwealth Engineer* there were 37 applicants. Some councillors wanted to know the necessity for a general manager, seeing that they already had two managers, one of whom was receiving £800 a year. The number of applicants was reduced to seven, and the majority of votes was given to Mr. B. L. Murray, local manager of the Victoria Insurance Co., who had at one time served with Messrs. Siemens Bros., but had devoted most of his business career to insurance. Until two months ago he was a member of the Perth Council. When Mr. Murray was informed of his election, he wrote asking to be relieved of the appointment, and another Council meeting was called at which, "after considerable wrangling," it was resolved to ask the six persons whose names were left in the final ballot, whether they were desirous that their applications should stand for reconsideration.

On July 15th, at Harpenden Parish Church, the marriage took place of Miss Marjorie Flora Down, daughter of Mr. Fred. J. Down, M.I.E.E., and Mr. Philip Blake, L.D.S., &c., of Portsmouth. A reception afterwards followed at "Glengariff," the residence of Mr. Down.

Mr. George G. L. Preece, who for some years has been in charge of the Manchester office of Messrs. Bruce Peebles & Co., Ltd., has temporarily left that company's employment owing to his having accepted a commission in the Lancashire Fusiliers. During his absence Mr. E. W. Browne, the company's representative in Birmingham, will act as manager in Manchester.

Mr. Ernest Emerson Stockens, of Aberdeen, district telephone manager for the North of Scotland district, has been appointed manager of the Blackburn district.

The marriage took place recently at Farnborough (Hants.) of Mr. Bernard W. Gothard, A.M.I.E E., and Miss Gertrude Frances Pierce, youngest daughter of the late Mr. Wm. Pierce and of Mrs. Pierce, of Canterbury.

Roll of Honour.—Much sympathy will be extended to Mr. Wilson Hartnell, of Leeds, in the great loss which he has sustained by the death of his only son Lieut. Cuthbert Hartnell. Lieut. Hartnell went to France with the 1st/8th Battalion West Yorks. Regiment (Leeds Rifles), and was killed in action on July 16th. He was in his 28th year. Educated at Bedford Grammar School he secured school honours as a sportsman, and later in Leeds acted as secretary of the local polo club. His training as an engineer was obtained at the Leeds University, and afterwards he became an Associate of the Institution of Civil Engineers and a director of the firm of which his father is the head. It was through the medium of the Leeds University Officers' Training Corps that Lieut. Hartnell secured his commission some five years ago. He was a member of the Leeds Court of Referees under the National Insurance Act.

Private Lamech Jordan, an electrician employed at the British Electric Traction Co.'s power station, Dudley, is officially reported to have fallen at Ypres.

Able Seaman J. E. Bolland, of the Nelson Battalion, Royal Naval Division, has been killed in action at the Dardanelles. He was formerly an electrician with Electrical Services, Ltd., of Bradford.

Private J. W. Brown, of the 7th Manchester Regiment, who was on the staff of Messrs. Mirrlees, Bickerton & Day, Ltd., of Hazel Grove, Stockport, has been killed in action in the Dardanelles.

Lieut. Lawrence Turnbull, who has been killed in action, was until October last with the Westinghouse Electric Co. at New York, and he returned to England to take a commission in the Bedfordshire Regiment.

Obituary.—Mr. H. A. Mavor.—We deeply regret to record the death of Mr. H. A. Mavor, M.I.C.E., M.I.E.E., which occurred on 16th inst. He was the founder, 30 years ago, of the well-known firm of Mavor & Coulson, electrical engineers, Glasgow. He did, in the early days, much pioneering work in connection with the electrical industry, and the generating stations put down and operated by his firm were taken over by the Glasgow Corporation to form the nucleus of the enormous electricity supply undertaking which that authority to-day controls. Subsequently Mr. Mavor directed his energies and his original and inventive resources to the design and manufacture of electrical machinery, and his firm has been in the front rank for the last 25 years. The latest important work which engaged his attention was the problem of electric propulsion of ships. His experimental work on a practical scale included the equipment of the *Electric Arc*, a vessel of 2,000 tons, with electric propelling machinery. Very full particulars of his work in this direction have been published in the Electrical Review, and during the last few years Mr. Mavor had read many papers on the subject before engineering societies and the British Association. His last two visits to America were made in the capacity of consultant to the company which equipped the United States Navy collier *Jupiter*, a vessel of 12,000 tons, with electric propelling machinery. As the result of the success of the *Jupiter*, a further notable step has recently been announced in the placing of a contract with the same company for the electric machinery for driving the new 30,000-ton battleship *California*, for the United States Navy. The funeral took place on Monday, at the Western Necropolis, Glasgow.

Mr. H. C. Harold.—We regret to learn just as we go to press of the death of Mr. H. C. Harold, which occurred on Monday last. Mr. Harold had been throughout the greater part of his life connected with the electrical industry on its commercial side. We knew him first of all at Clark & Muirhead's; subsequently he was associated with Johnson & Phillips at their City office; he later entered into partnership with Mr. Robert Jenkins (1886-1893), and connections with certain electric lamp companies followed. He was 63 years. The funeral takes place to-day, Friday, at West Norwood at 3 o'clock

Will.—The *Times* states that the late Sir John Cameron Lamb, former Second Secretary of the General Post Office, left £8,023 gross, with £7,815 net personalty.

NEW COMPANIES REGISTERED.

New Era Signs, Ltd. (140,951).—This company was registered on July 12th, with a capital of £5,000 in £1 shares, to acquire and develop an invention for improvements in or relating to flashlight advertising devices; to carry on the business of manufacturers of and dealers in apparatus for displaying electric and other advertisements, dynamos, lamps, wires, cables, insulating materials, accumulators, telephone and other apparatus, electrical and mechanical engineers, etc., and to adopt an agreement with the Magna Charta Publishing Co., Ltd. The subscribers (with one share each) are: D. Nimmo, Abchurch House, Sherborne Lane, E.C., solicitor; Phyllis M. Holden, 232, The Park, Tottenham, N., clerk. Private company. The number of directors is not to be less than two or more than seven; the first are not named. Registered office: 59, New Oxford Street, W.

Beacon Carbons, Ltd. (140,966).—This company was registered on July 14th, with a capital of £5,000 in £1 shares, to carry on the business of manufacturers of and dealers in carbons for electric arc lamps, makers of all kinds of electrical equipment, fittings and machinery, manufacturers of and dealers in appliances for electric lighting, and cables for the transmission of electric current, etc. The subscribers (with one share each) are: C. W. Webster, Villa Road, Bingley, electrical engineer; Mrs. A. M. Webster, Villa Road, Bingley. Private company. The first directors are C. W. Webster and Mrs. A. M. Webster. Solicitors, Neill & Dawson, 1, Piccadilly, Bradford. Registered office: Whitley Street, Bingley, Yorkshire.

John Russell and Co., Ltd. (140,981).—Registered July 15th, by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C. Capital, £200,500 in £1 shares (150,000 6 per cent. pref.). Objects: To take over the business of John Russell & Co., Ltd. (incorporated in 1876), to carry on the business of tube manufacturers, factors and merchants, coalmasters, ironmasters, dealers in gas, steam, locomotive, hydraulic, metallic and other tubes, gas and other fittings, chandeliers, gasoliers, and other articles, etc., and to adopt an agreement with the said old company and the liquidator thereof. The signatories (with one share each) are: Lt.-Col. W. E. Harrison, Wychnor Park, Burton-on-Trent; T. A. Negus, Shenstone Lodge, Lichfield, gentleman; F. R. Clarke, Fossway, Lichfield, solicitor; J. C. Forrest, Easington, Wolverhampton, mining engineer; C. Marshall, Highgate, Walsall, secretary; A. W. Hulton, Wayside, Streetly, engineer; C. L. Simpson, 13, Montague Place, W., engineer. The first directors (to number not less than three or more than seven) are: Lt.-Col. W. E. Harrison, T. A. Negus, F. R. Clarke, and J. C. Forrest. No qualification for first directors. Qualification of subsequent directors, £100 ordinary or £250 preference; or a combination of ordinary and preference shares, in which case £1 ordinary shares shall be equivalent to £3 10s. preference shares. Remuneration, £500 per annum, divisible. Solicitor: J. R. Holliday, 4, Bennett's' Hill, Birmingham.

Berry and Hayward, Ltd. (140,957).—This company was registered on July 13th, with a capital of £2,000 in £1 shares, to take over the business carried on at Nottingham, as "Berry and Hayward," to adopt an agreement with J. G. Berry and A. T. Hayward, and to carry on the business of electrical engineers and contractors, manufacturers of and dealers in electrical apparatus and appliances, manufacturers of electric cables and incandescent lamps, brassfounders, wire workers, metal tube manufacturers, etc. The subscribers (with one share each) are: J. G. Berry, 18, Glebe Road, West Bridgford, electrical engineer; A. T. Hayward, Glendale, Harlington Road, Sherwood, Nottingham, electrical engineer. Private company. The number of directors is not to be less than two or more than five: the first are J. G. Berry and A. T. Hayward. Qualification, £100. Solicitor, E. B. Stocker, 12, Zulla Road, Nottingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Western Electric Distributing Corporation, Ltd. (79,057). Capital, £31,000 in £1 shares (13,000 cum. pref., 3,000 pref. ord., and 15,000 ord.) Return dated August 12th, 1914 (filed May 20th, 1915). 9,715 cum. pref., 2,600 pref. ord., and 8,893 ord. shares taken up; £18,415 10s. paid; leaving £2,792 10s. in arrears. Mortgages and charges: Nil.

Leatherhead and District Electricity Co., Ltd.—Trust deed dated June 30th, 1915 (supplemental to trust deed dated July 2nd, 1912), to secure an issue of £10,000 debenture stock, ranking *pari passu* with £15,000 like stock issued under principal deed, charged on land with buildings thereon at Fetcham, Surrey, and company's other assets, present and future, including uncalled capital. Trustees: P. P. Ralli, Ashstead Park, Surrey.

Trafford Power and Light Supply (1902), Ltd.—Particulars of £40,000 debentures, created by resolutions of March 30th and June 22nd, 1910, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £15,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Pintsch's Electric Manufacturing Co., Ltd. (in liquidation).—Charge on company's hereditaments, and premises, capital stock, machinery, goods, chattels, debts and other assets, dated June 30th, 1915, to secure £200 and further advances stamped up to £2,250. Holders: Pintsch's Patent Lighting Co., Ltd. (in liquidation), Friars House, New Broad Street, E.C., and H. W. Kirby, Bassishaw House, Basinghall Street, E.C., the liquidator.

G. H. Turner and Co., Ltd.—Issue, on July 12th, 1915, of £60 debentures, part of a series of which particulars have already been filed.

Anglo-Foreign Tramway Syndicate, Ltd. (112,859).—Capital, £10,000 in 9,500 pref. shares of £1 each, and 5,000 "A," 4,000 "B," and 1,000 ord. shares of 1s. each. Return dated August 19th, 1914 (filed May 31st, 1915). 4,200 pref., 379 "A," and 74 "B" shares taken up; £1 per share called up on the pref. and 1s. per share on the "A" and "B"; £4,222 4s. paid. Mortgages and charges: Nil.

Alert Electrical Co., Ltd. (78,971).—Capital, £2,000 in £1 shares. Return dated March 27th, 1915. 708 shares taken up; £708 paid. Mortgages and charges: Nil.

Hong Kong Tramway Co., Ltd. (75,486).—Mortgage created outside the United Kingdom, as additional security, dated April 28th, 1915 (supplemental to trust deed dated July 1st, 1903, securing £195,000 debentures), charged on certain land with premises thereon in Victoria, Hong-Kong. Trustees: United Exploration Co., Ltd., 19, St. Swithin's Lane, E.C., and the Consolidated Trust, Ltd., Dashwood House, New Broad Street, E.C. A memorandum of satisfaction to the extent of £2,500 on June 28th, and £600 on July 6th, 1915, of trust deed dated July 1st, 1903, securing £195,000, has been filed.

Wrexham Motor and Electrical Engineering Co., Ltd. (84,046). Capital, £5,000 in £1 shares. Return dated May 25th, 1915. 928 shares taken up; £928 paid. Mortgages and charges: £600.

CITY NOTES.

Chili Telephone Co., Ltd.

Mr. Geo. Keith presided, on July 14th, over the annual meeting, held at 42, Old Broad Street, E.C. Prefacing his remarks with an allusion to the absence of Mr. E. C. Quilter and Mr. E. B. Butler Henderson, two directors, on active service, he said that the year under review had been very abnormal, and one of great difficulty for the business in Chile. The company's revenue increased very favourably during the first four months of the year, but then came the crisis due to the outbreak of the European war, closing Chile's principal markets for the export of nitrate, her chief source of revenue. The subsequent naval activities off the west coast also interfered greatly with her shipments. Exchange fell to 7d., lower than it ever was before, and the whole business of the country became difficult and seriously depressed. The aggregate number of subscribers fell off about six per cent., due to the telephones being given up in consequence of economy or bad business. Fortunately, the loss of revenue incurred thereby was more than compensated for by the increase in the first four months' working; and the gross currency showed a small increase on the year. The working expenses had also increased. The winter in Chile was very severe, and the company's overhead plant in some districts suffered badly from storms and inundations, which rendered its maintenance both difficult and expensive. The total working expenses were equal to 54 per cent., and the net currency showed a small decrease on the year. The lower value of the Chilean dollar reduced the average rate of exchange to about 8½d., or nearly 12 per cent. less than it was for the previous year, and the net income in Chile when converted into sterling showed a decrease on the year of £8,030. The total income from all sources amounted to £54,392. Considering the set-back which the company had suffered in consequence of the abnormal conditions in Chile due to the war, he congratulated the shareholders upon the result of the year's working. The general reserve now stood at £96,000. The depreciation of the sterling value of the liquid assets due to the fall of exchange amounted to £6,344. This item occurred more or less every year, and went against or for the reserve according as the exchange rose or fell during the year. Investments remained unaltered, and a special reserve of £5,000 now covered the depreciation in their market value, which had, unfortunately, increased during the past year. The capital expenditure was increased by £6,137 expended on extensions to the property and plant. Amongst the new works carried out was the purchase of two sites for building a new exchange and the opening of two new offices. Several inter-town lines had also been built, and a further extension made to the underground system in Santiago. Since the commencement of the present year the general situation in Chile had shown signs of improvement. The shipment of nitrate had been renewed, but any great era of prosperity was not to be expected while the war lasted. High prices were also benefiting the mining and agricultural interests, and were leading to an increase in the exportation of these products, while the reduction of public expenditure and war imports was producing a healthy state of things in the money market. The business, as far as it had gone this year, showed an improvement which it was hoped might continue and at least cover the set-back which had taken place since the war broke out. The Chairman concluded with an expression of appreciation at the loyal manner in which the staff had carried on the work during the past most strenuous and difficult year.

Mr. Charles W. Parish seconded the motion, and the report was adopted.

British Electric Traction Co., Ltd.

The scheme for the reduction and re-arrangement of the capital of the British Electric Traction Co., Ltd., as modified since the referendum on the proposals, is now before the proprietors. It appears in tabulated form below:—

Proposed Reduction and Rearrangement of Capital of the B.E.T. Co.

Present Issued Capital.		Proposed to be converted into: 6 % cumulative participating preference stock with priority as to capital.		Proposed to be converted into: New ordinary stock ranking after the preference stock as to capital and dividends.		Proposed to be written off.	
Issued—	£	%	£	%	£	%	£
6 % Cumulative preference stock	403,592½	100	403,592½				
7 % Non-cumulative preference stock	807,185	35	282,514¾	65	524,670¼		
6 % Pref. ordinary non-cumulative stock	1,070,097½			50	535,048¾	50	535,048¾
Deferred ordinary stock...	666,505			30	199,951½	70	466,553½
All the above stocks rank equally as regards capital.							
	£2,947,380		686,107¼		1,259,670½		1,001,602¼
Non-interest-bearing income certificates, £266,371 1/-		10	Add 26,637	25	Add 66,593		Deduct 93,230
Entitled to redemption by purchase or drawings out of a sum to be set aside out of the profits available for dividend in each year equal to the sum paid by way of dividend for that year on the preferred ordinary stock.			£712,744¼		£1,326,263½		£908,372¼
			£2,039,007¾				Representing the net result of the scheme on the issued capital of the company.

The issued capital of the company, now standing at £2,947,380, will be written down by £1,001,602; or, if the £266,371 in income certificates are included, the net effect of the scheme is to reduce the capital by £908,372. The two classes of preference stock and the two classes of ordinary stock (all ranking equal as regards capital), together with the income certificates, will be converted into £712,744 new 6 per cent. cumulative participating preference stock with priority as to capital, and £1,326,263 ordinary stock ranking after the preference both as to capital and dividends. The present 6 per cent. cumulative preference stock is not called upon to bear any portion of the capital reduction, and is converted in its entirety into the new preference stock. As compensation for the fact that the re-arrangement increases the total amount of preference stock, priority as to capital is conceded to the new preference stock, and also a right to participate in further profits up to 8 per cent. after the new ordinary has received 8 per cent. in any one year. The holders of the present 7 per cent. non-cumulative preference stock will convert into 35 per cent. of new preference stock and 65 per cent. of new ordinary stock, retaining, in common with the 6 per cent. preference stockholders, the full percentage of their holdings. Upon the ordinary stockholders falls the reduction of the capital. The 6 per cent. preferred ordinary non-cumulative stock will receive 50 per cent. in new ordinary stock and 50 per cent. will be written off; the deferred ordinary stock will secure 30 per cent. new ordinary stock and 70 per cent. will be written off. The income certificates are to be exchanged into 10 per cent. of new preference stock and 25 per cent. of new ordinary stock.

Marconi's Wireless Telegraph Co., Ltd.

The report for the year ended December 31st, 1914, shows that the gross profit was £371,072, and the net profit carried to the balance sheet £232,716, showing an increase of net profit of £110,392. Adding £76,550 brought forward, the balance now to the credit of profit and loss account is increased to £309,266. The basis of remuneration from the Government for the use of the company's high-power stations since the beginning of the war and other services not yet having been settled, it has not been possible to include any sum in respect of them in the profit and loss account of last year. These items will, therefore, have to be entered to the credit of the account of the current year. In the balance sheet, shares in associated companies and patents are again taken into account at their cost price, viz., £1,360,126, showing an increase of £61,382. This addition is mainly comprised of the company's proportion of the increased capital of the Russian company. The company's holdings in associated companies, except for these additions, have undergone no change during the year. The par value of shares held in associated companies now stands at £2,469,859, exclusive of shares which have no capital denomination. The amount which stood to the credit of share premium account has been transferred to general reserve account, which now stands at £867,530.

The French Company (Compagnie Française Maritime et Coloniale de Telegraphie sans Fil) has declared a dividend for the year 1914, at the rate of 10 per cent. on the ordinary shares and 31.25 francs per share on the founders' shares.

The Marconi International Marine Communication Co. has again shown substantial increase of business and profits. Dividends for the past year amounting to 10 per cent. have been declared, and £30,747 was placed to reserve and carried forward

The Russian Company (Société Russe de Télégraphes et Telephones sans Fil) has made satisfactory progress. A dividend at the rate of 15 per cent. for the year 1914, as compared with 6 per cent. for the previous year, has been declared.

The Marconi Wireless Telegraph Co. of America earned increased profits for the year, but owing to the conditions prevalent in Europe, and the consequent necessity to defer the opening of their trans-Atlantic service, the directors decided meantime not to declare a dividend.

The outbreak of war caused considerable dislocation of the company's affairs as well as those of the associated companies. Businesses of importance which were on the point of fruition had had to be deferred; many negotiations which were in course of successful progress with foreign Governments had for the time being to be abandoned; the opening of the direct public telegraph services between this country and the U.S.A. and Spain have had to be postponed. In some cases, owing to the unfavourable rates of exchange, substantial sums have had to be deposited at interest with bankers abroad, and some payments from foreign Governments deferred with interest accruing until after the war. £4,347 due from the Turkish Government has not been received. In all these circumstances the directors consider it prudent to recommend the declaration of a dividend of 10 per cent. upon the ordinary shares; to place a further £100,000 to general reserve account, increasing that account to £967,530, and, after deducting the dividend of 7 per cent. paid earlier in the year upon the preference shares, to carry forward £69,497. The directors do not contemplate that any loss in consequence either of loss in exchange or deferred payments will result, but having regard to the war, they consider they are best studying the interests of the shareholders in adopting a conservative policy. The board are gratified to be able to state that during the current year the company has been engaged to its fullest capacity in supplying the demands of the British, Colonial and foreign Governments. The orders in hand justify the anticipation that the volume of business this year will exceed that of any previous year.

Annual meeting: July 25th.

Kalgoorlie Electric Tramways, Ltd.

The directors report that for the year ended December, 1914, the gross receipts were £31,891, against £34,643, and the net profits £7,265, against £9,549. The depressed condition of affairs in Kalgoorlie during the past few years has been accentuated by the European war. The competition of motor-cars also continues to adversely affect the receipts. A system of return fares has been inaugurated to encourage travelling. Expenditure is kept as low as possible, but the tramway must be efficiently maintained, and there is a limit to the reduction of expenses. The car miles run were 582,114, against 568,000; passengers carried 2,125,094, against 2,266,361; earnings per car mile 13.12d., against 14.57d.; expenses 9.48d. per car mile, against 9.91d. The power supply units consumed were 632,165 (£7,242), against 610,370 (£6,994), the increase being accounted for by the additional mileage run on account of the motor-car competition, and the slightly higher consumption per car mile was due to additional road-making and the motor cars running over the tracks and the dirty rails forming a bad contact. During the present year it will be necessary to carry out a considerable amount of work in the way of renewals to cars, overhead lines, etc. The "A" debenture stock has been reduced to £48,000 by the purchase of stock. Owing to the inability of the company to maintain the full sinking fund the trust deed was varied with regard to the annual sum to be set aside for sinking fund. The reduction of the expenses to the present low level was made possible by the extra work done by the whole of the staff in Western Australia.

Mr. A. H. P. Stoneham presided, on Monday, over the annual meeting, held at the London Chamber of Commerce, E.C. He said that the war had had an adverse effect upon the company, as it had upon practically all enterprises. In addition, they continued to suffer from the unfair competition of the motor 'bus services and also from the depressed condition of the mining industry in Kalgoorlie. Kalgoorlie was dependent almost entirely upon the mines, and while the industry was keeping up as far as the deep mines were concerned, there were very few new discoveries taking place, and owing to the high price of labour it was impossible to work some of the low-grade mines. The result was that the country was not flourishing, and it was only natural that they should suffer in their receipts from the tramways. A year or two ago they hoped to receive benefit from the construction of the Trans-Continental Railway and from the development of the agricultural resources of the State, but in both respects they had been disappointed. Last year there was a serious drought all over Australia, which had had a very serious effect upon the finances of the country. In that respect matters were much more promising this year, for the drought had quite broken up. The construction of the Trans-Continental Railway was proceeding very slowly. With regard to their traffic, the Boulder line showed the heaviest decrease, due to the motor car competition, where they had been forced to run an additional 21,533 miles. The mileage had been slightly reduced on the other lines, with the result that the total for the year showed an increase of 13,614 miles. Their issue of return tickets had, he thought, had some effect on the motor-car competition and had helped them to keep some of their traffic. When one had to compete against motor-cars which paid no licence, and which only came out when the weather was fine and when there was a good demand, they were up against an almost impossible proposition. They were bound to run their services, wet or fine, passengers or no passengers. At one time he had an idea that the Government allowed the motor-car competition so that they might beat down the receipts of the tramways and then buy them up at a reduced price, but he did not think that even the Australian Government would find it easy to raise money to-day to buy up any enterprise. When they found their profits going down they had to meet the question of the debenture interest and the sinking fund. They found it was impossible to keep up the sinking fund at the rate prescribed by the trust deed. They, therefore, called the trustees together and took their opinion as to the best course to be adopted. They showed those gentlemen all the figures, and they advised them to call a meeting of the debenture holders and reduce the sinking fund. They acted upon that advice, and a resolution was passed reducing the sinking fund, so that the difficulty had been got over for the time being. Whenever they returned to a state of prosperity they would resume the sinking fund on its old basis. In the meantime they were in danger, for a few weeks, of the debenture holders coming in and taking the property from them. However, that danger had been averted, and they could only go on and do their best and hope for better days.

Mr. C. C. Baker seconded the motion.

Replying to a number of questions, the Chairman said that up to the end of May this year the gross receipts had amounted to £13,472, as against £12,830 for the same period in 1914. With regard to the sinking fund, they were liable under the trust deed to set aside £9,000 a year for interest and sinking fund. They were still liable to put away the profits up to that amount if they earned them, but they were not bound to put aside the full £9,000 if the profits did not admit of it. About £2,500 was required each year for interest, and the balance would go to the sinking fund. If the company could be pulled round it could only be done by the present directors, most of whom had a very intimate and long acquaintance with Australian affairs.

The report was adopted.

German Electrical Companies.

The Elektra A.G., of Dresden, which earned net profits of £18,900 in 1913 and paid a dividend of 6 per cent., reports gross profits of only £6,400 for 1914. This sum is disposed of by an allocation to the depreciation fund and the balance carried forward to 1915.

The Elektro-Treuhand A.G., of Hamburg, which is the joint financial institution of the A.E.G. and the Siemens group, earned net profits of £27,000 in 1914, which were derived from dividends on Hamburg Elevated Railway shares and from interest on bank deposits. It is intended to pay a dividend of 5½ per cent. on the paid-up capital, being the same rate as in 1913, when the net profits were £25,000.

The Dr. Paul Meyer A.G., which constructs electrical apparatus and instruments, reports that the turnover in 1914 declined below the level which is regarded as the profitable limit. The orders for the army first come into consideration for the year 1915, whereas the preparations for this work imposed a charge upon 1914. Under the circumstances, the past year resulted in a loss of £15,500, this comparing with net profits of £15,100 and a dividend of 7½ per cent. in 1913.

The Deutsch-Ueberseeische Elektrizitats Gesellschaft, of Berlin, reports that the economic crisis in South America became aggravated after the outbreak of the war in Europe, and was felt by all the company's undertakings, which are situated in Buenos Ayres, Santiago, Montevideo, etc. Nevertheless, the gross receipts in 1914 were higher at £1,618,000, as compared with £1,567,000 in 1913, but the taxes increased and a larger sum has been set aside for depreciation, so that the net profits amounted to £739,000, as against £736,000. A dividend at the rate of 10 per cent. has been declared on the ordinary capital of £6,000,000, this comparing with 11 per cent. in 1913. It would, however, have been possible to distribute the same rate as in 1913 if five per cent. preference shares for £1,500,000 had not become entitled to participate in the profits for the first time in 1914. The report gives details of the various undertakings, and it is mentioned that the competition of the Italo-Argentina company in Buenos Ayres is still scarcely perceptible.

Austrian Electrical Companies.

The undertaking of the *Budapester Allgemeine Elektrizitats Gesellschaft*, which is chiefly an electricity supply company, is to be absorbed by the City Council of Budapest. The company was formed in 1893, and its dividends since 1911 have been at the rate of 12½ per cent. It is considered that the purchase price will reach at least £1,250,000.

The Ver. Gluhlampen und Elektrizitats A.G., of Neupest, after making ordinary provision for depreciation, records net profits of £44,700 for 1914, as compared with £52,400 in the previous year. A war reserve fund has been created by the allocation of £12,500 for this purpose, and a further sum of £4,100 has been set aside for depreciation. The balance permits of the payment of a dividend of 8 per cent., this contrasting with 12 per cent. in 1913.

The report of the *Oesterreich. Siemens-Schuckertwerke* states that the total orders received in 1914 were less than in the preceding year, the decline particularly affecting contracts for public electricity works and tramways and the work of the cable factory. On the other hand, the department for the transmission of power for industrial purposes was unfavourably influenced to a lesser extent, as many firms engaged on army orders were compelled to improve their equipment so as to enhance their efficiency. The company's plant was adapted as far as possible to the production of munitions of war. The gross profits experienced a considerable reduction, and the net profits receded from £121,000 in 1913 to £79,000 last year, the dividend on the share capital of £1,333,000 falling from 7 per cent. to 5 per cent. in the two years respectively.

Lanarkshire Tramways Co., Ltd.—**Interim dividend at the rate of 5½ per cent. per annum, less income-tax, for the past half-year.**

Sao Paulo Tramway, Light and Power Co., Ltd.—**The directors have declared a dividend of 2½ per cent. on the common stock.**

Electric and General Investment Co., Ltd.—The report for the year ended May 31st, 1915, states that the gross profit was £7,243. After deducting all general charges, interest on debenture stock, transferring £2,409 to reserve, and adding £3,074 brought forward from last year, there remains £5,222, which is to be carried forward. The amount of £84,000 appearing as a provision for contingencies in the last balance-sheet has been debited with £4,255 in respect of losses incurred, and after transferring thereto £2,409 from profit and loss, there remains £82,154, which has been deducted from the value of investments and retained as an investment reserve fund.

Companies Struck off the Register.—The following companies have, according to notice in the *London Gazette*, been struck off the Register :—

Automatic Telephone Co., Ltd.
Hilo Manufacturing Co., Ltd.
Illuminated Signs, Ltd.
New Imperial Electric Lamp Co., Ltd.
Sudd Fuel (Suddite), Ltd. (registered September, 1911).*
West India and Panama Telegraph Co., Ltd. (registered July, 1869).*

* In these cases another company with the same title is in existence at the present time.

New Issues.—*Coventry Chain Co., Ltd.*—This company has been inviting subscriptions for 70,000 6 per cent. cumulative preference shares, and 50,000 ordinary shares, all of £1 each, for the purpose of works extensions and additional plant, &c., which are necessary in order to enable it to keep pace with the large business in hand.

Shawinigan Water and Power Co.—This company is inviting subscriptions for an issue of $1,237,500 new common stock, at $100 (par) per share.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange business is still quiet enough to permit members of the House to engage in munition-making and volunteer-work without such things interfering with the less stern duties of their daily life. Without a doubt, the 4½ per cent. War Loan has absorbed a very substantial proportion of the floating supply of capital which the public had available for investment. Its effect will be felt until such time as it is superseded by other borrowing, such as Mr. Bonar Law and several other Ministers have already hinted at in the various debates in connection with the loan. This season of the year, too, is always a slack one in the Stock Exchange. Times being out of joint, there is but languid interest taken in holidays as a whole, but the spirit of the dog-days is upon us, investment and speculation make little appeal now that everyone has locked up his savings in the War Loan, and the August Bank Holiday approaches.

The coal crisis in South Wales caused less anxiety in the Home Railway market than it would have done in normal times, inasmuch as it is argued that the railway companies are now being operated by the Government, and that the strike will have only a slight effect upon the industry as a whole. But as an influence over all the Stock Exchange markets, it has made its weight heavily felt. Strive as they may to find some strictly impartial ground which may enable excuses to be found for the miners' conduct, those who endeavour to be most fair admit that they can discover no solid ground for the miners to take up such a *non possumus* attitude, and condemnation of the methods by which they have sought to enforce their demands is as unanimous as it is bitter.

Steam stocks have given way a little, but the Undergrounds mostly maintain their values. Central Londons are none too firm, and while we quote 73 as the middle price for Central London ordinary stock, it is probable that a buyer would find it much easier to deal than a would-be seller. The Underground Electric Railway income bonds hold their price with a good deal of firmness at 75. The "A." shares enjoyed a spurt to 6s. Metropolitans have gone back a little. Districts at 13½ keep steady.

The Electric Lighting market exhibits the dulness which is its usual feature at this time of the year. City of London preference are 10s. lower, St. James's dropped to 7, bringing their yield to the round 7 per cent. on the money. Some, at least, of the electricity supply companies are likely to be engaged before long in the manufacture of munitions, and it may be that in this way they will find a useful aid to maintenance of returns in the dead season. The coal crisis presses upon this market, as it does also upon that for gas issues, the latter being decidedly depressed and out of favour.

Within the past few days Westminsters have been done at 7, County First Debenture at 96½, Edmundson's preference at 3¼, and the six per cent. non-cumulative preference at 20s. 6d. Metropolitans last week were dealt in at 2¾ for the ordinary and 3¾ for the preference, while Bournemouth and Poole second preference changed hands last Friday at 10¼ and a shade lower. To give some idea of the quietude of the market, we may add that up to the beginning of this week Kensingtons had not been dealt in since February, City preference since May, and many other of the ordinarily popular shares have not changed hands for over a month. South Metropolitan ordinary are wanted at about 15s.

Marconi's Wireless Telegraph Co. has provided one of the most interesting features of the week by the issue of its report for 1914. The net profits have been nearly doubled, but the dividend on the ordinary shares is halved, viz. : from 20 per cent. to 10 per cent. ; while the dividend on the preference shares comes down from 17 per cent. to 7 per cent. The directors, instead of dividing the profits up to the hilt, have elected to put £100,000 to general reserve, raising that fund to £967,000, and the market is well satisfied with the cautious policy which the directors have adopted. The report mentions that the Russian Co. has announced a dividend of 14 per cent. for 1914, which is an increase of 9 per cent., but that the American Marconi directors have decided not to declare a dividend for a time, in consequence of the conditions prevalent in Europe. Nothing comes from the Canadian Marconi Co. Possibly, it may be stated at the meeting whether the Marconi Co. gets an allowance from our Government in respect of the German wireless news, which it collects and publishes with the consent of the Censor over here. The French and the International companies have both paid 10 per cent. for the past year, the Argentine and Spanish subsidiaries bringing nothing to the accounts. On the issue of the report, the shares fell a small fraction to 1 13/16, but the movement is only a third of the rise which occurred just previously. American Marconis have had a sharp rise, the price spurting to 13s. 9d. on buying, which is said to have its inspiration on the other side of the pond. Canadians remain at 4s. 3d., and Marconi preference at 31s. 3d. are a shade lower than they were a week ago.

Telegraph issues remain a very dull market. The necessity for raising money wherewith to pay the call for the full amount on the 4½ per cent. War Stock has led to further sales of securities throughout the markets this week, and to this cause must be traced the fall of 4 points in Eastern Telegraph ordinary, while the preference stock lost 1 in sympathy. Eastern Extensions fell ¼ to 11½, so that the shares are still relatively cheaper than Eastern Telegraph ordinary stock. The Anglo-American Telegraph issues are slightly easier, the preferred having now got to the round 100, while the deferred drooped to 21½. Globes are steady. New York Telephone bonds have been up to 96¼, but went back again to their previous price at 95½. Bell Telephone of Canada 5 per cent. bonds changed hands the other day at 101. West India and Panama shares are somnolent, not a bargain having been transacted in the ordinary for about six weeks. Great Northerns changed hands recently at 33¾—33. Henleys weakened to 14, losing their rise of last week. Other manufacturing shares connected with the telegraph industry are very steady.

Brazilian Traction common shares fell back to 49½, although the Rio exchange keeps fairly steady. The Sao Paulo Tramway, Light & Power Co. has declared a dividend of 2½ per cent. on the common stock. The First Mortgage Debentures stand around 85 and the 5 per cent. Consolidated Debenture stock is nominally about the same figure. Mexican issues are a slightly better market, although no change has occurred in the quotable levels. The latest news, which comes *via* Washington, declares that the Carranza party is restoring order, and that telegraph and train services between Mexico City and Vera Cruz have been resumed. Adelaide 5 per cent. debenture stock gained a point to 99. The Anglo-Argentine Tramway group is generally lower, the 5 per cent. debenture stock shedding three points to 75, at which the return on the money comes to nearly 6¾ per cent., allowing for accrued interest.

The British Electric Traction Co. has now announced the details of its proposal for rearranging the capital. The scheme differs but slightly from that which was put forward just before the outbreak of war, but the 7 per cent. preference proprietors under the present proposal are to receive 35 per cent. new preference and 65 per cent. new ordinary, instead of 33⅓ per cent. and 66⅔ per cent. respectively. The income certificate holders are to be offered 10 per cent. preference and 25 per cent. ordinary, instead of 30 per cent. of the last-named stock. In the market the scheme is received in a friendly way, and it seems likely to go through. The prices of the various stocks at the present time are about 67 for the 6 per cent. preference, 40 for the 7 per cent. preference, 10 for the preferred ordinary, and 4 for the deferred.

The Electric & General Investment Co. has decided to carry forward its balance of £5,200, which remains after deducting general charges, interest on debenture stock, etc.

British Westinghouse preference and Electric Tractions have both lost 1s., and except for these, and the decline in Henleys already mentioned, the Miscellaneous Market is unchanged. Rubber shares have been good, and although scarcely as firm as they were at the end of last week, the undertone is decidedly strong. Notwithsanding the depression caused throughout the Stock Exchange markets by the news of the German advance on Warsaw, the rubber market held its own with a good deal of strength. The price of the raw material has shaded off a little because of the cessation, for the time being, of American demand, but those who closely watch the share market are confident enough of prices recovering before long, their contention being that rubber is so necessary for war purposes that the industry cannot help making big profits just now. In the Armament group there is less going on, but prices all round showed resistance to the dulness which overtook other departments on the Warsaw news, the latter counteracted to some extent, by the way, by the expectation that the coal dispute was, on Tuesday evening, about to reach an amicable settlement.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price July 20, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	8¼	—	£6 1 8
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4	—	6 5 0
do. do. do. 4½ Pref.	4½	4	—	5 12 6
do. do. City Pref.	4½	3⅞ xd	—	5 16 2
do. 4 Deb.	4	82	—	4 17 7
Chelsea	5	4½	—	5 11 1
do. 4½ Deb.	4½	88 xd	—	4 17 10
City of London	9	13¼	—	6 15 10
do. do. 6 per cent. Pref.	6	11½	— ½	5 4 4
do. do. 5 Deb.	5	105 xd	—	4 15 8
do. do. 4½ Deb.	4½	90 xd	—	5 0 0
County of London	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	11	—	5 9 1
do. do. 1st Deb.	4½	96 xd	—	4 13 6
do. do. 2nd Deb.	4½	90	—	5 0 0
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4⅞	—	6 3 1
do. do. 4 Deb.	4	82	—	4 16 5
Metropolitan	8½	8	—	5 16 8
do. 4½ per cent. Pref.	4½	3¾ xd	—	6 0 0
do. 4½ Deb.	4½	90 xd	—	5 0 0
do. 3½ Deb.	3½	70 xd	—	5 0 0
St. James' and Pall Mall	10	7	— ¼	7 0 0
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70 xd	—	5 0 0
South London	5	3	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7	—	6 8 7
do. 4½ Pref.	4½	4⅝	—	4 17 4
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	100	—1	6 0 0
do. Def.	1½	21½	— ¼	6 19 6
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8¼	—	6 1 3
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11½	— ¼	*6 19 0
do. 4 Deb.	4	82½	—	4 17 0
Eastern Tel. Ord.	7	121	—4	*6 12 2
do. 3½ Pref.	3½	71	—1	4 18 7
do. 4 Deb.	4	81	—	4 18 9
Globe Tel. and T. Ord.	6	10	—	*6 17 0
do. Pref.	6	11¼ xd	—	5 6 8
Gt. Northern Tel.	22	34	—	6 9 5
Indo-European	65/-	52	—	6 5 0
Marconi	10	1 13/16	— 1/16	6 3 1
New York Tel. 4½	4½	95	—	4 13 0
Oriental Telephone Ord.	10	1⅞	—	5 6 8
do. Pref.	6	1 3/16	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 8
United R. Plate Tel.	8	5¾	—	*7 19 10
do. Pref.	5	4⅜	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12¼	—	*6 10 6
do. 4 Deb.	4	83	—	4 16 5
Home Rails.				
Central London, Ord. Assented	4	73	—	5 9 7
Metropolitan	1¼	25	— ½	5 0 0
do. District	Nil	13½	—	Nil
Underground Electric Ordinary	Nil	1⅜	—	Nil
do. do. "A"	Nil	6/-	+1/6	Nil
do. do. Income	6	75	—	*9 3 0
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref.	5½	4xd	— ⅛	6 17 6
do. 2nd Pref.	5½	3½ xd	— ⅛	7 17 2
do. 4 Deb.	4	75 xd	—3	5 6 8
do. 4½ Deb.	4½	80 xd	—	5 12 6
do. 5 Deb.	5	75	—3	6 13 4
Brazil Tractions	6	49½	—2½	12 2 6
Bombay Electric Pref.	6	10¼	—	5 16 10
do. 4½ Deb.	4½	90	—	5 0 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds	—	50	—	Nil
do. 6 per cent. Bonds	—	80	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	45	—	—
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	99	+1	5 1 0
Manufacturing Companies.				
Babcock & Wilcox	14	2¼	—	6 4 5
British Aluminium Ord.	5	1 1/16	—	4 14 1
do. Pref.	6	18/3	—	6 9 0
British Insulated Ord.	15	11	—	6 13 4
do. Pref.	6	6	—	5 0 0
British Westinghouse Pref.	7½	35/-	—1/-	8 11 6
do. 4 Deb.	4	70 xd	—	5 14 4
do. 6 p. lien	6	100	—	6 0 0
Callenders	15	11¼	—	6 13 4
do. 5 Pref.	5	4⅞	—	5 2 7
do. 4½ Deb.	4½	95	—	4 14 9
Castner-Kellner	15	8¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/6	—	Nil
do. do. fully paid	Nil	1¾	—	Nil
do. do. 4 Deb.	4	60 xd	—	6 13 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	12/6 xd	—1/-	9 12 0
do. do. Pref.	7	1 xd	—	7 0 0
Gen. Elec. Pref.	6	9¾ xd	—	6 3 1
Henley	20	14	— ½	*8 8 8
do. 4½ Pref.	4½	4¾	—	4 14 9
do. 4½ Deb.	4½	95	—	4 14 9
India-Rubber	5	8¾	—	5 14 3
Telegraph Con.	20	33	—	7 5 6

* Allowance made for dividends being paid free of income-tax.

Western Union Telegraph Co.—The report for the six months to June 30th will show:—Revenue and income, $24,019,260; expenses, including maintenance and reserves, $19,359,745; interest on bonds, $668,600; net income, $3,990,915, being an increase of $1,891,080 over the corresponding period last year.—*Financial Times.*

Liverpool Overhead Railway Co.—Interim dividend to June 30th at the rate of 5 per cent. per annum on the preference shares and 2½ per cent. per annum on the ordinary shares, less income-tax at the rate of 2s. 3½d. in the £.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 21st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a „ Nitric	„	19/-	..
a „ Oxalic	per lb.	..	..
a „ Sulphuric	per cwt.	..	..
a Ammoniac Sal	„	£49	..
a Ammonia, Muriate (large crystal)	per ton	£40	..
a Bleaching powder	„	£9	..
a Bisulphide of Carbon	„	£21	..
a Borax	„	£22	..
a Copper Sulphate	„	£28	£1 dec.
a Lead, Nitrate	„	£35	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
c Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	7½d.	½d. inc.
a Potash, Caustic (88/90 %)	per ton	..	..
a „ Chlorate	per lb.	1/6	..
a „ Perchlorate	„	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers	„	£11 10	..
a „ Recovered	„	£8	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %)	„	£10 2 6	..
a „ Chlorate	per lb.	1/1	..
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	4d.	[illegible] inc.
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	..	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	..	..
b „ Sheet, in ton lots	„	..	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/1¾ to 1/2¼	
c „ Tubes (solid drawn)	„	1/2¼ to 1/2¾	..
c „ Wire, basis	„	1/2 to 1/2½	..
c Copper Tubes (solid drawn)	„	1/2 to 1/2½	..
g „ Bars (best selected)	per ton	£106	£4 dec.
g „ Sheet	„	£106	£4 dec.
g „ Rod	„	£106	£4 dec.
d „ (Electrolytic) Bars	„	£95	..
d „ „ Sheets	„	£113	..
d „ „ Rods	„	£101	..
d „ „ H.C. Wire	per lb.	1/0¼	..
f Ebonite Rod	„	3/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/6½	¾d. dec.
i Iron Pig (Cleveland warrants)	per ton	66/7	1½d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£23	£1 inc.
g Lead, English Pig	„	£25 15	5/- inc.
g Mercury	per bot.	£18 5 to £18 10	£1 10 inc.
e Mica (in original cases) small	per lb.	4d. to 2/6	..
e „ „ „ medium	„	3/- to 5/-	..
e „ „ „ large	„	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/2 to 1/3½	..
p „ „ rolled strip & sheet	„	1/3½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£80	..
g Tin, Block (English)	„	£167	£5 to £6 dec
n „ Wire, Nos. 1 to 16	per lb.	2/8	..
p White Anti-friction Metals	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

The Russian Rubber and Telegraph Co.—The Caoutchouc, Gutta-percha and Telegraph Co., of Riga, which is a Franco-Russian undertaking maintaining branches in Germany and Austria under normal circumstances, reports gross profits of £660,000 in 1914, as compared with £415,000 in the previous year. It has, however, been necessary to write off a considerable sum for doubtful debts apart from £165,000 for ordinary depreciation as against £100,000 in 1913, so that there only remains £180,000 available for distribution as contrasted with £252,000 in 1913. It is proposed to pay a dividend of £1 per share on the capital of £1,800,000, this comparing with £1·4 in the preceding year, but the actual payment is to be postponed until September owing to the depreciation in the Russian rate of exchange.

The Italian Westinghouse Co.—The Società Italiana Westinghouse, of Vado, reports that the course of business in 1914 was quite normal notwithstanding the war, the orders for military and naval purposes fully compensating for any lack of private contracts. The net profits amounted to £29,000, of which £15,000 has been applied to the extinction of losses in 1913, and the balance has been devoted to depreciation.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JUNE, 1915.

The June returns of electrical exports show a welcome improvement on the figures of the previous month, the total of £417,769, comparing with £380,159 in May, and being not so much below the monthly average of 1914 as might be expected.

The imports and re-exports, on the other hand, show a falling off in value as compared with the previous month; the totals being for the former, £223,801 in June, and £268,848 in May, and for the latter £10,778 in June and £13,299 in May.

The increased exports total is traceable to improved business in telegraphic and telephonic material, electrical cables, goods and fittings; machinery exports fell off somewhat, as also did lamp and battery exports.

Decreased imports of machinery, cables and telegraphic and telephonic material account for the falling off in that section, though lamp imports—mainly from Holland—and carbon imports were higher in value.

Victoria was our best customer during the month, while in Europe, France and the Scandinavian countries made large purchases; Indian trade fell off during the month.

The United States supplied the bulk of the electrical imports, but the total was some £20,000 less than in May.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	2,802	4,731	472	1,936	596	2,025	3,815	440	806	107	12,647	10,633	41,010
German Colonies	...	...	...	...	...	...	28	...	...	...	...	53	81
Netherlands, Java and Dutch Indies ...	156	7,807	1,212	...	...	13	227	30	595	...	2,939	508	13,487
Belgian Congo...	17	...	...	41	...	...	...	...	...	...	...	65	123
France	852	358	975	12	4	63	4,565	1,3255	2,618	5	9,329	12,511	44,547
Portugal	...	77	50	87	10	68	317	11	31	...	259	329	1,239
Spain, Canary Isles and Spanish N. Africa...	448	126	550	173	22	565	1,530	11	25	7	871	198	4,526
Switzerland, Italy and Austria-Hungary ...	2,307	...	190	...	...	815	2,594	143	...	101	88	2,257	8,495
Greece, Roumania, Turkey and Bulgaria ...	536	...	23	29	...	...	149	...	24	...	385	5,145	6,291
Channel Isles, Gibraltar, Malta and Cyprus...	86	...	90	...	...	...	115	200	...	19	...	20,037	20,547
U.S.A., Philippines and Cuba	1,135	27	...	71	...	29	2,742	...	62	...	...	136	4,202
Canada and Newfoundland	246	178	50	128	...	1,748	1,741	...	825	7	32	84	5,039
British West Indies and British Guiana ...	116	124	68	58	...	...	408	...	20	25	52	57	928
Mexico and Central America	49	133	...	10	...	36	...	...	110	...	10	176	524
Peru and Uruguay	...	135	41	27	...	...	1,456	32	...	...	102	27	1,820
Chile	9	2,012	148	42	...	89	35	...	83	29	...	105	2,552
Brazil	517	776	431	300	10	...	3,128	379	30	28	52	713	6,364
Argentina	1,417	15,141	1,349	179	18	265	1,791	8,493	989	24	1,722	346	31,734
Colombia, Venezuela, Ecuador and Bolivia...	...	938	...	...	...	69	53	...	...	...	28	...	1,088
Egypt, Tunis and Morocco	237	555	128	138	...	...	877	60	594	11	301	92	2,993
British West Africa	...	278	...	...	...	...	351	...	...	6	60	181	876
Rhodesia, O.R.C. and Transvaal	911	775	1,001	967	...	247	1,424	16	700	203	16	31	6,291
Cape of Good Hope	1,848	1,098	1,091	888	...	707	1,025	611	2,508	146	102	1,759	11,783
Natal	370	5,202	1,281	197	...	80	3,351	1,713	346	20	21	151	12,732
Zanzibar, Brit. E. Africa, Mauritius & Aden	45	116	63	108	...	132	215	12	17	...	...	148	856
Azores, Madeira and Portuguese Africa ...	93	264	113	184	...	93	117	235	...	...	...	828	1,927
French African Colonies and Madagascar...	...	...	...	...	...	...	400	71	925	14	...	...	1,410
China and Siam	618	490	722	60	...	254	1,021	680	117	91	32	...	4,085
Japan and Korea	...	...	329	17	...	658	...	2,941	318	54	...	42	4,359
India	2,506	4,735	4,207	1,807	204	1,008	9,545	3,146	4,097	101	829	15	32,200
Ceylon	112	332	90	26	...	26	159	31	92	...	105	615	1,588
Straits Settlements, Fed. Malay States and Sarawak	196	30	410	223	...	144	1,961	5,142	...	...	187	124	8,417
Hong Kong	118	2,192	412	17	...	...	456	382	...	94	62	16	3,749
West Australia	84	696	244	1,156	...	750	243	...	...	88	50	...	3,311
South Australia	102	899	175	27	...	20	758	40	11	11	1,194	33	3,270
Victoria	1,049	13,971	7,802	1,394	105	766	36,004	20	650	232	8,542	...	70,535
New South Wales	465	6,313	2,894	2,171	31	1,184	12,246	4,777	1,616	24	4,174	119	36,014
Queensland	136	22	473	523	...	282	271	19	956	...	3,609	178	6,469
Tasmania	15	...	...	82	...	...	155	...	...	...	337	...	589
New Zealand and Fiji Islands	387	1,077	1,078	929	...	526	2,132	287	1,423	...	1,666	213	9,718
Total, £	19,985	71,608	28,162	14,007	1,000	12,662	97,405	43,177	20,588	1,447	19,803	57,925	417,769

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	...	756	21	235	470	240	4,571	18	460	1,198	2,052	10,021
Germany	...	...	...	...	...	...	...	...	...	...	...	...
Belgium	...	...	...	...	...	...	...	...	...	...	...	...
Holland...	...	...	264	11,944	349	...	446	...	143	...	...	13,146
France	59	1,936	505	48	1,165	2,089	542	...	3,909	4,912	159	15,324
Switzerland	4,178	198	86	...	61	1,171	463	...	...	1,160	...	7,317
Italy	...	1,185	...	...	...	...	2,184	...	...	121	...	3,490
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...	...
United States	8,300	322	2,468	3,129	4,408	272	8,095	122,549	2,294	8,960	4,706	165,503
Total, £	12,537	4,397	3,344	15,356	6,453	3,772	16,301	122,567	6,806	16,351	6,917	214,801

Additional imports.—Spain, electrical goods, £1,510; arc lamps, £429; carbons, £1,808. Portugal, batteries, £6. Canada, wires, £2,349; fittings, £1,020; arc lamps, £267; electrical machinery, £998; batteries, £46; carbons, £466; telegraph and telephone apparatus, £101.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	1,691	83	...	1,272	34	363	4,155	...	582	573	2,025	10,778

Total Exports: £417,769 Total Re-Exports: £10,778 Total Imports: £223,801

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE WEAVERHAM AND DISTRICT ELECTRICITY SUPPLY.

The scattered and thinly populated rural district in Mid-Cheshire served by the Weaverham and District Electricity Supply Co. is a feature of particular interest in connection with this undertaking. As far back as the year 1874 the idea was conceived to form a local company to supply the Weaverham district with gas, and again in 1894 a movement was on foot to establish an electric supply company, but both these proposals were set aside owing to the heavy capital expenditure that would have been necessitated for mains.

The present company was formed five years ago chiefly for supplying the districts of Weaverham, Acton and Acton Bridge, and the current was switched on for the first time in February, 1912, for 20 consumers, representing 600 30-watt lamps. At the end of the same year the consumers had been increased more than three-fold and the output multiplied by seven.

Low-tension Overhead Line, with B. of T. Guards.

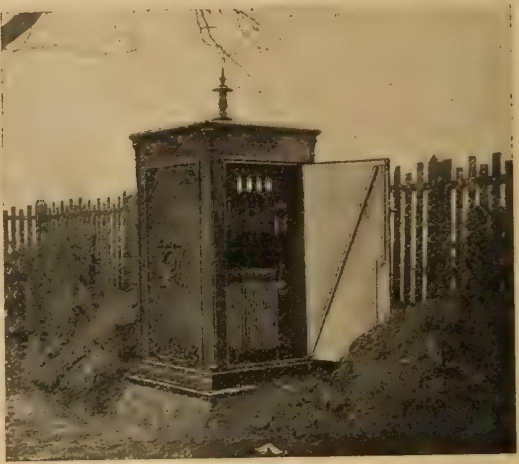
Several of the surrounding districts were constantly appealing to the company to extend their supply into their areas, and the directors, in view of the fact that the initial scheme had been a success, finally decided to extend the system and applied for statutory powers as regards Milton Gorstage, Cuddington, Sandiway, Oakmere and White Gate. The supply was first given over this new area on December 22nd, 1913, and some 30 consumers were connected to the mains.

At the end of last year, 180 consumers were connected to the mains, representing 8,500 30-watt lamps.

The scattered nature of the area served, which will be seen by reference to the plan which we reproduce, involved special consideration in view of the difficulty of keeping down the capital outlay on mains, and at the same time meeting the requirements prescribed by the Board of Trade as to the variation of pressure.

The original supply was on the three-wire direct-current system at 460/230 volts, consisting of some 5¾ miles of feeders and distributors, run overhead with three exceptions where for local reasons the roads were crossed with lengths of underground cable. The direct current area of the supply is at present served from the generating station by a ·1, ·06, ·1 sq. in. feeder terminating at a pole type distribution box adjoining the Gate Inn, Weaverham, at which point it passes through double-pole switches and fuses, and distributors are taken off for Weaverham, Acton and Milton townships. A second feeder is run from the generating station to supply the Weaverham Refining Co.'s works at Acton Bridge. Provision is also made for a third feeder to meet the foregoing network at Acton at a point called Wall Hill, 3¾ miles from the station.

The Sandiway and Cuddington extension consists of nearly four miles of 7/16's S.W.G. concentric paper-insulated lead-covered and armoured 3,000-volt main, laid direct in the ground from the generating station to a kiosk situated at the crossroads at Sandiway. On this route several large houses have taken current, reducing the voltage by means of transformers to their own particular needs.



Transformer Kiosk at Sandiway.

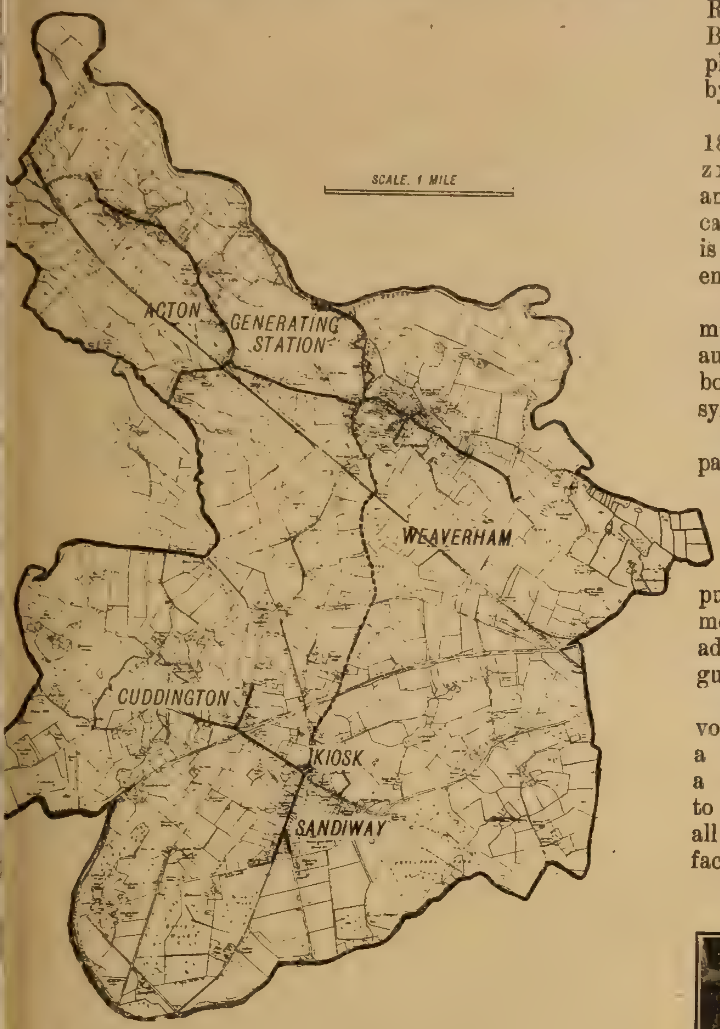
The kiosk consists of a substantial ornamental cast-iron pillar mounted on a concrete base, with the high-tension and low-tension apparatus kept quite separate. To meet the present demands, and as duplicates there are two 15-k.v.a. oil-cooled transformers stepping down from 3,000 volts to 230 volts, and two high-tension main oil switches. Between the high-tension cables are bifurcating boxes with links, by means of which either or both transformers can be connected up. The door on the high-tension side is interlocked with the main switch, so that it cannot be opened until the switch is in the "off" position, making the kiosk dead. The switch can also be worked by means of a long detachable handle through a hole in the kiosk door closed by a shutter when not in use.

A second high-tension oil switch is fixed in the h.t. section for controlling a feeder which is at present tapped to supply two pole type transformers serving three large houses whose grounds are passed, but this feeder will eventually be extended into the low-tension distributor by means of step-down transformers at different points, in order to boost the voltage when the load increases and makes this necessary.

Interior of Generating Station at Weaverham.

The low-tension section of the kiosk is provided with its own door, and contains switches with porcelain handle fuses controlling the outgoing distributors, the ends of which are sealed in bifurcating boxes.

Owing to the position of the kiosk it was considered advisable to cross the roads underground, and run some distance to terminal poles, which are provided with lightning arresters, and up which the armoured cables are taken to pole type bifurcating boxes, from which overhead bare copper conductors continue.



Weaversham and District Electricity Supply Area.

The low-tension single-phase 230-volt bare copper distributors are carried on insulators mounted on swan-neck brackets, and a cross-arm with two insulators is fixed on each pole above the line insulators, with bare copper wires taken over each insulator and connected to the lower conductor by means of brass tee connectors, to form a "V" each side of the pole, the lower conductor being earthed at the generating station. By this means the upper conductor, should it break, cannot fail to come into contact with the lower earthed conductor, as required by the Board of Trade.

Battery Room, Weaverham Generating Station.

The site selected for the generating station adjoins the River Weaver, and was presented to the company by Lord Barrymore, who owns considerable property in the district; plenty of water is always available, and fuel can be brought by boat as desired.

The plant in the original scheme consisted of two 18-kw. D.C. 460/500-volt generators, driven by two horizontal British Westinghouse gas engines fed from a Dowson and Mayson suction-gas plant. This plant is of such capacity, and the pipework so arranged that each producer is capable of serving either engine, or, if necessary, both engines can be run on either producer.

Particular care was given to the switchboard; all the machines are protected by double-pole enclosed fuses and automatic switches. On the left-hand side of the switchboard the conductor is arranged for the positive side of the system and the right-hand side for the negative.

The switchgear is fool-proof; in the case of the booster panels the switch is interlocking so that it is impossible for the booster armatures to be short-circuited whilst the fields are excited.

The battery panels are provided with instruments recording charge and discharge, and wattmeters recording units put in and taken out of the battery, the charge side of the meters reading slow and enabling the staff to put back the additional amount of energy required, based on the efficiency guaranteed by the makers.

The new plant installed consists of a 65-kw. 460/500-volt direct-coupled Johnson & Phillips generator, driven by a vertical four-cylinder Hindley engine taking gas from a Salmon & Whitfield gas plant. The latter is designed to burn low-grade anthracite, and is capable of dealing with all three engines. An electrically-driven fan is provided to facilitate starting, and also the engines are started up by the "Leigh Osborn" patent starting gear, the combined arrangement enabling either engine or gas plant to be started up under five minutes.

Main Switchboard, Weaverham Generating Station.

Two 16-kw. Johnson & Phillips motor alternators link up the A.C. and D.C. systems. The D.C. machines are 460/500-volt, compounded when running as generators to give a flat voltage curve, and owing to cyclic variations experienced in a gas-driven station, as motors to give a constant speed. The A.C. machines are single-phase for 300 volts 50 periods, the fields being excited at 460 volts from the main switchboard.

One 14-kw. three-machine booster operates with the storage batteries, or, if desired, in series with the three-wire feeders.

The low-tension switchboard was extended by the addition of a 65-kw. generator panel; two D.C. motor and two A.C. generator panels for the motor alternator; a transformer and synchronising panel for the primary sides of two 15-K.V.A. step-up single-phase oil-immersed transformers, arranged through D.P. switches and fuses so that either or both can be placed in work. The transformers step up from 300 to 3,000 volts, and from the high-tension sides leads are taken to a high-tension switchboard consisting of two steel cubicles built upon angle-iron framework, which contain two sets of isolating switches, two automatic oil switches, and two high-tension voltmeters.

This board puts either one or both of the transformers into the H.T. line.

All the cables are drawn through earthenware pipes, the H.T. cable terminating inside the cubicles; provision has been made at either end of the H.T. board for another feeder and an A.C. generator panel.

Both the H. and L.T. switchboards and cables were also made by Messrs. Johnson & Phillips.

The battery room contains two 500 ampere-hour batteries by the D.P. and Premier Battery Companies, and provision has been made in the containing boxes for the addition of more plates to increase the capacity to 700 ampere-hours. All the leads are bare copper rods supported on porcelain insulators.

The company's charges for energy are on a very reasonable basis, being 6d. per unit for lighting; 1¼d. for heating and cooking; and 2d. per unit for power up to 1,000 units per quarter, all in excess being charged at 1d. per unit. As an alternative, the consumer can be charged £4 per K.V.A. of maximum demand, plus ¾d. per unit.

To deal with smaller classes of consumers, the company supplies at a fixed charge of 3s. 3d. per quarter per 30-watt lamp, or 400-watt iron, subject to the latter being used during non-lighting hours. Financially the company has been very successful; at the end of 1912, after only nine months' working, a dividend of 5 per cent. was paid, after allowing 2 per cent. depreciation and wiping 20 per cent. of the preliminary expenses off. At the end of 1913 the same dividend was paid and depreciation allowed.

The contractors for the scheme were Messrs. Johnson and Phillips, Ltd., who carried out the work to the specification of Mr. A. J. Leigh, the company's consulting engineer, the resident engineer being Mr. F. Foster.

AN INVESTIGATION OF DIELECTRIC LOSSES WITH THE CATHODE-RAY TUBE.*

By JOHN P. MINTON.

(*Concluded from page 93*)

The dielectric loss, power factor, and current have been determined for a number of different insulating materials and have been plotted against the applied voltage, the temperature, and per cent. absorbed moisture in the case of paper.

All the tests embodied in this paper have been made at 60 cycles with a generator which produces very nearly a sine wave. The tests were made in good transformer oil to avoid corona, and the brass test terminals were either 20 cm. or 25.4 cm. in diameter and 0.5 cm. thick. They were square-edged and arranged so that they could be clamped into position after good contact was obtained.

A large number of tests have been made on various kinds of varnished cloths. The different test samples were about 30 cm. square, and were built up of separate sheets of the same size to the required thickness. In figs. 7 to 10 are illustrated some of the results. For sample No. 1, it is seen that the losses at 138 deg. Cent. are forty-five times as great as they are at 25 deg. Cent., and for sample No. 2 the ratio is twenty-five to one. All the curves are consistent in showing that No. 1, No. 3, and No. 2 represent the order in which the samples should be placed, as far as their insulating value is concerned.

It will be interesting to compare these results on varnished cloths with those on some others. In one instance, with another varnished cloth at about 200 volts per mil and 100 deg. Cent. the watts per cu. cm. were about 4.0, the per cent. power factor 98, and the milliamperes per sq. cm. about 0.050. Comparing these values with those given in figs. 7 to 10, one will note the following points: watts per cu. cm. at 200 volts per mil and 100 deg. Cent. are about twenty-three times as great for the above cloth as they are for sample No. 1; the current value is about five times as great and the power factor about four and a half times as great for the former cloth as for the latter. On the other hand, another sample of varnished cloth has yielded a power factor at 100 deg. Cent. of about 13.5 per cent. compared with about 20 per cent. as shown in fig. 9. These numbers show in a striking manner the difference likely to be found in various kinds of varnished cloths, and they also show that tests of dielectric losses yield most valuable results. When a loss of 4.0 watts per cu. cm. is observed in a piece of insulation whose volume is about 250 cu. cm., it means that about a kilowatt is producing heat in it. Under such severe conditions a piece of insulation will always be punctured within a few minutes.

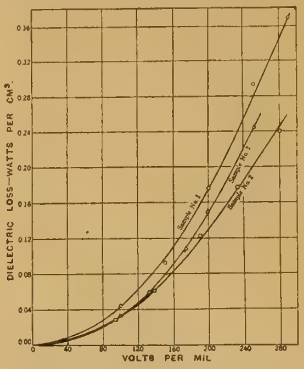


Fig. 7.—Dielectric Loss and Volts per mil at 100° C.

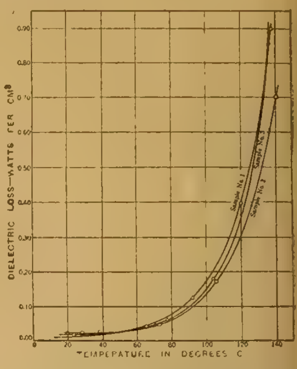
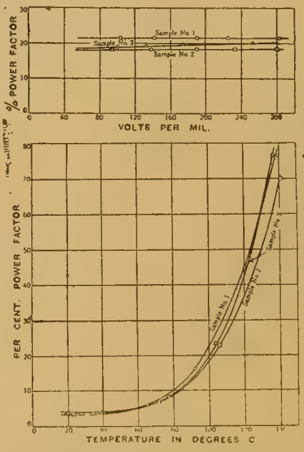


Fig. 8.—Dielectric Loss and Temperature at 200 v. per mil.

Twelve-mil Black Varnished Cloths; Total Thickness: 1, 0·1214 in.; 2, 0 1245 in.; 3, 0·1093 in.

Samples of pressboard were cut, 30 cm. square, from regular 3/32-in. stock, and after drying were impregnated with good transformer oil. Each of the test pieces consisted of one sheet of oil-treated pressboard of the dimensions given above. Figs. 11 to 13 show a set of curves taken on pressboard sample No. 1.



Figs. 9 and 10.—Power Factor of Varnished Cloths.

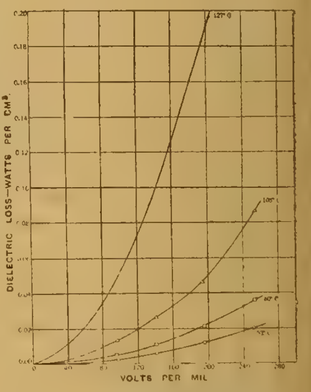


Fig. 11.—Dielectric Loss and Volts per mil; Oil-treated Pressboard 0·193 in. thick.

Results on two other samples of oil-treated pressboard, of the same kind as sample No. 1, show that a peculiar phenomenon occurs as the applied voltage is increased. One is surprised to observe large variations in the losses, power factors, and current values for the same insulations under the same voltage and temperature conditions. The explanation of these variations is found in the quantity of absorbed moisture the samples contained. In order to determine how the losses, power factors, and current for oil-treated pressboard are affected by the quantity of absorbed moisture, a number of samples of the same kind of pressboard as tested above was taken.

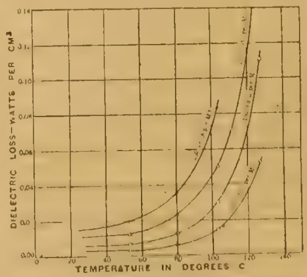


Fig. 12.—Dielectric Loss and Temperature.

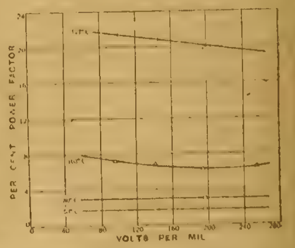


Fig. 13.—Power Factor and Volts per mil.

Oil-treated Pressboard.

In figs. 14 and 15 will be found results taken at 200 volts per mil and at three different temperatures on several sheets of pressboard containing different percentages of moisture, which show the enormous influence absorbed moisture has on the losses and power factors for porous insulation capable of absorbing moisture.

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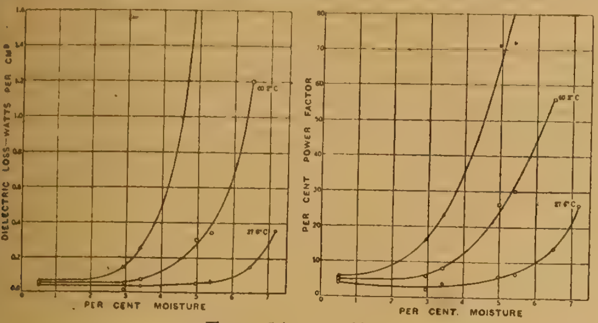
* Abstract of paper read before the American Institute of Electrical Engineers, July 2nd, 1915.

The results are expressed in the form of empirical equations connecting the various quantities. The equations reveal the fact that the nature of the increased conductivity is the same for both temperature and moisture. This lends strength to the belief that moisture may be responsible for a large part of the phenomena observed. This is also further strengthened by the fact that the currents, power factors, and losses, increase many fold in the neighbourhood of 100 deg. Cent. and especially above this temperature. This temperature is a critical point for water at atmospheric pressure, but it would require over 100 deg. Cent. to boil water in extremely small capillary tubes such as exist in porous insulation. If the moisture is entrapped in an insulation that is only slightly porous, then it could not be eliminated by evaporation so easily. Consequently, when the temperature of the insulation is, say, 125 deg. Cent. the moisture may show decided increases in conductivity that do not show up below 100 deg. Cent. Since most of the losses are due to the absorbed moisture it is reasonable to believe that they are to a great extent in the moisture itself rather than in the insulation. This means that the temperature-rise occurs in the former before it does in the latter. Not more than 12 cu. cm. of moisture existed in any of the test samples considered in this paper, and for this reason the losses could apparently produce marked changes in the insulation. As a matter of fact, probably little change took place in the material itself, and almost the whole change probably was due to the increased conductivity of the moisture on account of the heating effects within it. It is advisable, therefore, to look carefully into the nature of the foreign material an insulation contains, whether this material be moisture or other harmful substances. The equations show that the weakening effects increase as the 5th or 6th power of the temperature and moisture. So that, if the moisture is present to only a few per cent., these effects become excessive and the increase of temperature magnifies them still more. As a whole, the results point to a conductivity of an electrolytic nature.



Figs. 14 and 15.

Effect of Moisture on Dielectric Loss and Power Factor of Oil-treated Pressboard.

Both the current and voltage can be measured to within one or two per cent., but the largest error is introduced by the measurement of the minor axes of the ellipses on the photographic plates. For low power factors, as shown in the first illustration in fig. 6, each point for dielectric loss may be in error by 5.5 per cent. One, two, and five per cent. are used respectively for the errors due to voltage, current, and power factor measurements. When points for a curve are taken it is probably true that a point taken off an average curve will not be in error by more than about 2.5 per cent. Certainly, with the larger power factors this precision can be obtained with the cyclograph. An accuracy equivalent to this is quite satisfactory for the kind of work to which this apparatus is adapted.

The following conclusions are arrived at as a result of this investigation on dielectric losses:—

1. The successful application of the cyclograph in determining dielectric losses in insulations is amply demonstrated by the results given in this paper.

2. For good insulation the current should vary directly as the applied voltage. If the current increases more rapidly than this, it will show weakening properties.

3. The dielectric losses vary over wide limits depending on the condition of the tests and the nature of the insulations. The losses show clearly the electrical value of an insulation.

4. The results given in the paper show that the power factor of insulation may vary from about 2 to 99 per cent. The nature of the insulation and the condition of the tests determine its value.

5. It is shown that the watts do not vary as the square of the voltage, but may vary from the 1.32 to the 2.52 power of the voltage.

6. The weakening effects in insulation, as shown by the dielectric losses, power factors, and currents, may increase as rapidly as the 5th or 6th power of the temperature.

7. The weakening effects in pressboard, and very likely other water-absorbent insulations, may also increase as rapidly as the 5th or 6th power of the per cent. absorbed moisture. When the free moisture is above 3 per cent. the weakening effects due to its presence are quite pronounced.

8. Empirical equations are derived that will express the dielectric losses, currents, and power factors, as functions of the voltage, temperature, and absorbed moisture.

NEW ZEALAND'S WATER-POWER.

In a recent issue of the *Engineering Magazine*, Mr. W. Wilson deals in an interesting manner with the various hydro-electric projects in the Dominion.

Both islands are mountainous in character and contain numerous lakes, cataracts, and waterfalls, and it has been estimated that at least 4,000,000 H.P. awaits development.

The Government controls the water powers, but, while developing certain large schemes itself, permits private concerns also to utilise water powers subject to an annual payment for the privilege.

About thirteen years ago a private company applied for rights to use the Waipori Falls, some 30 miles from the City of Dunedin. This request was granted without any payment, and not long afterwards the City Corporation purchased from the company the water-rights, which had been acquired for nothing. As a result, the Government decided in future to retain and develop all water powers, and announced, after some delay, their intention of expending £2,000,000 upon eight schemes distributed through the Dominion, at the following places:—

	H.P.	Cost.
1. Wairua Falls, North Auckland ...	3,000	£100,000
2. River Kaituna, South Auckland ...	10,000	320,000
3. Makuri, North Wellington	6,000	200,000
4. River Hutt, South Wellington ...	10,000	300,000
5. Lake Coleridge, Canterbury	10,000	270,000
6. Kumara, Westland	3,000	75,000
7. Teviot, Otago	10,000	300,000
8. Lake Hauroto, Southland	10,000	350,000

It was proposed to make an immediate start with locations Nos. 1, 4, and 5 at once, but eventually it was decided to complete No. 5 as soon as possible, and to use the experience so gained in carrying out the others. At the end of nearly four years, the plant mentioned is now in operation, but in the meantime the Government, which had held office continuously for 21 years, was replaced by one whose announced intention was to afford much greater facilities for the use of water-power. At once, a private company purchased, for £150 per annum, the rights to the Wairua Falls, No. 1, and their station is fast approaching completion. Other enterprise has taken place on smaller schemes, and is foreshadowed on a larger scale in the near future, though the rapid improvement in the lignite gas-producer has assisted the institution of small local power-houses at the expense of the hydraulic central station.

Dealing with the individual plants, that at Lake Coleridge was selected by the Government as their initial enterprise partly because of the demand for electricity by the citizens of Christchurch, who had been vainly endeavouring for years to secure water-rights for themselves, and partly because of the outstanding advantages of the scheme itself.

Christchurch is 70 miles distant, and three-phase transmission was decided on, at 66,000 volts—ten times the dynamo pressure. Entirely duplicate lines have been constructed, pursuing different routes. Aluminium cables carry the current, supported on porcelain pin-type insulators attached to ironbark poles at six-chain intervals.

The power-house was designed to contain six 1,500-H.P. Francis turbines, of which three by Escher-Wyss are already working, in conjunction with Bruce Peebles alternators. It is now probable, however, that the new units will be double the intended capacity. Six single-phase General Electric (U.S.A.) water-cooled transformers are used at each end of the line, and protection from lightning is afforded by aluminium electrolytic arresters made by the same firm. All are housed in a flat-roofed ferro-concrete power station, the construction of which cost 8¼d. per cubic foot.

The current from this installation is to operate the first electric railway in New Zealand, that from Christchurch to the coast, which passes through a tunnel nearly two miles in length.

The Wairua Falls scheme is situated on a lowland river with no natural storage. It is being undertaken by the Dominion Portland Cement Co., whose new mill is under construction on the shores of Whangarei Harbour, sixteen miles distant; but electricity is also to be provided for the town of Whangarei, five miles further on. The Falls themselves are 48 ft. high, but they are followed by a series of cataracts which more than treble the head. A low dam 8½ ft. in height is being constructed across the river immediately above the Falls, which will impound sufficient water to keep the plant working for three weeks without any assistance from the river.

From the dam a race, 1½ miles long, will secure a head of 140 ft., and two Boving turbines are being installed in a ferro-concrete power-house to give 1,350 H.P. each. It is intended to duplicate this plant in the near future. The General Electric Co. (U.S.A.) have furnished practically all the electrical machinery. As in the previous scheme, aluminium cables are employed. The delivery of current was to begin in the middle of 1915, and the cost of the work is estimated at £50,000.

At the power plant of the Waihi Gold Mining Company at the Hora Hora Rapids on the Waikato River, by cutting a straight canal, 100 ft. wide at the bottom, to short-circuit the rapids, and projecting an inexpensive crib-work dam into the river, a remarkably simple scheme for generating 9,000 KW. has been brought about. Six quadruple sets of Boving turbines drowned in forebays external to the generating station, drive the Siemens three-phase alternators within.

A distance of about 50 miles separates Hora Hora from Waihi, and the transmission voltage is 50,000 stepped up from 5,000 by single-phase transformers in a separate sub-station. A single transmission line only has been erected on latticed-steel towers with copper conductors. Current is provided to any towns in the vicinity that desire it. In this case, the water-rights cost the company £1,200 per annum.

Other power production is probable before many years upon the Waikato. At Hora Hora, the capacity of the present plant can be increased by at least 60 per cent. Nearer the lake are the Huka Falls capable of giving 38,000 H.P., and the Arateatea Rapids with a capacity of near 60,000 H.P.

Scheme No. 2 of the Government list possesses advantages of constancy equal to those of the Coleridge and Hora Hora plants; the Kaituna River will provide about 40,000 H.P. for development. This project is marked down for the supply of Auckland, but the transmission distance of 150 miles is delaying its achievement. Meanwhile, Auckland is equipped with a growing steam station, and other towns are also acquiring their own installations. At present there is in the Kaituna Gorge a small 250-KW. plant which makes use of a short cataract known as the Okere Falls. The system is three-phase, at 6,000 volts and 50 cycles, which frequency is the standard in New Zealand. A wooden pole line runs to Rotorua, eleven miles away.

The Waipori Falls station is interesting as being the first large hydro-electric enterprise in the Dominion, and an example of the mountain cataract type of scheme. The power house contains six 1,000-KW. units, each consisting of a General Electric (U.S.A.) generator driven by two Pelton wheels with Lombard governors and deflecting nozzles.

About 29 miles separate the Falls from the sub-station just outside Dunedin, and three-phase current is generated at 2,400 volts, and transformed to 34,700 volts for transmission. Dry seasons have caused constrictions in the output, and lately a Diesel stand-by station has been erected, which has largely corrected these faults. Storage, too, has been effected at three places above the Falls, with good results.

A small installation utilising Pelton wheels operates the pumping and other machinery of the Ross Goldfields, in Westland, where the chief requirement was the unwatering of abandoned workings. There was available an electric supply of 700 KW. obtained from Lake Kanieri, 23 miles away. This body of water covers twelve square miles, almost equal to that of Lake Coleridge but situated in a region where the annual rainfall is 120 in., about three times that at the latter place.

The generators give three-phase current at 2,300 volts, and single-phase transformers raise the voltage to 24,000 for transmission. In addition to the mine load it is intended to supply the towns of Ross and Hokitika, the capital of Westland, and the surrounding districts from this plant.

Railway electrification in the partially completed Otira Tunnel and its approaches in the mountain range separating Canterbury from Westland will make a demand for energy that is already under the consideration of the Public Works Department. While it is quite feasible to bring current from Lake Coleridge, roughly fifty miles distant, there are many local falls that may easily serve the purpose. Two of these are at present providing power for drilling the big tunnel on opposite sides of the Pass. Each contains two 290-KW. sets working at a head of 700 ft. Both plants suffer from occasional shortage, chiefly in winter, when the sources partially freeze. A steam plant of about 150 KW. is employed at the western end, where most work is done, to assist the water-wheels during times of scarcity. At Te Aroha, in the North Island, there is a municipal power station where a reservoir 800 ft. above the Pelton wheels equalises the supply to some extent.

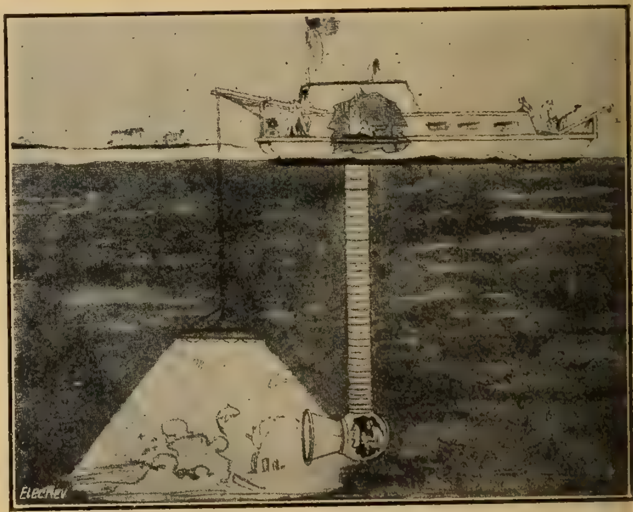
In addition to public schemes there are a number of private ones which have for their object the supply of single enterprises. New Zealand farmers are recognising more and more the great advantages of electricity not only for lighting, but also for shearing, milking, pumping, chaff-cutting, and the host of operations on a farm performed nowadays by machinery. Such plants, driven by hydro-electric current, are established at Kaiwarra, Glenmark, Hawarden, and Temuka, in Canterbury, and in other parts of the Dominion. So far, electric ploughing has not yet made its appearance, but this should not be long delayed.

Future opportunities for power development occur over almost the whole country. Practically every one of the numerous lakes is a potential power site of the most satisfactory order, and in spite of the war, activity in exploitation should continue. In one of the big schemes now under construction it was found that the electric machinery, though nominally British, was of German manufacture and could not be delivered. However, the deficiency was at once made good by an American firm and the opening will not be delayed by the change. For a long time New Zealand will be dependent upon imported machinery, the local manufacturers being at present restricted to the smaller apparatus, such as low-power transformers.

SUBMARINE PHOTOGRAPHY BY AID OF QUARTZ LAMPS.*

In these days of daring exploits of arms, where the engines of destruction that operate under water are the cause of so much comment, it is pleasing to turn to an equally remarkable but humane and constructive development of science. An achievement that seems destined to play an important part in marine affairs is that of submarine photography, or the taking under water of pictures, both stationary and moving. The actual taking of the photographs is not so difficult, the main requisite being to get beneath the water, to remain there in comfort, and be able to perform the work.

This work is made possible by an invention of Charles Williamson and his two sons, of Norfolk, Va., which consists of a collapsible accordion-like submarine tube of waterproof canvas and rubber, three feet in diameter, braced at regular intervals by iron rings. This construction permits the passage of a person down the tube, and its flexibility permits it to be dragged along by a vessel. The top of the tube remains open at the deck; the lower end extends down into the water and expands into a chamber about five feet in diameter, one side of which is provided with a glass observation window through which the pictures are taken. The space in the chamber is sufficient to accommodate two men, one to operate the camera and the other to control the movement of the tube, which is effected by chains operated from the deck of the boat. Fresh air is provided by a simple ventilating device, enabling the operators to work in comfort. The general arrangement is shown in the figure. In order to accomplish submarine photography, however, it was necessary to secure some efficient means of artificial illumination which could be easily handled, would furnish the desired light, and not be prohibitive in cost. After trying other types with varying success, the Cooper Hewitt mercury-vapour quartz lamp was adopted. A battery of nine of these lamps, each of 2,400 C.P., was installed. The essential parts of the lamp are the quartz burner and the auxiliary. The former comprises the light-giving tube, its support and enamelled reflector, while the latter consists of the necessary tilting mechanism and coils for starting and maintaining the mercury arc.



ARRANGEMENT FOR OBTAINING SUBMARINE PHOTOGRAPHS.

In ordinary commercial use, the burner is suspended from the lower part of the auxiliary and enclosed in a glass globe, but for submarine work, the auxiliary is kept on board the boat, and the burner with its reflector holder is mounted in a casing that is placed in a frame and lowered into the water. The method of installation is shown above.

Highly instructive and interesting photographs and moving pictures have been taken through the water by the method described for a distance of 100 ft., thus marking an epoch in photography and surprising even the most ardent advocates of the scheme.

Electric Motor-car Running Costs.—With the object of ascertaining approximately the average cost of running electric motor-cars of the pleasure type, the Electric Vehicle Association of America recently sent out a circular letter to owners scattered over all parts of the United States. Over 100 replies were received, an analysis of which showed that where the vehicle is privately garaged, the average cost for battery charging energy is 23s. 10d. per month. The cost of washing, polishing, storage and battery charging in public garages varies from £3 to £8 per month; the average monthly distance travelled was found to be 300 miles, while the average battery life worked out at 2¼ years. Tire costs average 11s. 7d. per month, the length of service secured from the tires extending from 15 to 48 months.

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* *Electrical Review and Western Electrician.*

WAR ITEMS.

Exports to Allied Countries.—The Board of Trade desire to inform merchants, manufacturers, and shippers that applications for permission to export to allied countries goods of which the export is prohibited by proclamation will receive special consideration if it can be clearly shown that the goods are destined for the use, directly or indirectly, of the Allied Government concerned or its military or naval forces. Such applications must be made to the Secretary, Commission Internationale de Ravitaillement, India House, Kingsway, W.C. The Commission will not recognise as evidence of the official destination of the goods documents issued by provincial military or naval officers, other local authorities, or Government contractors in the country to which the goods are to be exported unless such documents are formally approved in writing by the competent Department of the Government concerned. British manufacturers, merchants, and shippers are, accordingly, warned that before entering into any contracts for the supply of goods stated to be for the use of the Government of an allied country they should first instruct their clients in that country either to furnish them with written evidence that the proposed contract has the approval of the Ministry of War, Ministry of Marine, or other Department concerned, or to have a notification of its approval transmitted by such Department to its representative on the Commission Internationale de Ravitaillement. Any firms accepting contracts without following the above procedure will do so at their own risk, and with full knowledge that permission to export the goods which they have contracted to supply may be refused. Applications for permission to export goods which are ordered by firms or individuals in an allied country for purely industrial purposes, and which are not destined for the use of an allied Government or its military or naval forces, should be made in the ordinary manner to the Secretary, War Trade Department, 4, Central Buildings, Westminster, S.W.

The Views of a German Electrical Manufacturer.—According to the "Morning Post," Dr. Wilhelm von Siemens, head of the great German electrical company that bears his name, has written, in the "Journal" of the Association of German Engineers, his views concerning the possibilities of submarine warfare. He declares that German engineering science must devote itself with supreme energy to the task indicated by the success achieved by the submarine boats in order to furnish the requisite counterpoise to the weight of the 12-inch guns and of their successors. He urges the necessity of losing no time in devoting work, pains, and money to the accomplishment of an aim that may at present be somewhat problematic, and in exhausting all possibilities and points of departure. It is an abnormality, he declares further, that a nation with a small number of its men under arms can occupy a commanding position in the world solely by the creation of a surpassing technical implement, whereas the real worth of a nation must depend on its size, on the nature and character of its men, of its culture, and of its capabilities. Dr. von Siemens concludes as follows:—"What has been achieved by means of our submarine boats is a tangible beginning which we shall bring to perfection. The power that we shall then obtain to exclude England from the trade routes leading to the centre of the English world-power we shall hold in our hands as a pledge, until the freedom of the seas and of the trade routes has been wrested from the English, not only for us but for the whole world."

The French Thomson-Houston Co.—The report for 1914 of the Compagnie Francaise Thomson-Houston, which was formerly in close relations with the Berlin A.E.G., details the arrangements which existed between the two companies, by way of reply to the attacks made upon the French company on account of the connection in question. Concerning the future development of the undertaking, the report remarks that co-operation between the French and the Germans appeared to be out of the question, but a solution of the complicated conditions would probably be simplified by the victory of the French arms. In the meantime, the French A.E.G. company had been dissolved. The gross profits of the French Thomson-Houston Co. amounts to £302,000, and the net profits, after meeting general expenses and interest on loans, to £181,000, as compared with £213,000 in 1913. The sum of £61,000 has been applied to depreciation, and the balance of £120,000 permits of the payment of a dividend of 5 per cent. on the ordinary share capital of £2,400,000.

The Berlin A.E.G.—According to a statement issued after a meeting of the board of directors on July 8th, the invoiced turnover from Berlin down to the end of April, plus the orders on hand—that is to say, for a period of ten months—amounted to the same figure as in the corresponding term in the preceding year, despite the absence of business with enemy countries. The credit held at the bankers at the end of the financial year, on June 30th, is reported to have totalled £4,150,000, exclusive of the £1,800,000 advanced to the A.E.G. High-Speed Railway Co., and the sum of £425,000 lent to the Berlin Electricity Works Co., whilst £500,000 has been invested in German and Austrian war loans. An order for a complete power station, with an initial equipment of 100,000 H.P., has been received from the Electro Works Co., which is to supply power in connection with a great scheme for the fixation of atmospheric nitrogen. The number of the company's employés called up for service has been 20,500, and the voluntary grants made by the company to their dependents have been about £250,000 down to the end of June.

Pro-German Agents Abroad.—The Board of Trade calls the attention of British firms who contemplate the appointment of new agents in foreign countries to the desirability of their satisfying themselves that the persons they propose to select are not unfriendly to Great Britain or her Allies. Where the individuals selected are not personally known to those with whom the appointment rests, the advice of His Majesty's Consular officers can always be secured in such cases by British subjects who apply to them.—"Financial Times."

Catalogues Wanted.—Lieutenant W. H. Marshall, R.E., M.I.E.E., M.I.Mech.E., would be glad to have the latest catalogues and price lists of cables, joint boxes, feeder pillars, dynamos, motors, switchgear, fittings for internal electric wiring, incandescent lamps, transformers, etc., sent to him at the Royal Engineer Office, Weymouth.

The War Loan.—In addition to the £17,000 already held by them in the original War Loan, the Armorduct Manufacturing Co., Ltd., have applied for a further £7,000 in the new Loan.

The St. Pancras B.C. has invested £10,000 of the electricity reserve fund in the new War Loan.

The County Co.'s Roll of Honour.—One of the most impressive rolls of honour that has yet reached us from electrical undertakings is that of the County of London Electric Supply Co., Ltd., and its associated companies. It gives the name, rank and regiment of 226 men "who have answered their country's call in defence of a 'scrap of paper.'" Three out of the number have been killed and four wounded.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

SOUTH AFRICA.—The following regulations have been laid down by the Government:—

Exportation of the following goods is prohibited except with the permission of the Minister of Defence: Mining cables; mines and parts thereof; searchlights; naval and military stores of every description; shipbuilding materials; signalling lamps; submarine and other signalling apparatus.

Exportation of the following goods is prohibited, except with the permission of Collectors of Customs, to destinations in the British Empire and countries of Allies and Neutrals: Asbestos; copper and zinc in ingots of approved brands (affecting re-exports only); india-rubber sheet, vulcanised; mica (including mica splittings) and micanite.

Exportation of the following goods is prohibited to all destinations other than the United Kingdom, British possessions and protectorates: Aluminium, aluminium alloys, etc.; copper unwrought and part wrought, all kinds; ferro-alloys; graphite; lead, pig, sheet, or pipe; tungsten, molybdenum, vanadium, nickel, selenium, cobalt, and manganese; rubber goods.

Exportation of the following goods is prohibited to all foreign ports in Europe, and on the Mediterranean and Black Sea, other than those of France, Russia (except Baltic ports), Belgium, Spain, and Portugal: Magnetic iron ore; copper ore, hematite iron ore, iron ore, hematite pig iron, iron pyrites; railway material, both fixed and rolling stock; materials for telegraphs, wireless telegraphs, and telephones; galvanised wire; steel wire.

NORWAY.—The Norwegian Government has prohibited the exportation of the following goods: Antimony, unwrought, crude, and scrap; graphite, unwrought or crude, except graphite produced in Norway and accompanied by a certificate of origin; graphite for use in foundries, including crucibles; molybdenum, unwrought or crude; scheelite, wolframite, and molybdenite, except that produced in Norway and accompanied by a certificate of origin; vanadium and tungsten, unwrought or crude.

FRANCE.—The Board of Trade are in receipt, through the Foreign Office, of copy of French Ministerial Decree, dated April 28th, which abrogates the provisions of the Decree of February 12th in virtue of which lead ore was allowed to be exported from France, without special authorisation, when consigned to the United Kingdom, the British Dominions, Colonies and Protectorates, Belgium, Japan, Montenegro, Russia, Serbia, and the United States of America.

H.M. Ambassador at Paris, in forwarding this Decree, states that he has been informed by the French Ministry for Foreign Affairs that applications for special permission to export consignments of lead ore to the United Kingdom will be favourably considered.

SPAIN.—The Spanish Government has prohibited the exportation of the following goods: Aluminium and alloys thereof, antimony and alloys thereof, bauxite or aluminium ore, tin and alloys thereof, zinc and alloys thereof in cakes, nickel and alloys thereof, rubber and mixtures thereof, wholly or partly manufactured; anhydrous or hydrated alumina, chrome, molybdenum, manganese (metal), vanadium, ferrochrome, ferro-molybdenum, ferro-nickel, ferro-tungsten, ferrovanadium, and partly or wholly manufactured articles of copper or brass; tinplate.

ROUMANIA.—The Roumanian Government has prohibited the exportation of the following goods: Old iron; metal ores; tinplates and tins; graphite; mercury; cords and cables of any kind.

CANADA.—The following regulations regarding the prohibition of exportation of certain goods have been issued by the Canadian Government:—

Mica and micanite to all destinations other than the United Kingdom, British possessions and protectorates, France, Russia (except Baltic ports), Japan, United States (when for consumption in United States only or shipped to specified consignees in United Kingdom *via* United States, or exported *via* United States under licence or dispensation from Canada).

To all destinations abroad other than the United Kingdom, British possessions and protectorates: Carbons suitable for searchlights; certain chemicals; ferro-alloys; graphite, including foundry, plumbago. Metals and ores, the following, namely:—Alumina and salts of alumina; aluminium and alloys of aluminium; antimony and alloys of antimony; bauxite; chrome ore; cobalt; copper, unwrought and wrought; lead, ore, pig, sheet, or pipe (including solder containing lead); manganese and manganese ore; mercury; molybdenum and molybdenite; scheelite; selenium; tin and tin ore; tungsten; vanadium; wolframite; zinc and zinc ore, and sheets; mines and parts thereof; rubber; searchlights; signalling apparatus; telephone sets and parts thereof; galvanised wire and steel wire.

To all foreign ports in Europe and on the Mediterranean and Black Seas other than those of France, Russia (except Baltic ports, Belgium, Spain, and Portugal): Asbestos; rubber sheet, vulcanised; copper ore, iron ore, hematite pig-iron, iron pyrites, nickel and nickel ore; engine and boiler packings; railway material, both fixed and rolling stock; materials for telegraphs, wireless telegraphs, and telephones.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

9,783. Sparking-plugs for Internal-combustion Engines. Daimler-Motoren-Ges. July 5th. (Convention date, July 6th, 1914, Germany.) (Complete.)

9,792. Starting Arrangement for Internal-combustion Engines in which an Electric Starting Motor is used. Soc. Anon. pour l'Eclairage Electrique des Vehicules. July 5th. (Convention date, July 30th, 1914, France.) (Complete.)

9,797. Apparatus for Opening and Closing Electrical Circuits at a Certain Temperature. E. J. Sumner. July 6th.

9,806. Switches for Controlling Lift or other Motors. J. A. Steven. July 6th. (Complete.)

9,808. Apparatus for Grinding the Plugs into the Seats of Steam and like Cocks. Smith Bros. & Co., Ltd., and J. M. Dempsey. July 6th.

9,809. Self-regulating Dynamo-electric Machines. Boultbee Brooks and W. Holt. July 6th. (Complete.)

9,812. Devices for Localising Bodies by the Aid of X-rays. F. F. Renwick. July 6th.

9,828. Manufacture of Electric Heating Elements. H. J. Dowsing & D. Huntley. July 6th.

9,834. Electric Mine Lamp. J. W. Rigby. July 6th.

9,836. Electric Motor Control Systems. British Thomson-Houston Co., Ltd. (General Electric Co., United States). July 6th.

9,852. Impulse Transmitters for Telephone Systems and the like. Relay Automatic Telephone Co., Ltd. (L. C. Bygrave). July 6th.

9,875. Electric Lighting Means. R. S. Woods. July 7th.

9,899. Electricity Transformers. J. Longman. July 7th.

9,903. Electrical Connections particularly applicable to the Sparking Plugs of Internal-combustion Engines. J. A. Kennedy-McGregor. July 7th.

9,912. Reception and Transmission of Sound or Compressional Waves. S. G. Brown. July 7th.

9,915. Brake for Electrically-propelled Vehicles. Rt. Hon. H. L. Samuel, W. Slingo, H. C. Gunton, and C. H. Douglas. July 7th. (Divided application on 15,539/14, January 28th, 1915.) (Complete.)

9,921. Electrical Transformers. G. Harlow. July 7th.

9,922. Rotary Motors. E. E. Hauer. July 7th. (Complete.)

9,934. Small or Pocket Electric Flash Lamps. F. O. Trautmann. July 8th

9,938. Night Gun-sighting Electric Torch. D. Goodman. July 8th.

9,957. Preparation of Electrolytes for use in the Electrolytic Deposition of Metals. P. Marino. July 8th. (Addition to 28,953/12.) (Complete)

9,960. Vapour Electric Devices. British Thomson-Houston Co., Ltd. (General Electric Co., United States). July 8th.

9,964. Electric Joint. G. H. Scholes. July 8th.

9,972. Storage Battery Element and method of making the same. J. Redding. July 8th. (Convention date, July 10th, 1914, United States.) (Complete.)

9,981. Electric Clock. F. O. Read. July 8th.

9,982. Apparatus for Detecting, Indicating, or Measuring Variations or Movements in Magnetic Fields. G. J. Paulin. July 8th.

9,993. Combined Locking Device and Shade Support for Electric Incandescent Lamps. W. C. Crockatt. July 9th.

10,006. Telephone and other Diaphragms. B. A. Pilkington. July 9th.

10,026. Electric Junction Box. G. H. Scholes. July 9th.

10,050. Impulse-senders for Subscriber Apparatus in Automatic Exchange Systems. Aktieselskabet Elektrisk Bureau. July 9th. (Convention date, July 14th, 1914, Norway.) (Complete.)

10,054. Telephone Locks. J. E. Lavalley. July 9th. (Complete.)

10,059. Vibrating Make-and-break Devices for use in Electric Signalling. A. C. Brown. July 10th.

10,067. Clockwork Time-switches and the like. E. H. Horstmann and Horstmann Gear Co., Ltd. July 10th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

24,029. "Manufacture of incandescent electric lamps." C. Gladitz. October 23rd.

24,450. "Arrangement for the automatic protection of air-cooled electrical machines against damage through ignition of the air filters." Allgemeine Elektricitats Ges. October 28th. (January 29th, 1913.)

1914.

3,020. "Magnetic speed indicators." W. Beckmann. February 5th (March 15th, 1913.)

3,021. "Eddy current speed indicators." W. Beckmann. February 5th. (April 14th, 1913.)

6,866. "Electrical treatment of ores." F. W. Highfield. March 18th.

7,214. "Trolley or collector wheels for electricity." H. McReynolds. March 21st.

7,265. "Regenerative braking of electric motors." Akt. Ges. Brown, Boveri et Cie. March 23rd. (March 22nd, 1913.)

7,682. "Incandescent electric lamps." British Thomson-Houston Co. (Allgemeine Electricitäts Ges.). March 26th.

7,684. "Methods of synchronising rotary and cascade converters." Siemens-Schuckertwerke Ges. March 26th. (April 16th, 1913.)

7,760. "Memorandum boards for use in connection with telephones and the manufacture thereof." J. F. Sessler von Herzinger. March 27th.

7,761. "Method and apparatus for the internal irradiation of the human body by means of rays emanating from a Röntgen-tube or other source." E. Pohl. March 27th. (March 29th, 1913.)

7,779. "Commutators for dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd., C. P. Bramley, & T. A. Wisdom. March 27th.

7,868. "Apparatus for diminishing the air friction in electric machines having flywheels." Siemens-Schuckertwerke Ges. March 28th. (March 29th, 1913.)

8,147. "Cooling device for the electrodes of vacuum tubes, particularly Röntgen tubes." R. Grisson. March 31st. (October 14th, 1913.)

8,258. "Polyphase commutator electric machines." Siemens-Schuckertwerke Ges. April 1st. (April 3rd, 1913.)

8,353. "Pocket electric lamps adapted to be used as target illuminating devices for pistols and the like." P. Schmidt & C. Dobslaw. April 2nd. (April 28th, 1913.)

8,367. "Electrolytic apparatus." Maschinenfabrik Surth Ges. April 2nd. (September 3rd, 1913.)

8,385. "Rotary converters provided with boosters." E. Rosenberg. April 2nd.

8,473. "Automatic signalling devices for indicating faults or other abnormal conditions of electric circuits." Siemens Bros. & Co., and W. H. Grinsted. April 3rd.

12,361. "Selenium cells especially adapted for use in connection with telegraphy." J. S. Withers (K. C. Cox). May 19th.

14,470. "Means for controlling the heating effect of electric heating apparatus." A. F. Berry. June 16th.

14,669. "Electric candle lamps." C. Damey & G. Bradley. June 18th.

14,800. "Apparatus for and method of operating electric signs, devices, indications, and the like." L. Martin. June 19th.

14,817. "Electrical condensers." British Insulated & Helsby Cables, Ltd., E. A. Bayles, and H. Higham. June 20th.

14,891. "Receivers for use with electrical apparatus for transmitting and receiving signals." Sir A. T. Dawson & G. T. Buckham. June 20th.

14,984. "Electric railway systems." Rt. Hon. C. E. H. Hobhouse, W Slingo, H. C. Gunton, & C. H. Douglas June 23rd.

15,194. "Electric motor meters." British Thomson-Houston Co. (General Electric Co.). June 24th.

15,329. "Metal-filament electric lamps." Siemens Bros. & Co., and W. H. le Marechal. June 26th.

15,489. "Electric lamps and their holders." F. Jones. June 27th.

15,585. "Dynamo-electric machinery." Hon. Sir C. A. Parsons. June 29th.

15,617. "Wire filaments for incandescent lamps, and other electric resistances." W. H. Sabine. June 29th.

15,749. "Electric fuses." A. F. Daum. July 1st.

16,590. "Cooling arrangements for dynamo-electric machinery." Siemens Bros. Dynamo Works, Ltd., and E. O. Kieffer. July 10th. (Cognate application, 18,396/14.)

16,680. "Radiators containing liquid and heated by fuel, steam, or electricity." H. Frank. July 13th.

18,870. "Combined lampholder and contacts for electric portable lamps." G. Pearson. August 20th.

19,054. "Receiver for wireless systems." A. J. Roberts. August 25th (August 25th, 1913.)

20,552. "Magnetic separators." S. Bruck. October 5th. (October 3rd, 1913. Additions to 11,898/11.)

21,435. "Electric incandescent lamps." British Thomson-Houston Co (General Electric Co.). October 23rd.

21,955. "Inter-communication telephone systems." W. Blogg & Sterlin Telephone & Electric Co., Ltd. November 3rd.

22,487. "Electric measuring instruments for alternating currents." P. M Lincoln. November 13th. (November 29th, 1913.)

22,691. "Footsteps for telegraph and like poles, brackets for shelving, and other like brackets." Bullers, Ltd., & B. Wood. November 18th.

23,791. "Electric ignition apparatus for internal-combustion engines." C. B. Burdon (Siemens & Halske Akt. Ges.). December 9th.

23,868. "Slot-keys or slot-closing devices for use in dynamo-electri machinery." C. B. Burdon (Siemens Schuckertwerke Ges.). December 10th.

1915.

1,453. "Mercury globule electrical contact maker for releasing mine win-ing signal indicators, actuating indicators of the stopping, starting, and redu-tions of speed of machinery and the like." G. Saint. January 29th.

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VOL. LXXVII. JULY 30, 1915. No. 1,966.

ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: July 30, 1915. [No. 1,966.

Page
Russia and Foreign Capital 129
Lead 130
Wireless Telegraphy and the War 130
E.A.C. Drum Type Control Gear for A.C. Motors (*illus.*) ... 131
The Practical Result of Point Five Tariff 132
Heavy Tonnage Electric Service on the Norfolk and Western Railway, U.S.A. (*illus.*) 134
Correspondence—
  Electric Signalling in Mines 136
  "Autres Temps, Autres Moeurs" 136
  Shop Window Lighting 137
  Branch Offices 137
Legal 137
New Electrical Devices, Fittings and Plant (*illus.*) 139
War Items 139
Business Notes 139
Notes 144
City Notes 148
Stocks and Shares 151
Share List of Electrical Companies 152
Reviews 153
The Central Power Station of the Randfontein Estates, by R. Turnbull Mawdesley (*illus.*) (*concluded*) 154
A Simple Radiographic Method for Localising Bullets, by L. Crouch (*illus.*) 155
On an Unbroken Alternating Current for Cable Telegraphy, by Lieut-Colonel G. O. Squier (*illus.*) 156
Calorising: A Protective Treatment for Metal, by H. B. C. Allison and L. A. Hawkins (*illus.*) 158
Indian Notes 159
Foreign and Colonial Tariffs on Electrical Goods 159
New Patents Applied for, 1915 160
Abstracts of Published Specifications 160
Contractors' Column ... ... Advertisement page xviii

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RUSSIA AND FOREIGN CAPITAL.

IT is undoubtedly a fact that Russian industries and public services, in the form of railways, tramways and electric lighting works, would not have reached their present stage of development had it not been for the enormous investments of foreign capital, which first began as far back as the forties of the past century. The country is considered to be, perhaps even more so than the United States, a land of unlimited possibilities owing to the possession of great natural resources, although the international impoverishment due to the war renders it probable, in the opinion of a German author, that on the conclusion of peace Russia will have to depend to a greater extent upon herself for future progress, as the financial strength of the other nations now at war will only suffice for themselves when that period arrives. If this assumption should eventually prove to be correct—and it certainly possesses an element of probability—it will follow as a matter of course that the present movement for the nationalisation of industries in Russia will not assume the proportions which are hoped for, if not expected, and that that country will still have to rely upon other nations for a large quantity of machinery and plant in the future, in exchange for agricultural and other natural products. In the meantime, let us see what foreign capital has accomplished for Russia in the past.

The foundation of modern industries in Russia is to be found in the iron and steel trades, the engineering trade, the coal industry, the petroleum industry, and the textile trades, all of which are the work of West European enterprise. Belgian and French capital has taken a prominent part in the coal and iron and steel industries, and German investments have been made in the textile industry of Russian Poland, whilst the petroleum district of the Caucasus has been opened up by Swedish and British capital. The real centre of the coal mining and iron and steel industries is in the Donetz basin, whence the bulk of the output of iron and steel is derived. Indeed, if foreigners had not come forward with capital and enterprise, notably John Hughes, it is thought that the iron and steel trade there would probably to-day have remained in an undeveloped state. It is calculated too, that one half of the total production of coal in the region of the Donetz, and in the Dombrovo basin in Poland, which has been for some months past in enemy occupation, is raised by foreign undertakings. In the case of the petroleum industry the expansion has likewise been effected without the assistance of the Government, the progress made being attributed to the arrival of Robert Nobel, a Swede, in Baku in the year 1874, and the formation by the Paris firm of Rothschild, of the Caspian-Black Sea Commercial and Industry Co.

Apart from the great indebtedness of Russia to other countries by reason of the flotation of various foreign loans, the greater portion of the capital invested in the railway system has been raised abroad. At one time the Germans realised considerable profits from railway construction, but that was in the early days of railway work. During the past few years English capital has participated specially in Russian joint-stock companies, particularly in regard to oil undertakings, whilst the North Americans, who formerly ignored the development of Russia, have entered into competition to secure concessions for naval work, tramways and electric lighting works. The Germans, however, claim to be the oldest in the field among the joint-stock companies, and in regard to the manufacture of iron and steel goods, the working of gas and electric lighting stations, the construction of electrical machinery, and the production of chemicals. The chief creditor of Russia is France and the second is Germany, which, it is estimated, has financial interests, including Russian Government securities, amounting to a minimum of £200,000,000 in the country. In recent years, however, the Teutonic participation has been more in the direction of investment in Government financial transactions than in industrial undertakings of any kind.

The future of Russia naturally depends to a great extent upon the successful conclusion of the war, when it is hoped to secure emancipation from German industry as far as possible. On the one hand, a new railway is projected from Petrograd and another city to the north of Russia, where the sea coast is free from ice all the year round, while on the other, a free passage through the Dardanelles is expected in the near future. In this way Russia should be able to find new or more extended markets for her products, and not be dependent, as was the case in 1912, upon Germany for the absorption of exports of the value of £75,000,000 out of total exports of £160,000,000. The exports from Germany to Russia, however, are stated to have amounted only to 7½ per cent. of the total exports of the value of £125,000,000 in the same year, a percentage which represents £9,375,000, and which seems an incredibly small sum. At any rate, it may be definitely concluded that the prospects of the further cultivation of British trade with Russia will be greatly improved on the conclusion of the war. Just as Russia is independent of Germany under existing circumstances, so, when the war is over, will the former endeavour to remain free from the latter as much as possible. That Teutonic competition will be resumed there can be no question, but it is doubtful whether the measure of financial support which it has received in the past will be also available in the future, owing to the financial exhaustion caused by the war. It is this breach that British firms, together with their Allies, should seek to fill, and provided that prices and general conditions are equal, their efforts should be crowned with success. The Anglo-Russian Chambers of Commerce in London and Petrograd, and the Anglo-Russian banking interests, should be able to render material assistance to British manufacturers in this direction, as the development of the British export trade would probably be a matter of some difficulty without substantial aid from these institutions.

Lead.

THE lead market has had a number of ups and downs during the last few weeks, and still shows a tendency towards considerable uncertainty and irregularity. The period of active manipulative buying seems to have given place, however, to a more subdued atmosphere, and considering the weakness which has been seen in other directions, prices have not yielded nearly as much as might have been expected. There has been some speculative selling, impelled to a certain degree by the manifold difficulties put in the way of the export trade, while activities on account of home consumers have been of a decidedly restrained character. It is most unlikely, however, that any insuperable obstacles will be placed in the way of merchants wishing to ship lead to our Allies in Russia or France, so that the actual interference with business may be more fanciful than real. The demand for Russia continues, but it is not possible to trace a great deal of business as having been done for shipment from English ports, the majority of the orders being placed in Spain, while inquiries put forward in America have been rather barren of result because holders there are asking too much money.

Whether American lead producers will be induced to moderate their terms remains to be seen, but certainly the United States metal markets generally seem to be suffering from a touch of what may be "the morning after." The reckless speculation in copper and spelter has left a lot of stale "bulls" across the Atlantic, and realisations sooner or later will have to become general. Consumers are certainly not disposed to play into the hands of the gang of German-American stockbrokers and others who have been engaged in rushing up metal prices, and it is to be hoped that some strong line will be taken by the British authorities in connection with the battering down of all German influences in the Colonial sources of supply, such as Australia. The definite and firm stand taken by the Commonwealth authorities puts the Mother-Country hopelessly to shame in this respect, for our policy, so far, is merely one of shuffling and temporising. It is important to note that the Broken Hill lead interests are firmly banded together now, and will brook no German interference. The extension of the smelting works at Port Pirie is being pressed on with urgency, and about 3,700 tons of concentrates a week are now being produced, while further extensions are in hand, and it is hoped within the next few months to enable the lead smelters to treat 4,500 to 5,000 tons of concentrates a week.

The American production has increased enormously during the last year or so, and output has not yet reached the greatest possible point. Under no circumstances at present obtaining, or at present in sight, can there be any shortage of lead in the United States, because not only is there an abundance of lead ore, but there is, also, a large surplus lead smelting capacity available, and if production is not stimulated by the prices now ruling, it is impossible to conceive what combination of circumstances can bring about enlarged output. It is interesting to note that prices of lead have begun to move up rather sharply in Germany, the natural inference being that that country is beginning to feel the pinch of the British blockade.

Wireless Telegraphy and the War.

THE furious controversy which raged around the question of the Imperial wireless chain in 1912-13 is still fresh in the minds of our readers; it involved vast interests, both political and commercial, of which the inner workings were known only to a few. It is therefore exceedingly interesting to obtain a glimpse behind the scenes, such as was afforded by Mr. Godfrey Isaacs in his speech at the annual meeting of the Marconi Co. on Monday last, which will be found fully reported elsewhere in this issue.

Thanks to party political considerations, the construction of our wireless chain was delayed at least a year, in spite of the extreme urgency attached to its provision by the Government. Writing on this subject in our issue of August 1st, 1913, we urged that the authorities who were responsible for the defence of the Empire had a right to be trusted, and pointed out that "no man can tell what to-morrow may bring forth." Truly we did not then anticipate that in 12 months, almost to the day, we should be at war with Germany.

Happily for us, our Navy was able to block up the German fleet in its own waters, and though two of our cable stations were wrecked by raiding cruisers, our communications with the Empire never for a moment suffered interruption, and the want of the Imperial wireless chain was not greatly felt; but if other conditions had prevailed —had we been opposed by a different combination, and had our enemies secured even temporary control of the sea— how bitterly we should have regretted the delay which deprived us of the wireless service!

They do things differently in Germany. How their wireless chain, erected regardless of cost in the minimum of time and without discussion, enabled our enemies to warn their ships that war had broken out, and they must run for safety, is tersely told in the speech to which we have referred. An interesting corollary to the story will be found in our "Notes."

E.A.C. DRUM TYPE CONTROL GEAR FOR A.C. MOTORS.

Up to the present but little effort has been made by manufacturers of motor control apparatus to adopt a similarity of design for starting gear for squirrel-cage and slip-ring motors. The former are usually of the double-throw knife switch pattern, while the latter have usually been of the face-plate type similar to D.C. starting switches. The causes for this are probably that the squirrel-cage motor was first introduced and used in America, and for some years was objected to by English supply authorities owing to the large current taken during starting. Consequently, the slip-ring motor was used here with starting gear on the lines of D.C. starting switches. When the squirrel-cage motor was finally taken up in this country, a similar type of starting gear was used to that which had been adopted in the United States.

This use of two different types of starting gear possesses nany disadvantages, as it is seldom that squirrel-cage or slip-ing motors can be used exclusively in any large industrial ystem. In such cases it frequently occurs that the actual tarting and stopping of the machine is in the hands of nexperienced operators, and only a small electrical staff is mployed for actual maintenance purposes. The fact that wo entirely different types of starting gear are used is likely o confuse these operators, and, in addition, means the dupliation of spare parts.

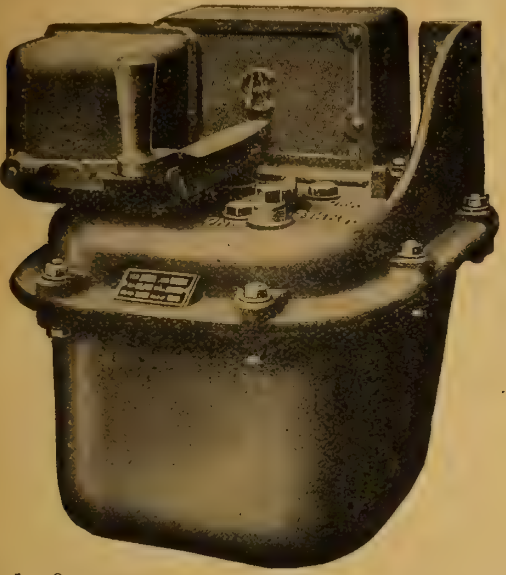

Fig. 1.—Oil-immersed Starter with No-volt and Overload Releases.

The Electrical Apparatus Co., having these points in view, ecided to adopt a standard system of motor control gear vhich could be used for any type of A.C. polyphase induction notor. The drum type of switch was adopted; it has been roved the most suitable for heavy industrial services.

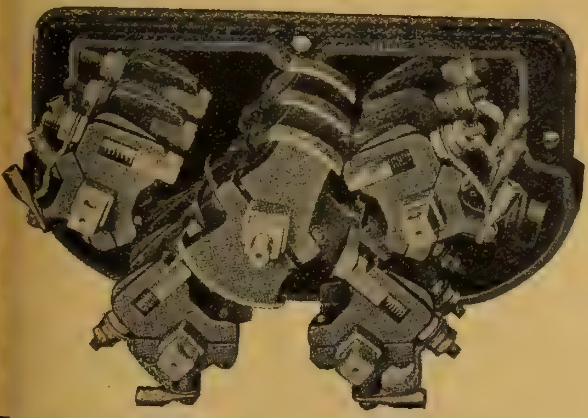

Fig. 2.—Contact Fingers, Compression Springs, &c., Drum-type Starter.

The starters and controllers for both slip-ring and squirrel-ge motors are similar in appearance and the operation starting is performed in the same manner; the switch ntacts are interchangeable for a given capacity of itch, thus reducing spare parts. Further advantages are at with squirrel-cage motors, the motors cannot be left nning connected in "star" if star-delta starters are used, with the auto-transformers in circuit if auto-transformer (compensator) starters are used. The method of starting is always by a straight forward movement of the handle, and the patent E.A.C. slow motion device ensures a compulsory pause in the starting position. The starters can be supplied either non-automatic or with fuses, or they can be fitted with no-voltage and overload release.

The whole construction consists of clamping the current-carrying parts on to mica-insulated steel bars—thus limiting insulation breakages and giving an absolutely fireproof construction.

The gear is made in two types, viz.: Air-break totally-enclosed starters and oil-immersed totally-enclosed starters.

Air-break Starters.—The range of totally-enclosed gear covers a small air-break switch arranged either to give star-delta or series-parallel starting connections, or suitable for switching small squirrel-cage motors direct on to the line. There is also a range of totally-enclosed air-break auto-transformer (compensator) starters for motors up to 100 H.P. on 650 volts. It will be noted that this provides for any moderately sized squirrel-cage motor, and is particularly suitable for textile mills, several electrically-driven spinning sheds having been equipped.

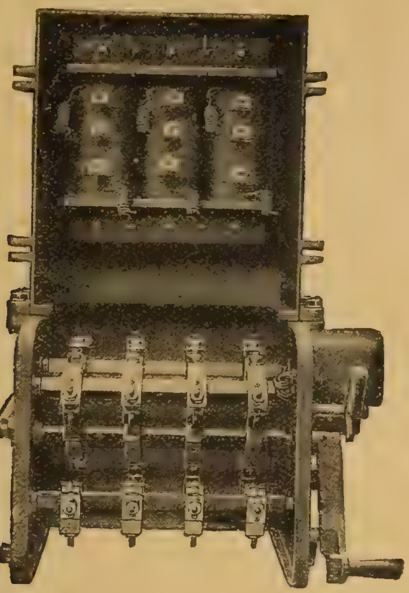

Fig. 3.—Interior, Air-break Auto-transformer Starter.

Fig. 3 shows the general arrangement of the air-break type auto-transformer starters, illustrating the accessibility of both transformer and switch for changing the transformer tappings or cleaning and general inspection purposes. As mentioned above, the starters can, if necessary, be fitted with no-volt and overload automatic release trips with fuses, ammeters, voltmeters, etc., a control unit being supplied consisting of an auto-transformer starter with no-volt and overload release or fuses, the starting switch being in the centre box, the transformer in the lower box and the overload release in the upper box; an ammeter can be fitted to the top of the control unit, which can be attached to a wall or mounted on a pedestal. The starters can be supplied with plain bushed cable holes, with holes screwed for conduit, or with cable sealing boxes where multicore cable is to be used.

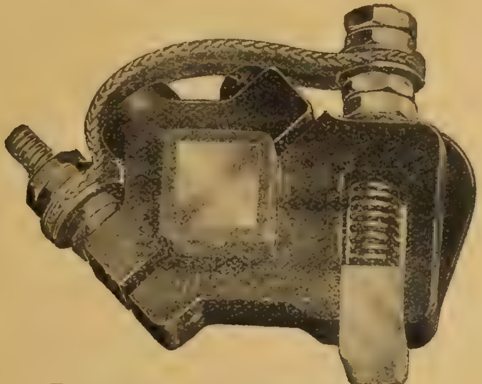

Fig. 4.—The E.A.C. Switch Finger.

Oil-immersed Gear.—In this class the range covered is very much greater. It includes star-delta starters, series-parallel starters, or non-automatic oil switches up to 125 amps. capacity of 650 volts, or auto-transformer starters up to 200 H.P. on 3,500 volts; also all types of starters for slip-ring motors up to 400 H.P. capacity. It is thus possible for a control equipment to be supplied for practically every duty and any type of induction motor, especially if used in combination with E.A.C. high-tension automatic oil switches. The range covered will be best appreciated from the following table :—

Squirrel-cage Motors.	Slip-ring Motors.
Direct-starting switches.	Rotor starters.
Series-parallel starting switches.	Combined rotor and stator starters.
Star delta starting switches.	Non-reversing controllers.
Auto-transformer starters.	Reversing controllers.

Slip-ring motor starters have usually to withstand heavier duties than the starting gear for squirrel-cage motors, and it is the opinion of the designers that it is preferable to have all starters with slip-ring motors oil immersed, as such switches have a larger starting capacity, and the wear and tear on the starter contacts is less if these are immersed in oil.

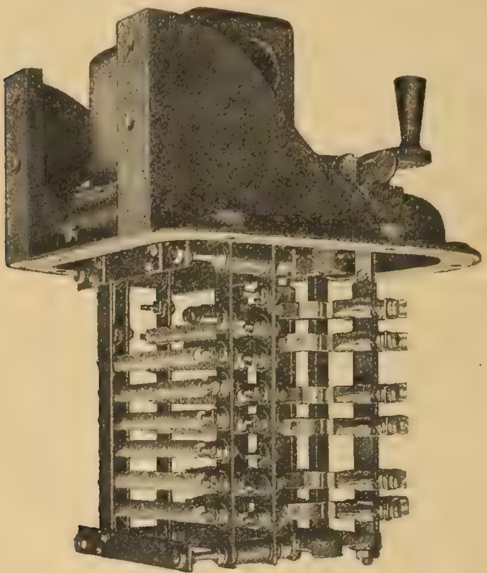

Fig. 5.—Interior, Oil-immersed Starter or Controller with Self-contained Resistance.

The similarity in appearance of various types of oil-immersed switches will be well appreciated from the fact that fig. 1 practically represents a non-automatic oil switch, a star-delta starter, auto-transformer starter, or any type of E.A.C. starter for a slip-ring motor. The similarity of the internal construction is illustrated by fig. 6, a transformer starter with the cover removed, and fig. 5, which shows a rotor starter with cover removed. Star-delta starters or non-automatic oil switches are also similar, but there is no resistance or transformer.

From the above remarks it may be thought that to obtain the full advantage of the E.A.C. system, it is necessary to instal oil-immersed gear throughout. This, however, is not the case, as the contacts and detailed parts are interchangeable for a given capacity of switch between totally-enclosed air-break switches and oil-immersed switches, and the oil-immersed switches can be fitted with similar automatic features, fuses or instruments to the air-break switches and cable outlets can be arranged in the same manner.

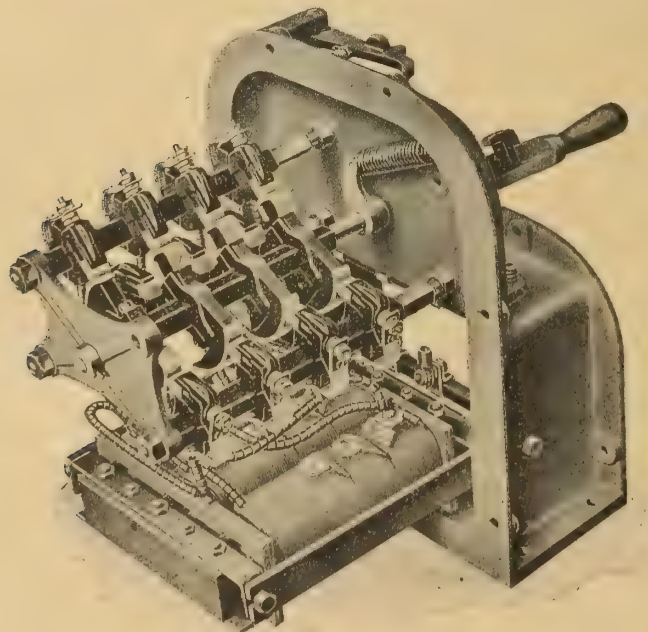

Fig. 6.—Interior, Wired-up Oil-immersed Auto-starter.

A further advantage is that the old arrangement of mounting the various details of control gear on an angle iron panel is entirely dispensed with, and all the control gear forms a complete self-contained ironclad unit.

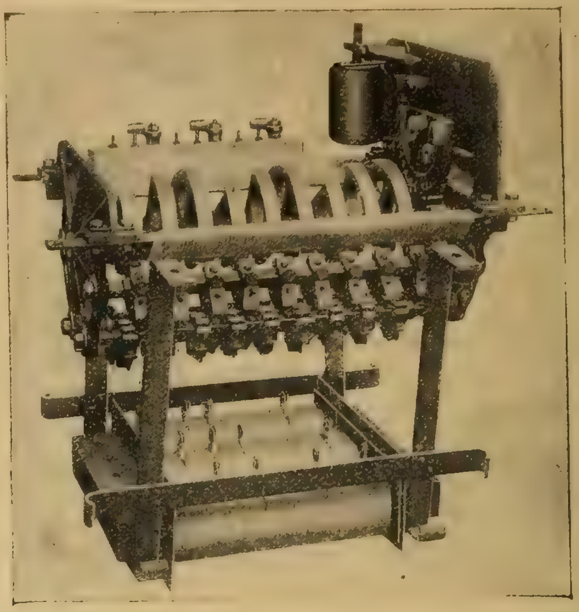

Fig. 7.—Interior, Floor-pattern Oil-immersed Auto-starter, for up to 400 h.p.

It should not be supposed that control equipments for slip-ring motors are very expensive as, in spite of the fact that the slip-ring motor starters are always oil immersed, an efficient motor control equipment for these motors can be supplied at a price competitive with the obsolete face-plate type gear. For large machines and high-tension machines the starters can be combined with the E.A.C. drum type oil switches.

THE PRACTICAL RESULT OF THE POINT FIVE TARIFF.

At the recent meeting of the Incorporated Municipal Electrical Association*, very little time was available for replies to the discussion on this subject. Mr. T. Roles (Chief Electrical Engineer, Bradford) has since communicated a detailed reply, of which the following is an abstract :—

Like Mr. Long, he was disappointed in the turn taken by the discussion. The majority of the speakers seemed to be under the impression that the Rateable Value tariff and the Point Five tariff were synonymous, whereas a number of Point Five tariffs were in no way based on the rateable value system of charging. As had been pointed out by the authors, it was somewhat unfortunate that the Point Five Association asked two persons, both of whom had adopted the rateable value system in connection with their Point Five tariffs, to undertake the preparation of the report; this being chiefly a statement of the results of the working of the Point Five tariffs in Bradford and Sunderland, it followed that the rateable value system must to a certain extent be dealt with.

The Point Five Association as a body held the opinion that no great headway could be made in the supply of electricity for heating, cooking, and other domestic purposes apart from lighting, at any price exceeding ½d. per unit, in districts in which gas was sold at 2s. 6d. or under per thousand cubic feet. In Bradford and Sunderland the fixed charge arrived at on a rateable-value basis had been so calculated that, plus a charge of ½d. per unit for current used for lighting purposes as registered by meter, it was on the average equal to the cost of lighting a house moderately well throughout at between 3½d. and 4d. per unit. It followed, therefore, that on the average all units sold for heating and cooking purposes, and any increase of illumination above the ordinary, were obtained by the consumer at a flat rate of ½d., and it was to the results of selling current for these purposes at a flat rate of ½d. that the attention of the members of the Association was primarily intended to be drawn, whereas by most of the speakers these results had only been given a secondary place, if mentioned at all, and the pros and cons of the rateable-value system had provided the main theme of the discussion. Several speakers revived a jibe which had on a number of occasions been made at the expense of the Point Fives, to the effect that a member of this Association was one who, while contending that he sold electricity at ½d. per unit, in reality sold it at an average price of between 1½d. and 2d. The makers of such statements were simply raising a bogey for the purpose of knocking it down, as, as far as he was aware, no member of the Point Five Association had claimed to supply electricity for *all* domestic purposes at a flat rate of ½d. per unit or less. The majority of the members, however, did claim to be selling electricity for heating and cooking purposes at ½d. per unit, whether their tariff was based on the rateable-value system or on a flat rate for lighting and a separate flat rate for heating and cooking. If the average rate paid by all domestic consumers for the whole of the electricity consumed by them for lighting and other domestic purposes were calculated out, it must naturally be considerably higher than ½d. per unit, owing to the higher prices which were charged for the lighting units. It would be equally as sensible to maintain that an engineer who charged a consumer a flat rate of 1d. per unit for energy supplied for power purposes did not supply electricity at 1d. per unit, owing to the fact that as the same consumer took a large lighting supply at 4d. per unit, the average charge made for lighting and power purposes combined might exceed 2d. per unit.

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* Electrical Review, June 18th and 25th.

In opening the discussion, Mr. Wilkinson called attention to the table on page 11 of the report, and deduced from the same that although a Point Five tariff caused a very healthy increase in the number of units sold, the effect upon the revenue of the undertaking was anything but healthy. As several other speakers emphasised this point, the authors thought it well to clear up a misunderstanding which had arisen in respect of these figures. In putting forward this table and a similar table applying to the Sunderland undertaking, the authors wished to show the effect of a Point Five tariff on consumers who had previously been supplied under the tariffs existing prior to the adoption of the new method of charging. The report stated that, "Owing to changes of tenancy and alterations in other conditions, the comparison given below relates to only 138 of the consumers changed over, the periods covered being the year prior to the introduction of the Point Five tariff and the year ended December 31st, 1914." As the consumptions of these consumers increased by 94.9 per cent. under the new tariff, it was very clear that the tariff encouraged consumers to increase their consumption of electricity, and it had been ascertained that the additional units were mostly consumed by reason of the use of heating apparatus. With regard to the falling-off in the revenue derived from the 138 customers, this was only what might be, and in fact was, expected. As pointed out by Mr. Wilkinson, only the consumers who would benefit by the introduction of an alternative new rate would take advantage of it. It was hardly likely that the 138 consumers in question, having the option of remaining on the flat rate of 4d. or of changing over to the domestic rate of 15 per cent. on the rateable value and ½d. per unit, would have changed over to the latter unless they saw some definite advantage would be gained by so doing. In some cases the only advantage was that they could obtain current for heating purposes at a low rate, but in the majority of cases a direct reduction was effected in the cost of their lighting supply. The table, however, made it very apparent that, in the case of Bradford, at any rate, there was no foundation for the suggestion that a Point Five tariff under the rateable-value system was a means of deluding the undertaking's consumers into believing that they were getting a substantial reduction and current for heating and cooking purposes at a low rate, whereas in reality they were not.

It should also be pointed out that when the domestic tariff was instituted at Bradford, it was fully realised by the Electricity Committee that the time had arrived for a reduction to be made in the charges to domestic consumers who had wired their houses throughout or practically so, and consideration was given to the lines upon which such reduction should be made. Such consumers were, as previously stated, at the time being charged on a flat rate of 4d. per unit, and it was obvious that if a flat rate was retained and a reduction made to 3½d. or 3d. per unit, all consumers would benefit irrespective of the amount of current consumed or the load factor. By adopting the rateable value system, the good consumers were put in a position to obtain the necessary reduction, and little or no reduction was allowed to consumers with poor load factors. Encouragement was given to the latter to increase the size and use of their installations, and to all domestic consumers to utilise electricity for heating and cooking purposes. Had the committee adopted the same course as had been pursued in a number of towns, and reduced the price to 3d. per unit, the revenue received from the 138 consumers mentioned in the first table on page 11 would have been reduced from £1,566 to £1,174. As shown by the table the revenue actually obtained was £1,358. The result, therefore, as regards the 138 customers was almost identical with what it would have been had the flat rate for lighting purposes been reduced from 4d. to 3d. per unit and these consumers used exactly the same amount of current for lighting purposes, and 94.9 per cent. increase in their consumptions—equal to 88,992 units—had been sold them for heating and cooking purposes at ½d. per unit. These consumers, however, were naturally better off under the Rateable Value tariff, as a certain proportion of the increased consumption had been used for lighting purposes, for which under the above-mentioned double flat rate system they would have been charged 3d. per unit. The revenue of the undertaking has, in addition, not suffered to the extent it would have done under flat rates of 3d. for lighting and ½d. for heating and cooking purposes, as the consumers whose residences are only partially wired and/or the load factors of whose installations are low have not received an undeserved reduction of 25 per cent. on their accounts.

The table at the bottom of page 11, which was either overlooked or ignored by the various speakers who were alarmed at the results set forth in the table at the top of the page, gives a much better indication of the results of the working of the Point Five tariff. In this case the comparison applies to all domestic consumers connected for the complete twelve months ended December 31st, 1914, and shows that the average number of units consumed per house in the case of consumers on the flat rate was 367 and the average revenue £5 18s., as against an average number of units per house of 1,082 and an average revenue of £7 12s. 4d. in the case of the consumers on the Point Five tariff. There is little doubt that consumers on the flat rate are using electricity for lighting purposes only, and, therefore, those on the Point Five tariff are consuming on the average 715 additional units per house either for increased lighting or for heating and cooking purposes. The average revenue obtained for the additional 715 units is £1 14s. 4d., so that the average price per unit obtained for the additional current sold is .575d. Taking into consideration the very small additional capital outlay involved, and the fact that the total running costs and expenses due to management are but slightly increased, in the writer's opinion the result is very satisfactory.

As to large supplies of electricity being immediately demanded by upper-class residential houses for heating and cooking purposes in the event of a Point Five tariff being adopted, with consequent overloading of the mains, well over 50 per cent. of such consumers reside in premises having rateable values of £30 or less, which are naturally those of middle-class consumers.

The writer agrees that the supply of electricity for heating and cooking purposes presents a difficult problem in a small residential town. It must, however, be recognised that if a satisfactory half-watt lamp of moderate candle-power makes its appearance, as is likely to be the case, the revenue received by all undertakings for current supplied for lighting purposes will be considerably reduced, and the undertakings in residential districts will be far more badly hit than those relying chiefly upon power supplies for their incomes. The only way in which such districts can make up this loss in revenue appears to be in the direction of increasing their outputs for other domestic purposes. The problem has, therefore, to be tackled sooner or later, and in the opinion of the writer it is better to face it now and obtain some very necessary experience, rather than to wait until the reduction in the lighting output is an accomplished fact. A tariff of 1d. or ¾d. per unit for heating and cooking purposes, in accordance with the price charged for gas in the district, might be adopted, and the results of such a tariff would no doubt form a valuable basis on which to decide whether still further reductions could usefully be made. As far as his experience goes, however, even were a Point Five tariff to be instituted at once, no such rush of applications for supplies for heating and cooking purposes would be experienced as many persons seem to anticipate.

The statement made that St. Marylebone was the only Point Five undertaking which had not adopted the rateable-value system, but had the kilowatt maximum-demand system in operation, was totally incorrect. Both Poplar and West Ham were also working on the kilowatt-demand system, and Southampton, Luton, and Wakefield had adopted a flat rate of ½d. per unit for heating and cooking purposes.

The statement that the rateable-value system lent itself to the production of a tariff which landed the undertaking in a loss was certainly not borne out by the experience gained in Bradford, and must astonish those in control of the very large number of undertakings in the country which charged on this system and yearly showed most excellent results. Mr. Wordingham also appeared to be under the delusion that the rateable value system and the Point Five tariff were one and the same thing.

He (Mr. Roles) was in total disagreement with this speaker's dictum that the figures given in the paper clearly showed that a system could not be right which nearly doubled the consumption and yet reduced the revenue. Taking all residential consumers into account, the undertaking had very considerably increased its revenue, and the revenue per house received from consumers on the Point Five rate was nearly 30 per cent. more than that received from the flat-rate consumers. Any substantial reduction in a tariff was almost certain largely to decrease the revenue derived from and to increase the consumption of existing consumers, but the loss in income in respect of such consumers was usually more than made good by additional revenue obtained from new consumers gained. The speaker also stated that he did not believe it was possible to heat water by electricity economically in sufficient quantities for ordinary domestic supply, and that it was a great mistake to try to do it or to say that it could be done. Whatever he might believe, it was a fact that a number of electric water heating installations were at present in use, were giving satisfaction, and were proving economical. Even if this were not the case, the writer was at a loss to know why it was a great mistake to try to do it. Had the pioneers of the electrical industry been imbued with similar ideas, instead of faith in the future of electricity and courage to tackle the apparently impossible, electricity supply undertakings would probably be non-existent to-day.

With regard to the opinion expressed that it was wrong to increase the capacity of radiators in order to heat the air of the room in which they were installed, and that it was essential to keep the air cool, and warm the individual, this, though it might be scientifically correct, was not the opinion of the great body of consumers who had to be catered for. Whatever form of heating was adopted, the usual practice was to warm the air of the room until it reached a temperature of about 60° F., and one would find it very difficult to persuade a person that he should sit in a room having a temperature somewhere near freezing point—as was the case on many winter days—and toast a portion of his anatomy by the rays of a one-kilowatt radiator, leaving the other portions to freeze, it being usually difficult, if not impossible, to arrange for such a person to be surrounded by radiators.

Mr. Lackie's example of what the bill of a domestic consumer living in a £40 house in Glasgow would probably be, indicated that while the lighting consumers at Glasgow were supplied at an exceedingly cheap rate, the heating and cooking tariff was not sufficiently low to induce consumers to use such apparatus to any great extent. It was shown that in such a house the number of units used for heating and cooking purpose would only be 400. On a very moderate basis, one might except a consumption of over 2,000 units for cooking purposes alone, leaving heating entirely out of the question.

Mr. Nichols Moore maintained that progress in the supply of current for heating and cooking purposes could be made with a tariff of 1d. per unit. The writer did not think that any member of the Point Five Association would disagree with him, as practically all had had experience with a 1d. or ¾d. rate prior to adopting a Point Five tariff. To compete seriously with other methods of heating and cooking, however, they were of the opinion that the tariff must be reduced to ½d.

Mr. Long asked how a Point Five tariff could be justified in the case of towns in which the cost of coal per unit was in the neighbourhood of ½d. When fixing the amount to be allocated to standing and running costs under any tariff, it was usual for at least 25 per cent. of the coal costs, and considerably higher percentages of other items making up the works costs, to be debited to standing costs (see Report of Joint Committee of M.T.A. and I.M.E.A. on "Charges for Electrical Energy supplied for Traction Purposes from Combined Stations.") It must also be remembered that the coal costs quoted were average costs, and that the cost of generating units during the hours of light load was very much higher than during the heavy load periods. In works supplying residential districts the number of hours of light load was very high compared with the number of hours during which a moderately good load was sustained. The supply during the hours of light load was usually provided by small inefficient generating sets or by large generating sets run at an uneconomical load. If, therefore, by selling electricity at a cheap rate for heating and cooking purposes, a good day load could be obtained, not only was the cost of generation reduced during the hours of light load, but the average figures per unit in respect of each item of works costs might also be appreciably lowered.

HEAVY TONNAGE ELECTRIC SERVICE THE NORFOLK AND WESTERN RAILWAY, U.S.A.

A recent issue of the *Railway Review*, of Chicago, contains interesting description of some electric locomotives which h been introduced by the Norfolk and Western Railway (U.S to deal with heavy coal traffic on its main line between Bluef and Vivian, a distance of about 30 miles, in West Virginia.

This section of road is double track except for the Elkh tunnel, 3,000 ft. long, and there is also a large amount of th track or passing sidings, works sidings, &c.; the grades vary fr 1 per cent. at the west end to 1·5 to 2 per cent. up to and throu the summit tunnel, for 10 miles, followed by a short descent 10½ miles of about ·25 per cent. up-grade and a final three m ascent of 1·22 per cent. grade. Fully 60 per cent. of the lin curved, the maximum being about 12°.

The east-bound traffic is very heavy, constituting the chief traf and all of it is handled by the electric locomotives which coll the coal from sidings and haul it over the summit to the classifi tion yard at Bluefield.

In addition to heavy coal traffic, through merchandise a passenger traffic, which is still handled by steam locomotiv is assisted by electric locomotives as pushers up the grades.

A condition favourable to the electric locomotives is the pos bility of despatching trains at uniform intervals throughout the da

The electrification was undertaken primarily to increase t capacity of the line by reducing the time taken on the journe and heavy freight trains are now handled at 14 miles an hour, against 7½ miles under steam operation; further, delays due coaling locomotives on the grade are avoided. In the Elkho tunnel, running up grade, the steam speed was limited to six mil an hour on account of ventilation difficulties, requiring seve minutes to clear the block, which time is reduced to thr minutes under electric operation.

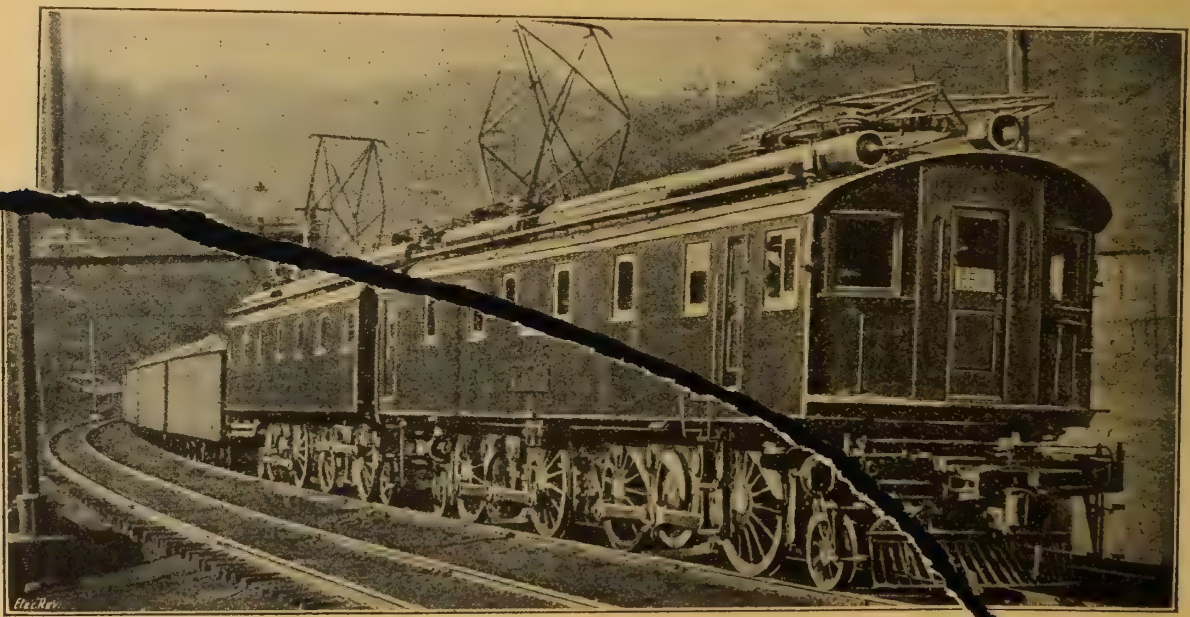
Coal trains of 3,250 tons were handled up grade by three stea locomotives, one locomotive at each end of the train over th whole division, and the third as a pusher up the steep grades. The engines were heavy Mallet articulated compounds with machine stokers and superheaters. Under electric operation one locomotive handles the train except on steep grades where an extra pusher locomotive is required, and the speed has been approximately doubled.

The electrical equipment, which was supplied by the Westinghouse Co., Pittsburgh, Pa., is designed to handle 20[illegible] tonnage trains a day of a total of 65,000 tons, and at the present time 12 such trains are handled in addition to the assistance given to through freight and passenger trains.

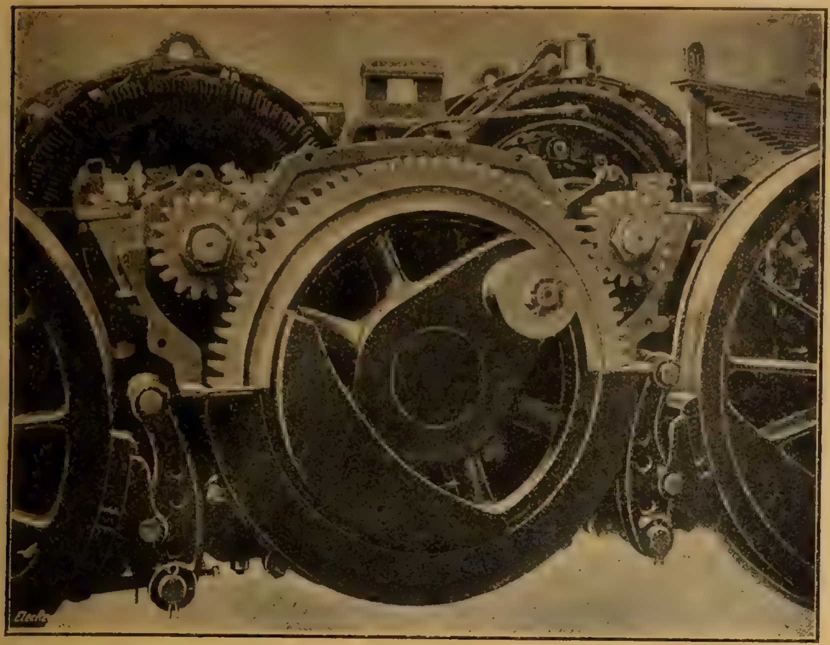
The line is supplied on the single-phase system, the trolley line pressure being 11,000 volts, 25 cycles. The locomotives, however, are unique in that they are equipped with phase converters, which in connection with the main step-down transformer on the locomotive, transform the single-phase current to three-phase current, which is utilised in induction type motors. Thus, while retaining all the advantages of high-voltage single-phase distribution an collection, the advantages of the three-phase induction motor on mountain grade conditions are secured, and it is feasible to adopt regenerative braking.

The latter system has, of course, been used on the Italian railways, but not for heavy freight train service such as obtains on American railways.

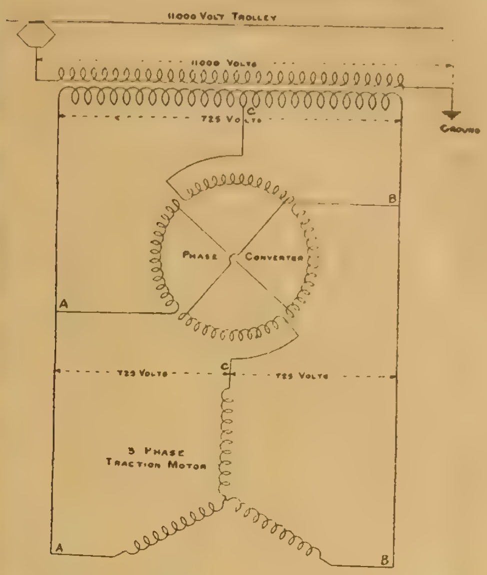
The feature has proved very satisfactory in service, the heaviest trains being handled down mountain grades at the uniform spee of about 15 miles an hour by a single locomotive with ease, the air brakes being held in reserve for stopping purposes.



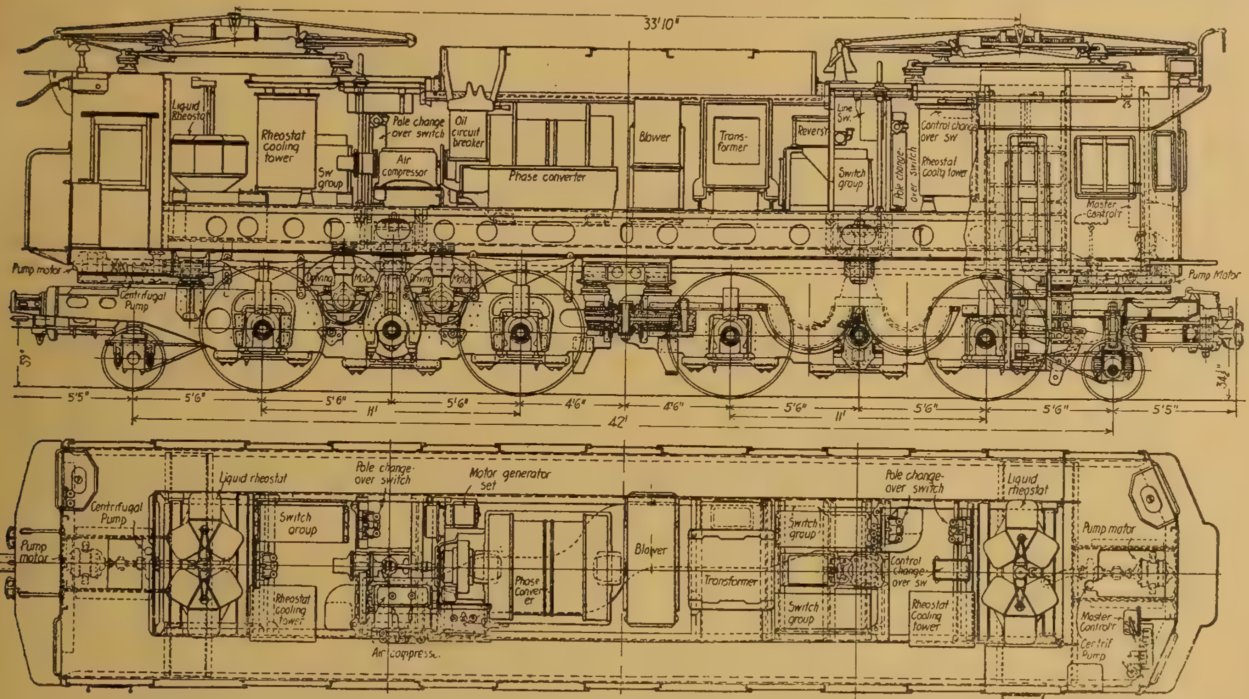
Norfolk and Western Electric Locomotive and Coal Train.



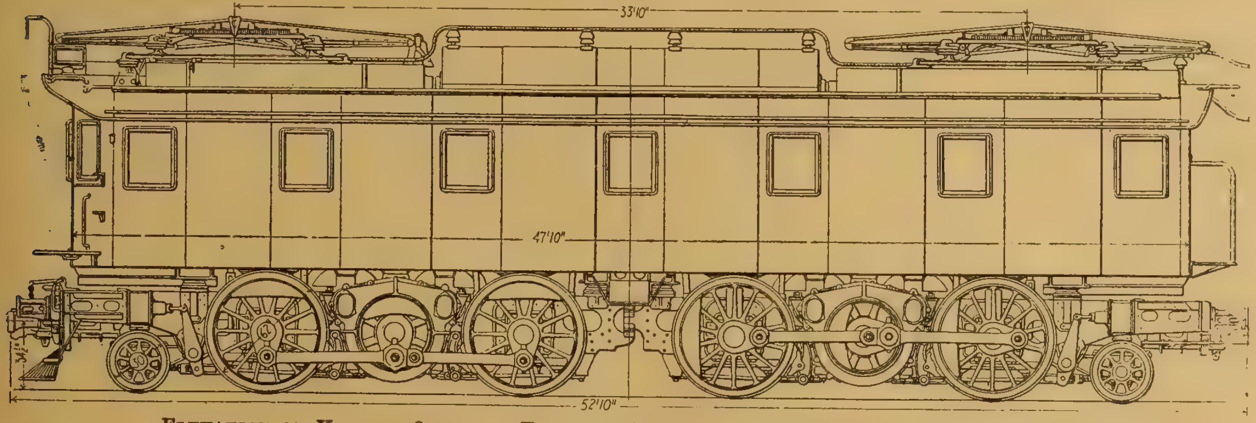
Detail View of Motor Truck, Partly Dismantled.



Circuit Diagram, from Single-phase Trolley Wire to Three-phase Motor, Norfolk & Western Locomotive.



Sectional Plan and Elevation showing Arrangement of Norfolk & Western Locomotive.



Elevation of Unit or One-half Electric Locomotive, Norfolk & Western Railway.

The traffic on the electrified division is handled by 12 270-ton electric locomotives, each consisting of two 135-ton units or halves. The mechanical portions were made by the Baldwin Locomotive Works and the electrical portions by the Westinghouse Co.

Each unit has two main trucks connected by a Mallet type hinge, and each main truck has two driving axles included in a rigid wheel base, with a radial two-wheel leading truck.

The cab is of the box type, with an engineer's compartment at one end of each unit, the two units being coupled to provide for operation from either end of the locomotive.

Each locomotive is equipped with eight three-phase induction driving motors, with wound secondaries for four and eight-pole operation; the motors are cooled by air forced from the main ventilating duct, which also delivers air to the phase converter and to cooling towers for the liquid rheostats.

There are two running speeds, 14 and 28 miles per hour.

In starting, resistance is inserted in the secondary circuit of the motor by means of a liquid rheostat; for both the 14 and 28 miles an hour speeds all the motors are connected in parallel, but with the 8-pole motor combination for the former and the 4-pole motor combination for the latter. Unit switch type of control, arranged for simultaneous operation of the units from the control of either, is provided.

The 11,000-volt line current passes from the pantograph trolleys to the main transformers through an oil circuit breaker; the transformer secondary is connected to a phase converter, which runs continuously when the locomotive is in service.

The converter, which is coupled to a blower for supplying ventilating air for the equipment and to an air compresser, is an induction motor with a short-circuited or cage-wound secondary having two windings on its stator, one to drive the rotor and the other to furnish current out of phase with the main supply current.

The motor circuit of the primary winding of the converter is connected across the transformer secondary and receives current at 725 volts; the windings are so arranged that a current of 90° phase displacement is induced in the second winding on the primary of the converter and by connecting this displacement circuit to the middle tap of the main transformer a three-phase current is produced by the ordinary two-phase three-phase method of connection.

The converter is started from a direct-coupled, single-phase series commutator-type motor. On each unit are four liquid starting rheostats, one for each motor; each pair of rheostats has a storage reservoir and cooling tower, a circulating pump and one operating mechanism in common.

Each rheostat consists of a cast-iron tank, with two sets of metal electrodes connected to the motor and ground respectively, and a central hollow plunger which is raised or lowered to regulate the height of the liquid in the tank. Continuous circulation of the liquid is obtained, by a motor-driven circulating pump, between the reservoir and the tank, and the temperature is lowered by passing a portion of it through a cooling tower containing a series of trays arranged so that the liquid flows over them in a thin film and is cooled by air from the main ventilating duct. The air to the latter is supplied by the 36-in. fan coupled to the phase converter.

On the roof of each unit a couple of pantograph trolley collectors are mounted; these are raised by springs and lowered by compressed air, and are specially constructed to work in the restricted tunnel clearances.

The following table shows the performance of these locomotives under varying conditions of load:—

	Train on 1·5 and 2 per cent. grades.	Train on 1 per cent. grades.	Train on 0 4 per per cent. grades.
Weight of train—tons	3,250	3,250	3,250
Locomotives per train	2	1	1
Approximate speed, miles per hour	14	14	28
Drawbar pull per locomotive, pounds:—			
Uniform acceleration	91,800	114,000	79,400
At speed on 2 per cent. grade...	75,400	—	—
At speed on 1 per cent. grade...	—	85,000	—
At speed on 0·4 per cent. grade	—	—	4,600
Maximum guaranteed accelerating tractive effort per locomotive	133,000	133,000	90,000
Approximate maximum guaranteed horse-power developed by motors	5,000	5,000	6,700

On tests and in service the locomotives have developed a drawbar pull considerably in excess of the guaranteed maximum, the highest record with the dynamometer car being 180,000 lb. This corresponds to an adhesion of about 40 per cent.

The electrified section of the Norfolk and Western line is supplied from a 30,000-KW. power station at Bluestone Junction, over duplicate 44,000-volt, 25-cycle, single-phase transmission lines, carried on the overhead line structures. There are five transformer stations of 28,000 K.V.A. installed capacity, in 44,000-11,000-volt, single-phase, step-down transformers.

The overhead line takes the form of single catenary, with an auxiliary messenger wire above the trolley, one main hanger being provided for every two intermediate connections between auxiliary and trolley wires on tangents. On curves the angularity of the hangers provides flexibility, and the auxiliary messenger and trolley wires are connected to the hanger at the same point.

On the main line the catenary is supported by steel structures, but in yards an overhead cross-catenary cable, attached to side poles, supports the running wires.

The catenary is hung from a steel casting attached to the overhead girder on tangent tracks, being supported by three suspension type insulators, each good for 11,000 volts, and 8 in. diameter by 5 in. long.

A malleable casting on the bottom insulator clamps the messenger wire—a $\frac{1}{2}$-in. stranded steel cable; galvanised steel rectangular hanging straps, at 30-ft. intervals, to the bottom of which are bolted malleable iron trolley clips, hold the auxiliary messenger wire (on tangent track), and from the latter the grooved contact wire is supported by clips spaced 15 ft. apart.

The catenary supporting structures are nominally 300 ft. apart on tangent tracks and rather closer on curves, where the hangers are spaced at only 15-ft intervals, and due to the drag of the catenary system, the latter with the supporting insulators lies in an inclined plane. The catenary system is anchored or dead-ended at certain points, and in view of breakage of the messenger, the support under the insulator is designed to allow the wire to slip through at a certain pull and thus distribute the strain. The system being a regenerative one, special automatic switchgear and rheostats are provided at the power station to safeguard the running plant when excess power is returned from the line.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electric Signalling in Mines.

With reference to the leading article on the above subject in your issue of the 16th inst., I fear that the writer of that article has fallen into an error in his statement, that "For every gaseous mixture there is a constant value of the product $Li^{\frac{3}{2}}$ beyond which the break-flash will be capable of igniting the mixture." True it is that the statement seems justified on the evidence from which the statement is drawn, but the evidence cited is only a particular case. When the inductance is extremely small on the one hand, or when no current and no spark passes as in a high-tension gap on the other hand, the formula does not apply, and yet ignition is obtainable in both these limiting cases. My experience of the subject leads me to the conclusion that when dealing with spark ignition it is necessary to distinguish between the energy which produces the spark and the ability of the spark to produce ignition. To the latter I have given the term "incendivity." Apparently the spark-producing energy is not a direct measure of incendivity, although there may be some relationship between the two quantities when certain other conditions are constant.

I am not able to deal with the matter fully here, as I hope shortly to present a paper to the Inst.E.E., in which this subject is considered.

J. D. Morgan.

Birmingham, *July 22nd*, 1915.

[Certainly ignition can be produced in the total absence of inductance; suitable gaseous mixtures can be ignited by sunlight, for example, but the article in question related to the range of conditions met with in mine-signalling, and was not intended to be applied to limiting cases. Mr. Morgan agrees that for the case considered the statement seems justified. It will be noted that the energy stored by inductance is proportional to Li^2, not $Li^{\frac{3}{2}}$, a fact which was referred to in the article, and which suggests that the electromagnetic energy is not the only factor concerned in producing ignition, though it appears to be the principal factor in this case. In view of the importance of the subject, we shall await Mr. Morgan's paper with great interest.—EDS. ELEC. REV.]

"Autres Temps, Autres Moeurs."

Mr. Stevenson's letter, published in last week's ELECTRICAL REVIEW, is particularly interesting, in that it shows that the American manufacturer takes up that very attitude with customers, which you and other Editors have so long decried as "Antiquated British"; you will note that any customer who wants to place an order for insulated wires and cables in the States must take American standard stuff, must take American gauges, and must not even ask for quotations for the sections he has been used to; moreover, he must pay cash in New York against shipping documents.

May your publishing this letter be taken as a sign that the war is causing you to alter your views, even as it is causing Mr. Harold Cox and others to see that it is necessary to be economical and check imports as much as possible now that they and other financial magnates are beginning to feel the stress and pinch of lack of money, just as the manufacturing working classes have felt it in the past?

Is it possible that the manufacturer will at last be considered of really more importance than the merchant, the banker and the lawyer, for whom and by whom our laws are made?

P. R.

[In a few lines our correspondent contrives to raise half-a-dozen diverse and independent questions. Taking them in order: (1) Publication of a letter in our pages has not the slightest bearing on our views; our "Correspondence" columns are written by our readers, and reflect their views, not necessarily ours; (2) with regard to the relations between manufacturers and purchasers, our contention, based on abundant evidence, has been that British firms are apt to adopt a "take it or leave it" attitude, whereas the Germans sedulously inquire into, and lay themselves out to comply with, the needs and wishes of their customers, with the result that trade has been passing from us to them for years. The Americans, as we have pointed out by quotations from their own Consular reports and other evidence, are as culpable as the British in this respect, and Mr. Stevenson's letter bears this out; (3) in the future, after the war, German competition will be redoubled in intensity and virulence, and it will be still more urgently necessary to meet it by consulting the interests of foreign purchasers; (4) we are not responsible for "Mr. Harold Cox and others," but we have always advocated that preference should be given to British manufactures; (5) the war has revolutionised conditions throughout the world of industry, and whatever economic principles may have been supported by ourselves and others in pre-war times, we and they are under no obligation to maintain them under the new *régime*; (6) with the suggestion contained in the last paragraph of our correspondent's letter we are, and always have been, in hearty sympathy. Our aim has always been to promote the interests of the electrical industry.—EDS. ELEC. REV.]

Shop Window Lighting.

In December last I sent a letter to your paper in regard to shop window lighting in war time, dealing with the amateurish attempts made by shopkeepers to conform to regulations. I drew attention to the much favoured method of wrapping tissue paper around bare lamps, and pointed out that this not only was very ineffective but was a distinct source of danger, as witnessed by the large amount of badly-scorched tissue paper seen.

The note of warning which I struck in that letter was amply justified in the Press this week, where it was stated that the L.C.C. Fire Brigade was recently called to an outbreak of fire caused by crinkled paper round electric lamp bulbs in a shop window. One is led to wonder how many small outbreaks, not necessitating the attendance of the fire brigade, have been caused by this highly dangerous practice. The system I mentioned in my December letter was the scientific lighting of shop windows by means of concealed lighting units placed high in the window. This method ensures the effective lighting of the articles displayed with complete control to accord with the lighting restrictions of the police—and has the additional merit of being safe and free from danger of fire. A large number of shops have been lighted on this approved plan and give absolute satisfaction to all concerned.

F. Willcox, *General Manager,*
Lamp and Wiring Supplies Department,
The British Thomson-Houston Co., Ltd.

London, E.C., *July 24th*, 1915.

Branch Offices.

Amongst the many whose consciences claim exemption for them from joining the Forces are, I expect, the heads and staffs of the many branch offices in the country. Now, the release of these men—and a fine useful haul it would be—depends upon their firms. To the general public it does not matter which firm supplies, and branch offices in these times cannot surely speed up the delivery of goods. In fact, if the local competition were removed and matters dealt with from headquarters, it would probably save the time of both buyers and sellers.

Erimus.

Mr. John E. Gray.—The matter referred to in your letter has already been dealt with in several of our issues, and we think no useful purpose would be served by discussing it further.—Eds.

LEGAL.

Hamilton *v.* Marconi's Wireless Telegraph Co., Ltd.

(*Continued from p.* 108.)

The hearing was resumed on Thursday, July 22nd, when

Mr. Cappalare was recalled with regard to certain agreements and other documents, amongst them being letters from the Admiralty to the company, and the company's reply to one of them dated October 18th, 1912, relating to the Australian arrangement.

Mr. Pollock, K.C., said that they had had to get the letters from the Admiralty, and he thought in the public interest they should not be made public. He mentioned this as he noticed that a report of the case was appearing in the Electrical Review. It was a matter of some importance that these things should be treated as confidential.

Mr. Gordon Hewart, K.C., said he quite agreed with Mr. Pollock's remarks, and would not ask that the letters should be read.

The Witness, in answer to Mr. Stuart Bevan, said he produced the company's correspondence with Mr. Fisk as to the supply of the apparatus. Mr. Fisk, he said, was the company's resident agent in Australia, and the company from time to time furnished him with apparatus and materials for the purpose of the company's business, which he was carrying out there. In the correspondence he asked to be supplied with certain apparatus which he thought ought to be stored in Australia, and accordingly some sets were shipped to him on May 13th, 1912, and debited to the Sydney Stores account. One of those sets was for the ship *Manpouri*, which was fitted in Australia, on July 18th, 1912. That was one of the vessels on which commission was allowed to Mr. Hamilton, and included in the money paid into court. It was one of the Union Steamship Co.'s vessels. On August 27th Mr. Fisk wrote asking if it would be possible to send out a good supply of ship sets so that there might not be a rush at any time. On October 5th witness wrote him that five emergency sets would be placed on order, and they were sent accordingly.

The Witness produced a list showing apparatus from time to time sent to Mr. Fisk to the value of £3,534, which amount, he said, represented the apparatus remaining at the stores in Sydney, and disposed of by Mr. Fisk when the agreement with the amalgamated Australian company was entered into. Included in the amount, however, were the fittings for two ships, which had been taken from the stores. The company never agreed to pay the plaintiff for them, as the contract was made at an earlier date.

In answer to Mr. Gordon Hewart, in cross-examination as to the wireless chain, the witness referred to the reply of the Government in relation to the matter and the statement that they did not propose to proceed with it, when Mr. Pollock objected to the letter being produced in evidence.

The Referee, after some argument, said he would admit the letter, as it was important to know what the company had to say to the decision not to proceed with the Imperial wireless chain.

Mr. Pollock said that under the circumstances he would have to consider what course he would adopt. There was evidence that none of the stations contemplated had been built. The only way in which it could be material, was that it fell under the branch of the claim as to whether there was a sale effected within the plaintiff's territory, and the defendants said that the period of the agreement was not the term of his natural life, but the term of three years. That which came under the agreement of July 13th was not material, unless the Referee came to the conclusion that plaintiff was entitled to something for the rest of his natural life. Then the question would be whether he was entitled to make any claim in respect of damages for that which had taken place between the Marconi Co. and the Postmaster-General. If he was entitled for his natural life the matter could be gone into when the Referee had made up his mind upon the point, and he (Mr. Pollock) would then have to consider whether he would on behalf of the Marconi Co. reopen that matter.

Mr. Gordon Hewart said his answer to that was twofold. In the first place, Mr. Pollock had put in a certain letter, and there was an answer to that letter. Having put the letter in he could not say that the answer to it was not relevant. The letter without the answer might be misleading. In the second place, Mr. Pollock suggested that the plaintiff's claim in respect of that document depended upon his submission that the commission was for the life of Mr. Hamilton. There was a contract made, which, if it had been performed by the defendant company, would have undoubtedly yielded a large commission to Mr. Hamilton. Mr. Hamilton said that so far as he was concerned, he did all his part, and if the matter did not go on, the fault was with the company.

Mr. Pollock suggested that if, after considering the matter, the Referee thought he ought to produce the correspondence, he would do so; they might have a further sitting in order to discuss the matter.

Mr. Gordon Hewart said he did not profess to know how much real substance there was in the question of publicity, but he would take whatever course the Referee might think right in regard to the letters.

Mr. Pollock said he would accept that position, which he thought very fair on the part of Mr. Hewart, and he would send for the letters in order that the Referee might see them.

Mr. Cappalare, in further cross-examination, said that the separate apparatus was sent to Sydney in accordance with Capt. Fisk's request. It was sent on February 20th, 1913, and the price was £166 16s. On April 27th there was a telegram from Sydney, asking to have other sets sent, part of which were sent—two on the 18th and two on May 28th. The Crown agents would not tell for what stations they required the spare stores. Whatever spares might have been sold for the stations would be included in the statement of commission due to Mr. Hamilton.

Mr. Wm. Walter Bradfield, the manager of the defendant company, examined by Mr. Pollock, said that the Admiralty from time to time ordered supplies of apparatus to be sent to the naval stores at different places, but he had never known the orders to specify the particular ships in which the apparatus was to be fitted, nor was it possible for the company to ascertain the place at which the apparatus was to be used. He had no documents, beyond those disclosed, in reference to the battleship *New Zealand*. The Malay States battleship had not been completed, and he had no documents relating to her. His company had never, to his knowledge, supplied apparatus to be fitted in the Australian battleships, but it was quite possible that some of the apparatus supplied to the Admiralty had been fitted to those ships. The company never asked the Admiralty what they did with the apparatus supplied to them. Besides the letters which had been produced there were no other documents relating to the Australian battleships. All orders passed through his hands or were brought to his notice before they passed into the company's books, so that he would know what documents existed. There were eight field sets for Australia in all, and the orders for these came from the War Office. In those orders there was an indication that they would be paid for by the Commonwealth of Australia, but he did not remember that their destination was mentioned. Altogether there were 12 field sets, four of which were for the War Office and eight for Australia. Four of the eight were ordered on January 25th, 1913, and they had not paid the plaintiff in respect of those. He did not know where the other four went to.

In cross-examination, Mr. Gordon Hewart produced certain letters which he submitted to the witness with the observation that he did not wish to read them aloud owing to circumstances which had already been stated. After the witness had inspected the letters, he said he had never had any communication with the Admiralty with regard to supplying apparatus for the Australian ships.

A letter and a reply which followed it from Mr. Godfrey Isaacs were submitted to the witness, and he was asked by Mr. Hewart whether after having read them he had any doubt that the apparatus installed in the Australian ships were apparatus manufactured by the Marconi Co. Witness replied that he should think it very unlikely that any considerable portion would be manufactured by the company. The proportion would be very small.

In further cross-examination, the witness said he did not think the company were supplying complete apparatus since 1899 or 1900. They had supplied particular portions of the apparatus.

Mr. Hewart: An important part of the installation is called the condenser, is it not?—Yes; we supply condensers and detectors, or receivers, as we should call them, to the Admiralty for use on board ships.

Mr. Hewart: I suggest that the price of a condenser and receiver would be about £100 a ship?—No; the price would be from £10 to £17 for a detector and condenser.

Do you suggest that the price of a condenser and receiver would not be more than £17?—Certainly. I cannot say the price of an Admiralty set, because I do not know how they are made up.

You know, if you supplied it, the cost of a set would be about £400?—That would depend upon the size of the installation. Some are more powerful than others. A small one would be from £400 to £500, and for larger ships the cost would go up to, and beyond, £1,000.

Supposing it were held that Mr. Hamilton was entitled to commission upon the apparatus supplied by you to the Admiralty, do you not think you could ascertain from your books, and inquiries at the Admiralty, the price of the parts of apparatus you supplied?—Our books would not tell us, and I do not think the Admiralty would give us any information on the subject.

Continuing, the Witness said that the New Zealand and Australian ships were equipped to a slight extent with apparatus supplied by the Marconi Co. No doubt it would be possible to find what was the total amount of business done with the Admiralty during the year, but there were no records of the names of the ships. The orders came from the Admiralty to the company to send the apparatus into one or other of the stores. He had a conversation with Mr. Hamilton before he went to Australia, as to calling upon certain shipping agents in London, and he understood that he was already in touch with the shipping houses in Australia, but he (Mr. Hamilton) was not largely interested in raising the subsidy from £200 to £250 per annum.

Mr. Pollock said that that was the defendant's case, and he submitted the correspondence with the Admiralty to the Referee for his private perusal.

The Referee, after having read the letters, said they did not show that there was anything likely to follow which would be material to the case.

(*To be continued.*)

[After hearing the addresses of counsel, the Referee reserved judgment.]

ATTWELL *v.* WEST HAM CORPORATION.

In the Bow County Court, on July 21st, before his Honour Judge Smyly, K.C., there was the fourth day's hearing of the action for damages brought under the Employers' Liability Act, 1880, by Arthur Edwin Attwell, an electrical labourer, against his former employers, the West Ham Corporation, for injuries received in an explosion in a transformer chamber.

Mr. C. T. Williams appeared for the plaintiff, and Mr. Kingsbury for the defence.

The man's duties were to go round the various transformer chambers and see that everything was in order. One day in April, when at Messrs. Suter, Hartmann's premises, there was an explosion, and he was badly "shocked" and his arm was burned. He had been unable to work since. He was never provided with rubber gloves. He had no technical electrical knowledge, and knew very little as to what was right or wrong to touch in a transformer chamber. He denied that he had said he had been in the employ of other corporations in their electrical works, or with firms, in the same position. For five years before going to the defendants he had been a ship's steward, and prior to that a barman. He had not the slightest training as an engineer, and when he entered their employ he was paid 30s. a week to carry tools. He was always under the supervision of Mr. Leece, the foreman. After the accident he used to go round the electric chambers, and report to the foreman as to their condition, but he never did any work; it was impossible, as his hand was dead. His reports seemed to show that he had been working, but he was asked to fill them up like that by the foreman. When with the men on these occasions he used "to tell tales, crack jokes and sing songs."

Judge Smyly: It must be very pleasant to be in the employ of the West Ham Corporation.

This closed the plaintiff's case, and Mr. Kingsbury, for the defence, said he would be able to call a witness to prove that, so far back as 1907, Attwell was a clever electrical assistant with technical knowledge, and was employed in erecting sub-stations on consumers' premises. When he asked for employment from the defendants it was as a skilled man, competent in all branches of electricity. On the day of the accident Attwell did not use the gloves that had been provided for him, besides which he tried to do work which should only have been done when the foreman was there. He worked after the accident, and then started staying away, which was put up with for a time, but finally the Corporation decided to put an end to it.

Dr. Angus Kennedy said that on May 2nd the plaintiff was a perfectly sound man with the exception of tremors of the fingers, due to cigarette tobacco poisoning, as indicated by the stains on his fingers. There was no evidence of electric shock.

Dr. Hugh Walsham, who had made a special study of electricity from the medical side, said the man could not have had a 6,000-volt electric shock, or he would have completely collapsed, instead of walking away as he did.

Wm. Lionel Leece, electricity foreman to the defendants, said he engaged plaintiff as a handyman and assistant. He showed him round the chambers, and told him what he must touch and what not. Gloves were provided for him. There was ample proof given by the man that he had technical knowledge. He had operated high-tension switches, and when plaintiff swore he did not know how, he was telling an untruth. Where the explosion occurred was behind the rail, where plaintiff had no right to go, as he knew, without witness being there. When he was called he found signs that a pot-end had been fusing. On the insulating stool he found plaintiff's bag, with his rubber gloves in it. Later he saw the plaintiff, who said he felt quite all right. He questioned him about the gloves, and plaintiff said he forgot to use them.

The case was again adjourned.

WORKMEN'S COMPENSATION.

At the Warrington County Court, on July 22nd, Mr. Cellers, deputy judge, gave an award under the Workmen's Compensation Act on behalf of the widow of George Peplow, foreman shunter, late of Mill Street. Deceased was killed by a crane while in the employ of the St. Helens Cable Co., Ltd., and a claim was made on behalf of the widow and five dependents for £256. The company offered £189, but a compromise had been made, and they had paid £220 into Court. The compromise was arranged because there was some doubt as to what the wages of the deceased were to be, he having only been in the firm's employ for one day before he was killed. The present application was for an award of the £220 paid into Court; and the St. Helens Cable Co. consented to this award and applied for an indemnity against Messrs. J. Dolan and Son, builders, Napier Street, on account of a legal liability by them through deceased having been killed by their crane, which was working on land adjoining the cable works. The firm of Dolan consented to the indemnity, and an award was made on these terms, with costs on scale B.

SMOKE PROSECUTION.

Another summons against Messrs. Connolly Bros., cable manufacturers, of Mill Brow, Blackley, was heard at Manchester City Police Court, on July 21st, in respect of the emission of black smoke from their chimney. Defendants were fined £3.

A CONSULTING ENGINEER'S CONTRACT.

Judgment has been issued by Lord Hunter, in the Court of Session, in an action in which Thomas Crichton Fulton, consulting engineer, Glasgow, sued the Govan District Board of Control for payment of £216, in respect of professional services rendered by him to them.

In February, 1912, the defenders decided to introduce electricity at Hawkhead Asylum, for certain purposes. The pursuer was appointed consulting engineer for the defenders in connection with the carrying-out of this work. He was to discharge his duties for a sum of £155. The work was finally completed for a less sum than the contract amount. The pursuer had been paid the £155 for which he contracted to do the work, and the sum for which he now sued—which was largely in excess of the contract sum—was alleged to be due in respect of extra work done by the pursuer, for which he was entitled to special remuneration. The defenders pleaded that the pursuer had not performed any duties for them except those of consulting engineer under his contract, and was not entitled to make any additional charge. The defenders admitted that the pursuer had taken a good deal of trouble in connection with the Clyde Valley Co. agreement, and to cover that they tendered £40.

Lord Hunter gave decree for £40, with expenses to the date of the tender, March 9th, 1915. From that date the defenders were found entitled to expenses.—*Edin. Evg. Dispatch.*

DISSOLUTION OF PARTNERSHIP.

A settlement was announced to Mr. Justice Astbury, in the Chancery Division, on Tuesday, of an action by Wm. Francis Morris, of 11, Arundel Square, Barnsbury, against George Edward Tate and Frank Oliver Monkhouse, carrying on business in partnership with the plaintiff as the Acme Arc Lamp and Engineering Co., Kentish Town, claiming dissolution of the partnership.

Mr. Kingham, for the plaintiff, who had joined H.M. Forces, said he was 24 years of age, and he asked for dissolution of the partnership under an agreement of September, 1913, and the usual accounts.

His Lordship said the plaintiff had put into the business £250, and he could not now continue in the business. He thought he should be treated generously.

After the parties had had a conference, Mr. Dill said they had come to terms which they would embody in a consent order for dissolution as regarded the plaintiff as from that day; the defendants to retain the assets and to indemnify the plaintiff against the liabilities of the firm; the defendants to pay the plaintiff £200, £50 now, and the balance by three instalments at two, four, and six months, with interest; no costs on either side; and a stay of all proceedings.

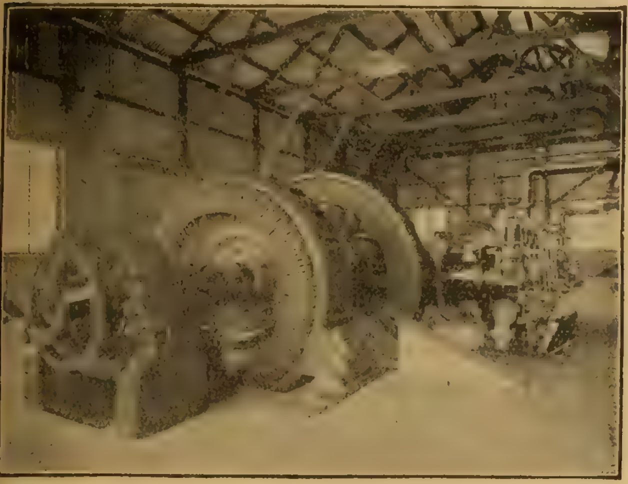
An Electrical Mosquito Exterminator.—An electrical engineer has discovered that mosquitoes are attracted by a certain note in harmonic telegraphy. He covered the machine with fly-paper, and the mosquitoes were lured to their death by the musical note. He has also found a way to electrocute the insects by using the same note.—*T. and T. Age.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electrical Driving in Cement Works.

The extensive application of electricity for driving cement works machinery obtains in the Oversea Dominions just as much as in this country. A recent installation of electrical plant for this purpose is that of the Adelaide Cement Co., of Adelaide, N.S.W. Gas engines were selected for the prime movers, the installation consisting of two 380-H.P. four-cylinder horizontal gas engines, running at 214 R.P.M., and manufactured by the Premier Gas Engine Co., of Sandiacre, coupled to 275-K.V.A. "Witton" alternators, supplied by the British General Electric Co., Ltd., of Sydney, and constructed at Witton, Birmingham. The gas producers were manufactured in South Australia by Messrs. Clutterbuck Bros. from designs prepared by their consulting engineer, Mr. W. S. Saunders.

Power is supplied to the works motors at 440 volts, 50 cycles, and the generators are designed for a power factor of 0·725. There are several interesting features about this installation. In the first place, the two units run in parallel without the slightest trouble. This is said to be the only plant in Australia in which three-phase gas-driven alternators are run in parallel. Not only do the sets run satisfactorily in parallel at no load as well as at full load, but they run well when one of the cylinders is cut out.



"Witton" Alternator driven by "Premier" Gas Engine.

A second point of interest is the low fuel consumption. On the official tests, the weight of fuel consumed per KW.-hour was 1·22 lb., the fuel used being gas coke. This performance was nearly 25 per cent. better than the guarantee.

With regard to governing, during the official tests full load was thrown off the engines and then switched on again; in both cases the engines showed no appreciable variation of speed.

The electrical side of the contract was arranged, and the plant installed, under the supervision of Messrs. Colton, Palmer and Preston, who are the Adelaide agents of the British General Electric Co., Ltd.

Tungsten for Telegraph Keys.

A modest but very essential part of a telegraph key has recently received the attention of an American manufacturer of telegraph apparatus and been really improved. The little platinum contact points, which have frequently been charged with being the cause of bad sending and been pounded into a shapeless mass by glory-seeking young operators, are being displaced by tungsten, which is taking a very prominent place in the manufacture of electrical devices.

Tungsten has proved to be a distinct advance in key construction. The points never stick or corrode, and they are practically indestructible. They are, moreover, much cheaper than platinum points, which is an important consideration. The platinum used in keys is one of the most expensive items of cost in manufacture, the value of the metal required for each key being, at present, between 40 and 50 cents for standard requirements. Tungsten points can be made for less than one-half the cost of platinum, and this price will, no doubt, be reduced with improved methods of manufacture.—*T. and T. Age.*

WAR ITEMS.

Trade Openings Abroad.—ECUADOR.—An agent in Guayaquil wishes to represent manufacturers of electrical goods. Applications should be made, in the first instance, to the Board of Trade Commercial Intelligence Branch in London, and, subsequently, to the British Consulate, Guayaquil.

ITALY.—A firm with branches at Florence, Geneva and Turin, wishes to secure representation of United Kingdom manufacturers of porcelain (or substitute) fittings for electrical gear, such as insulators (high and low tension), bobbin insulators, pulleys, and bases for fuses. Applications should be made to the Board of Trade Intelligence Branch in London, and, subsequently, to the British Consulate, Milan.

An Italian firm, through Messrs. Wm. Geipel & Co., is inquiring for insulating material in the form of sheets, sticks, &c., as a substitute for ebonite and vulcanised fibre at a low price. We will forward the address to firms interested in the subject.

The Situation in Belgium.—A German engineer, who is employed in connection with the civil administration in Belgium, reports that the engineering industry in that country is passing through gloomy days, although some makers of lathes and agricultural machinery are at work. A similar remark applies to the electrical engineering industry. Hardly any new machines are being made in the various works, where repairs of rolling stock are being carried out. The electricity supply and gas works have of necessity been compelled to restrict working, the street lighting is reduced, and light industries are less active than was formerly the case. Most of the electricity and gas works belong to private companies, which hold concessions from the local authorities. The Municipal Council of Brussels—greater Brussels consists of a number of independent communes—owns the gas and electricity works, except for certain districts. On the other hand, the (English) Continental Gas Co., to which belong the gasworks at Berlin and Hanover, furnishes gas and electricity to a number of the communes in Greater Brussels, as well as gas at Antwerp. The scarcity of coal which prevailed last winter has been overcome, and the stocks have been replenished, so that, if the deliveries continue, an interruption in the lighting service is not apprehended in the coming winter through the lack of coal. It is added that the light and power stations are employing almost the same number of workers as in peace time, and that the number of connections has increased owing to the total cessation of supplies of petroleum.

Shell-Making at ———.—Mr. V. Delebecque informs us that in his district a Committee was formed three weeks ago to look into the matter of the production of shells, of which he is a member, and his assistant, Mr. Blandford, is hon. draughtsman; in the short time which has elapsed a number of lathes have been selected, the attachments for them have been arranged for, a suitable building for housing them has been found, and in all probability within the next month a factory capable of turning out a large number of 4·5 shells a day will be in full operation.

British Insulated & Helsby Cables, Ltd.—In the course of a recent reference in this column to the work that this company has in hand, it was stated that some orders had been transferred to the United States; we have since ascertained that this statement was erroneous, as no such transfer of orders has taken place, and we withdraw it unreservedly.

Wireless in the War.—Signor Marconi, who is a Lieutenant in the Italian Engineers, has been in London for a short stay, on important business. He states that the Italians are using wireless telegraphy freely in the field, for directing the fire of big guns, and that wireless telephony has been found of considerable use at sea, particularly in the British Navy.

BUSINESS NOTES.

Holidays.—The factory of the "Z" Electric Lamp Manufacturing Co., Ltd., at Southfields, S.W., will be closed for August Bank Holiday week (from 2nd to 7th inclusive). A small staff will deal with urgent matters.

The factory of the "Omega" Electric Lamp Co., Ltd., at Hammersmith, will be closed from Monday, August 2nd, to Saturday, August 7th, inclusive, for the annual holiday.

Messrs. J. H. Tucker & Co.'s works and offices will be closed from Friday night, the 30th inst., until Wednesday morning, August 4th.

Prices Advance.—The Liverpool Electric Cable Co., Ltd., of Linacre Lane, Bootle, announces altered discounts to the trade for Association and non-Association rubber-insulated wires and cables, consequent upon the continued advance in raw materials.

Liquidations and Dissolutions.—Bryant Trading Syndicate, Ltd.—This company is winding up voluntarily, for the purpose of reconstruction, with Mr. A. C. Vincent, of 10, Pancras Lane, E.C., as liquidator. A meeting of creditors is called for August 3rd.

Aluminium Patent Nonflux Solder.—A meeting will be held on August 26th, at 10, Camomile Street, E.C., to hear an account of the winding up from the liquidator, Mr. C. Waterhouse.

Bessemer & Redman, Newton Abbot and Torquay.—Messrs. Robert Redman & H. A. Bessemer, electrical engineers and contractors, have dissolved partnership as from December 31st, 1914. The business will be carried on by H. A. Bessemer, who will attend to debts.

Outing.—A number of the employés of the Anchor Cable Co. had an enjoyable outing a few days ago to Gathurst, where tea was served and a bowling match was played.

Trade Announcements.—Mr. Wm. Palmer, of 386, Fulham Palace Road, S.W., has resigned his position as sales manager with the Anglo-Colonial Engineering Co., Ltd., 13, City Road, E.C., and by mutual arrangement with the company has withdrawn the agency for motors made by the Nya Foerenade Elektriska A. B. Ludvika, Sweden, from their business, and is working it on his own account from the above address. He holds good stocks of standard machines.

Mr. Francis Husband, A.M.I.E.E., late director of Electrical Contracts and Maintenance Co., Ltd., has been appointed managing director of F. Husband, Ltd., and all inquiries should be addressed to the firm at Craven House, Kingsway, W.C. The business carried on will be electrical manufactures and supplies to the trade.

Mr. Geo. B. Crockatt has entered into a working arrangement with Messrs. Douglas Primrose & Co., 163, Hope Street, Glasgow, and has transferred to that firm the agencies which he held on behalf of Messrs. Frankenburg & Sons, of Salford, and the Jackson Electric Stove Co., of London. Messrs. Douglas Primrose & Co. have a special office staff and ample store room for dealing with agency work.

The Walsall Electrical Co., Ltd., 57, Bridge Street, Walsall, inform us that they have been placed on the War Office list as suppliers of small meters as used on charging boards and in connection with signalling apparatus.

Trade between the U.K. and Russia.—An arrangement has been concluded between His Majesty's Government and the Russian Government for the reciprocal waiver of Consular fees in connection with the issue and legalisation of certificates of origin for goods sent from the United Kingdom to Russia, and *vice versâ*. This arrangement is to come into force on August 1st. —*Financial News.*

Catalogues and Lists.—Mr. Sherard Cowper-Coles, 1 and 2, Old Pye Street, S.W.—Leaflet describing the Cowper-Coles regenerative electro-galvanising process for depositing zinc on iron and steel.

The Homogeneous Lead Coating Co., 1 and 2, Old Pye Street, Westminster, S.W.—Illustrated circular respecting their homogeneous protective lead covering for iron and steel surfaces.

M. Paul Gadot, Porte Champerret, Levallois-Perret (Seine).—Catalogues Nos. 1 and 2, with supplement, describing the Paul Gadot accumulators, and electric lighting apparatus for automobiles, &c.

Messrs. Haylock & Haslett, 63, Queen Victoria Street, E.C. —Leaflet showing the "Penlite" flash light, for the waistcoat pocket.

Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, S.W.—The following new E.A.C. leaflets have been issued:—H17A (Field Regulators) superseding H17; H19P/1 (D.C. Pillar Panels) superseding H19P; H24/1 (D.C. Multiple Lever Starters) superseding H24; H25 (D.C. Automatic Control Gear) superseding H25/1, H25/a, H25b, H26/1, H27; H40/1 (Ironclad Switchgear) superseding H40; H41/2 (Ironclad Switchgear) superseding H41/1; H42/2 (Auto-Transformer Starters) superseding H42/1; H43/2 (Star-Delta Starters, &c.) superseding H43/1; H44/1 (Slip-Ring Motor Starters and Controllers) superseding H44; H45/1 (A.C. Motor-Control Units) superseding H45. Leaflet H29 has been withdrawn from circulation. The leaflets are fully illustrated, and contain tabulated data relating to dimensions, shipping weights, prices, &c.

The Edison & Swan United Electric Light Co., Ltd., Ponder's End, Middlesex.—Leaflet No. A 3,112, describing "Ediswan" circuit-breakers, types W and E, with prices; also revised booklet on "Ediswan" "Kingolite" patent upright candle lamps, shades, &c., and a leaflet on Ediswan electric fans.

The Cressall Manufacturing Co., 40 and 41, Staniforth Street, Birmingham.—Card illustrating woven asbestos resistance and heating nets, with sample attached.

The British Thomson-Houston Co., Ltd., Rugby.—Price list No. 5,111 on air-break Y-Delta starting switches for use with three-phase squirrel-cage induction motors up to 25 h.p.

Cameron Sales-Organisation, 9-10, Southampton Street, W.C.—Leaflet describing the "Junior" bell-ringing transformer and porcelain clamp bushing.

Messrs. David Rowell & Co., Ltd., 33, Old Queen Street, Westminster.—Reference list of fencing, staircases and constructional steel and iron work.

The New System Private Telephone Co., Ltd., 143-145, Great Portland Street, W.—Postal card *re* "intercommunicating telephones."

Licences to Trade.—The following statement by the War Trade Department in regard to the granting of licences to trade has appeared in the *Times*:—

"All applications for licences, of which a very large number, about 2,000, are received each day, are registered and then sent to the Trade Clearing House. The Trade Clearing House has collected and collated a huge mass of information about trading firms, especially in neutral countries. This House reports as to whether there is anything against either the consignor or consignee, and no application is considered without reference to this information. Many of the applications go next to a Government Department, *e.g.*, the War Office, the Admiralty, the Board of Trade, the Board of Agriculture, the Ministry of Munitions, and are then referred to a special sub-committee when such a sub-committee exists. No licence is granted in these cases without a recommendation from the Department or sub-committee concerned, and no licence is ever granted against a recommendation to the contrary from those quarters.

"The work of the War Trade Department is thus carried out with exact and scrupulous care. All possible dispatch is exercised, but a careful investigation of an application for a licence is not always compatible with great speed. Mistakes no doubt do occur, but it is claimed that they are few in number, and that every possible care is taken to prevent them. The strictest oversight and supervision are exercised."

Book Notices.—*The Universal Directory of Railway Officials*, 1915. Compiled under the direction of S. Richardson Blundstone. London: The Directory Publishing Co. 10s.—This directory has now reached its twenty-first year of publication. The sectional arrangement of the contents is, as usual, convenient, but the war has naturally had its effect upon the directories which deal with undertakings on the Continent. The editor announces that the war has made it necessary to omit the sections relating to the railways of Austria, Germany, Hungary, and Turkey, and for the same reason the sections relating to the railways of Belgium and certain parts of France have not been corrected. The information relating to the railways at home and abroad, also the tramways in the United Kingdom, and their *personnel*, is revised as usual, and altogether the directory is a very useful one for those who have dealings with the great railway systems of the world.

Manual of Electrical Undertakings and Directory of Officials, 1915-16. By E. Garcke. London: Electrical Press, Ltd. 21s. net.—The nineteenth annual edition of this well-known work contains all its usual features particularising the electrical undertakings of this, and many other countries, their finances, and their *personnel*. Altogether it consists of 2,000 pages and contains 48 maps. One of the latter is a large revised map of the United Kingdom, showing the situation of all lighting, power and traction undertakings. The "Survey of the Year" contains a good deal of comment relating to the war and war effects upon electrical undertakings, and a couple of articles describe the electrical position in Belgium and Germany as it was before the war.

"The *Engineer* Directory." London: The *Engineer.*

"Science Abstracts," A. and B. Vol. XVIII, part 7. July 26th, 1915. London: E. & F. N. Spon. Price 1s. 6d. each.

"*Proceedings* of the New South Wales Institute of Engineers." Vol. XXXI, No. 3. July 23rd. Cardiff: The Institute. Price 5s.

Bankruptcy Proceedings.—Herbert Page, electrical engineer, trading as "Smeeton & Page," at 63, Queen Victoria Street, E.C., and residing at 32, Marlborough Road, Chiswick.—The first meeting of creditors was held last week at the London Bankruptcy Court. Mr. Egerton S. Grey, Official Receiver, reported that the debtor had stated that he commenced business in 1891 at 63, Queen Victoria Street, E.C., in partnership with another person, who retired from the firm in 1894. The debtor continued the trading alone, but under the same style of "Smeeton & Page," and he attributed his failure to bad trade, the builders' lock-out in the early part of 1914, lack of capital, and the war. In the absence of any offer, the case was left in the hands of the Official Receiver, to be wound up in the ordinary course of bankruptcy. The public examination of the debtor is fixed for September 7th.

For Sale.—By order of the P.M.G., tenders are invited, up to 10 a.m., August 11th, for Plant and Machinery now at the Head P.O., Manchester. Particulars are given in our advertisement pages to-day.

LIGHTING and POWER NOTES.

Australia.—The Sydney Municipal Council, in connection with the construction of the State railways, is recommended to supply Messrs. Norton Griffiths, Ltd, with electricity for purposes other than lighting at not greater than 1d. per unit, provided Messrs. Norton Griffiths, Ltd., take the whole of the electrical energy required by them in the metropolitan district of Sydney from the City Council; the arrangement, so far as the supply for the State railway is concerned, is to include the provision by the company of the necessary cables between the Council's sub-stations and the railway.

The Manilla (N.S.W.) electricity supply is now complete, and it was expected to commence the supply at the commencement of the month.

The Walgate (N.S.W.) Municipal Council has decided to submit the question of adopting an electricity supply scheme to a plebiscite of ratepayers.

The Balmoral Shire Council (Queensland) is considering the question of lighting the Shire by electricity.

The Kyneton (Victoria) Shire Council has instructed Mr. V. J. Crowley, consulting engineer, to submit a report on the proposed electric lighting of Trentham.

The Blue Mountains Shire Council has approved of the draft Bill to be submitted to the N.S.W. Parliament, empowering the Council to raise a loan of £20,000 to finance an electric lighting scheme. It is proposed to have a generating station at Wentworth Falls; for street lighting there will be installed 365 50-c.p. lamps and 11 100-c.p. lamps.—*Tenders.*

The construction of the tunnel under Sydney Harbour, between Long Nose Point, Balmoral and Greenwich, for the purpose of carrying the cables from the new power house at Whitley Bay to the North Sydney sub-station, is being seriously impeded by an inrush of water, which has risen to within 25 ft. of the surface of the shaft. The tunnel has already taken nearly two years to build about half of the length, the construction having been often impeded by the water difficulty.—*Sydney Daily Telegraph.*

Bath.—Price Increase.—The T.C. has decided that the charges for electricity are to be increased by 10 per cent.

Bridge (Kent).—The R.D.C. has consented to the Canterbury T.C. extending its mains, so as to supply current to premises at the village of Harbledown.

Bristol.—Year's Working.—For the year ended March 31st last, the Corporation electricity undertaking had a total revenue of £116,626; the working expenditure was £53,574 and the gross profit £63,052. After meeting interest and loan charges the net profit was £13,594, making, with balance brought forward, a surplus of £15,909. This has been appropriated as to £3,523 largely for capital purposes; £6,011 has been placed to reserve, and £6,374 carried forward. Mr. Faraday Proctor, the city engineer, reports that 18,202,166 units were sold, an increase of 17 per cent. The revenue per unit sold has fallen below 1½d., and the total cost per unit sold to ·668d. The total connections are equal to 796,301 30-watt lamps, and include 19,542 h.p. of power connections, while applications have been received for some thousands of additional h.p. The consumers numbered 5,270, an increase of over 500 in the year.

Bury.—Loan Sanction.—The T.C. has decided to make a second application for sanction to the borrowing of £7,500 for electricity works extensions. Sanction has already been received, but in view of the war the L.G.B. has intimated that another application should be made before the money is spent.

Canada.—The Alberta Hydro-Electric Co., which proposes to construct a series of dams on the Bow River, within the city limits, for the production of electric power, has made an offer to supply power to Calgary at the following rates:—4,000 h.p. at $22 per h.p.; the next 1,000 h.p. at $21; the next 1,000 h.p. at $20; the next 6,000 h.p. at $19. The company asks, at the end of the five years, for a minimum of 10,000 h.p. on a renewed contract at the same prices.

In connection with the enlargement of the Montreal aqueduct and the generation of power for pumping and lighting purposes, the Board of Control has submitted an estimate of the cost of the scheme. This is put at $1,500,000, but the expenditure will not be made for a considerable time.—*Canadian Electrical News.*

Chislehurst.—Price Increase.—The U.D.C. has been notified by the Chislehurst Electric Supply Co. that the charges for electricity will be increased by 10 per cent. from the June quarter, this will bring the rate chargeable up to nearly 8d. per unit, which is the maximum price under the company's prov. order.—*Eltham Times.*

Continental. — Russia. — The Petrograd T.C. has prepared a report on the purchase of the electrical concessions in the town. A scheme is to be prepared for combining the various electrical concerns that will be taken over by the town between the years 1917 and 1918; the Belgian and the "1886" electrical concerns are both differently equipped, and the exploitation of such differently equipped installations would involve the extension of the stations and the systems of all three concerns, including the existing town establishment, independently, which would mean an uneconomical expenditure of the town's money in the future. Parallel with the preparation of a project of expenditure, a technical and commercial scheme for exploitation must be formed suitable to the town's requirements. It must also be remembered that all the electrical concerns in the capital will not pass into the hands of the town at the same time; in any case, it will be necessary to proceed with the conversion and extension of the electrical installations by May, 1917. The Town Board, therefore, submits to the Town Duma that a special committee be appointed for the preparation of the various measures involved in the project suggested.

Coventry.—Proposed Loan.—The E.L. Committee of the T.C. has recommended the Council to apply for a loan for extensions at the works, estimated to cost £91,417, subject to certain assurances from the Government. This has been agreed to by the Council. The extensions are necessary to meet the demands of firms engaged upon Government work, and the Council desires a Government guarantee against loss on capital account in the event of a cessation of the additional demand for power.

Crayford (Kent).—Public Lighting.—The P.C. has received from the West Kent Electric Supply Co. an offer to light the new estates at Barnes Cray and Northumberland Heath with 30-c.p. lamps at 65-yard intervals. at £2 2s. each per annum, on a five years' agreement, and with 100-c.p. lamps at £2 6s. each, the standards to become the property of the Council at the end of the contract term. The company is to be asked to quote for 80 and 100-c.p. lamps, at 60-yard intervals.

Croydon.—Year's Working.—The report of the borough electrical engineer (Mr. A. C. Cramb) on the working of the electricity undertaking shows that the total expenditure was £43,201, a decrease on the preceding year of £2,734. The reserve and renewals funds stand at £26,870, as compared with £39,000 three years ago. The surplus on the year's working was £2,595. In the present year an increase of £10,000 to £11,000 in working expenses is anticipated, of which the increased cost of coal will account for not less than £9,000.

Darlington.—Loan Sanction.—The T.C. has received anction to a loan of £26,000 for electricity purposes in respect of Government work; the total loan applied for was £34,000.

Exeter.—Refuse Destructor.—The T.C. has decided not to apply at present to the L.G.B. for a loan for the construction of a refuse destructor, the Board having intimated that a local inquiry would be held if desired, with a view to a loan being sanctioned when circumstances permit.

Faversham.—The T.C. has decided to extend the mains so as to supply current to the milling firm of Messrs. T. and T. G. Gillett.

Fleetwood.—The Electricity Committee has received complaints from the Electrical Contractors' Association, the Electrical Trades Union and the Fleetwood Chamber of Trade regarding the carrying out of private installation work by employés in the Council's electricity department, and has decided to take no action in the matter.

Gillingham (Kent).—School Lighting.—The T.C. has offered to install the E.L. and supply current for lighting at the non-provided schools in the borough at 6d. per unit, this to cover the cost of current and hire of installation and fittings.

Glasgow.—Year's Working.—The annual report of the electricity department shows that the gross revenue was £405,372, and the working expenditure £218,517, leaving a net revenue of £186,854. Last year's net revenue was £177,417. Interest and loan charges, &c., totalled £134,568, leaving a balance on the year's working of £52,286. After depreciation of £52,745 is written off capital account, the deficit on the year's operations is £459. Last year there was a surplus of £819. The revenue account shows an increase of income from all sources of £27,057, despite the abnormal conditions prevailing. On the other hand, the working expenses increased by £17,620, principally due, apart from the larger output, to an advance in wages to the workmen, a general overhaul of plant and mains, increased rates and taxes, and to a sum of £3,144 in allowances granted to those former employés now on service with H.M. Forces. Contracts had been entered into for the supply of coal for next year at prices very considerably in advance of those of last year. Having in view this serious addition in working cost, and increased amounts payable for interest, sinking fund, rates and taxes, and a general advance in the cost of all materials required during the coming year, the Committee has decided to recommend that rather than alter the existing scale of charges, 15 per cent. be added to all accounts from the date of last survey. The number of consumers at May 31st, 1915, was 32,030, an increase of 1,932. The quantity of electricity sold to private consumers during the past year was 85,718,795 units, an increase of 11,730,146 units.

Godalming.—Public Lighting.—The T.C. has agreed to the following offer for public lighting made by the Urban Electric Supply Co.:—Average number of units per annum to be taken as being 72,480; the average price per unit at which current is now supplied to be taken as being 2·9d.; from January 1st, 1915, to December 31st, 1915, the Council to pay for each unit supplied 2·9d.; the units actually supplied and paid for to be deducted from the 72,480 units, and on the balance (representing decrease due to restricted lighting) the Council will pay one-fourth of 2·9d. per unit, although no light is supplied.

Greenock.—Year's Working.—It is reported that the electricity department has made a profit on last year's working of £10,000, which is said to be the largest in the history of the department.

Huddersfield.—Price Increase.—The charges for electrical energy are to be increased 12½ per cent., commencing with the next half-year's accounts.

Leicester.—Price Increase.—The Electricity and Tramway Committee estimates that upon this year's generating costs there will be an increased expenditure of £15,000, and recommends that from September 30th the charge for lighting be increased by ½d. per unit, and that the charge for power be increased by 20 per cent.—*Leicester Daily Post.*

New Plant and Buildings.—The members of the T.C. recently inspected the new plant and buildings at the Lero power station and tramway car depôt, which have cost some £68,000. The station now contains three 1,000-h.p. and one 2,000-h.p. slow-speed 550-volt d.c. sets, which were installed in the first instance, a 1,500-h.p. motor-alternator, coupled to the Aylestone S.P. plant, a 1,500-h.p. exhaust turbine, and two recently-erected 6,000-h.p. three-phase 6,600-volt turbine sets running at 3,000 r.p.m. In connection with the latter plant there are two 2,000-h.p. rotary converters, linking it up to the 550-volt direct-current sets, while a further 1,000-h.p. rotary converter is installed at the Aylestone station, to link the latter up to the three-phase supply. Two new water-tube boilers have been installed, and a new brick chimney, 212 ft. high, has been built. The total plant capacity of the two Corporation power stations is nearly 29,000 h.p., and the output during 1914 was over 19 million units. At the car shed, the recent additions consist of repair shops.

London.—Hammersmith.—In his report on the year's working, Mr. Bell, the Council's electrical engineer, mentions the difficulty experienced in obtaining coal by the river, the extra cartage cost being 1s. 1d. per ton, compared with 1d. per ton for transporting the coal from the Council's wharf to the generating station by the new coal handling scheme. Coal and cartage together, however, cost £90 less than in the previous year, the coal cost per unit being ·323d. as against ·334d. in 1913-14. The output sold from the Council's station, 9,523,209 units compared with 9,276,365 in the previous year, but the maximum demand was only 4,646 KW. as against 6,162 KW., this being due to not holding the Olympia Motor Show when the highest load usually occurs. The total units sold, which includes certain energy purchased by agreement, amounted to 9,717,252; the gross profit was £26,995 as against £28,629 in the previous year, and the net profit £3,718 as against £6,386 in 1913-14. The department has a reserve fund of £16,774, and in addition to normal capital repayments, has written off a further £12,343.

L.C.C.—The Finance Committee recommends the Council to sanction the borrowing of £10,188 for the extension of Poplar electricity undertaking, being £3,688 for mains and £6,500 for machinery. The Treasury imposes the usual conditions, and asks that the amounts shall be provided out of funds under the control of the B.C., without resort to other sources for the next 18 months.

Sanction is to be given to the borrowing by the St. Pancras B.C. of £15,000 for the provision of a 5,000-KW. turbo-generator, to be repaid within 15 years, on the understanding that the B.C. will agree to repay within a reduced period, equivalent to one-half the periods now unexpired, but not exceeding 15 years, the debt now outstanding on the plant and machinery, for which a term of 42 years had been granted, and which will, on the introduction of new machinery, fall within the category of stand-by or reserve plant.

The Council is also recommended to sanction the borrowing of £4,153 by the Stepney B.C. for buildings in connection with the electricity undertaking; and of £2,172 by the Woolwich B.C. for the supply of electricity to 220 houses, including wiring the houses, forming part of the Commissioner of Works' housing scheme at Eltham; also of £4,700 by the Woolwich B.C. for linking up the undertaking with the South Metropolitan Electric Light and Power Co., including £3,000 for 10,000-volt feeder cable, £1,500 for two 750-K.V.A. transformers and switchgear, and £200 for a substation.

The Finance Committee, reporting on the application of the Battersea and Fulham B.C.'s for sanction to the borrowing of £5,814 and £8,376, in connection with the scheme for linking up the electricity undertakings of Battersea and Fulham and Hammersmith, says that the Treasury raises no objection to the loan in the case of Battersea as the expenditure is urgently necessary. The Committee is advised that the only work which complies with the Treasury requirement is that relating to the linking up of the Battersea and Fulham stations, and recommends that for the present sanction shall be limited to the cost of this work, viz., Fulham, half the cost of the main, £2,618, and transformer, £1,850; Battersea, half the cost of the main, £2,618. This is subject to the B. of T. approval of the agreement.

Mansfield.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £500 for electric services. A new five years' agreement for the supply of current has been entered into with the Tramway Co.

Market Weighton.—E.L. Scheme.—The East Riding of Yorks C.C. has consented to a company being formed to supply electricity to the town, and the laying of underground cables along the main roads in the district.

North Wales.—The North Wales Power and Traction Co., Ltd., has applied to the B. of T. for permission to erect 20,000-volt overhead lines from the sub-station at Gelli Ffrydian, Nantile, to Trevor Quarry.

Norwich.—Year's Working.—The report of the Electricity Committee on the year's working of the electricity undertaking shows gross receipts amounting to £57,261, and working expenses to £31,010, leaving a gross balance of £26,250 to be carried to net revenue. The charges for interest and sinking fund amounted to £18,237, and the balance carried to appropriation account was £8,013. The gross receipts for the previous year were £58,764, and the balance £27,831. Out of the balance of £8,013 a sum of £4,055 has been expended in completion of the scheme commenced three years ago, and the balance of £3,957 will be carried forward. For the first time in the history of the undertaking the output shows a decrease due to the restricted public lighting; the public electric lamps number 2,639. Due to more efficient working £706 was saved in coal cost, although a higher price was paid, and it is not proposed to raise prices to consumers.—*Eastern Daily Press.*

Nuneaton.—Street Lighting.—The Electricity Committee has decided to take over the existing gas lamp standards, which would be dispensed with when electric light was substituted for gas, at 17s. 6d. per standard.

Southampton.—Price Increase.—It is proposed to generally increase the price of electricity, by from ½d. to ¼d. per unit in most cases, for lighting and heating. A simpler scale of charges for power supply is proposed to be substituted for the present rates; the prices for public lighting and tramway supply are to remain unaltered.

South Africa.—The supply from the Cape Town electricity works recently suffered a brief interruption, the cause of which is supposed to have been an attempt by some person to cut an 11,000-volt cable supplying the southern suburbs. As the cable was alive at the time it is considered remarkable that the person in question was not killed, and efforts are being made to trace him.

Southend-on-Sea.—Sewage Pumping.—The T.C. has consented to a distributor and branch main being laid, at a cost of £201, to the sewage pumping stations in the town.

Stoke-on-Trent.—Wiring Contracts.—In a report to the T.C., the Electricity Supply Committee states "That this Committee cannot recommend any particular firm of contractors, and that it be an instruction to the engineer that when information respecting wiring contractors is asked for by consumers, a list giving all the contractors in the district be supplied."

Trowbridge.—The Electric Supply Co. has applied to the U.D.C. for permission to use overhead lines in order to supply current to the Isolation Hospital in Bradley Road.

Warrington.—Price Increase.—The price of current for lighting purposes and for tramways is to be increased as from August 1st by 10 per cent., and for heating and power purposes (except in cases where the price is regulated by a coal clause) by 15 per cent.

West Bromwich.—The Electricity Committee proposes to supply Messrs. J. B. & S. Lees, subject to agreement, for a period of five years.

Wirral.—Prov. Order.—The U.D.C. has decided to oppose an application, which is to be made to the B. of T. by Messrs. Johnson & Phillips, for a prov. order empowering them to supply electricity for lighting purposes within the district and to apply for a further order to make an electric tramway for passengers and goods.

Worksop.—Price Increase.—Owing to the war's effect on the undertaking, the U.D.C. has decided to increase the price of current by ½d. per unit for lighting, and by ¼d. per unit for power, from the end of the present quarter.

York.—Loan Sanction.—The L.G.B. in forwarding to the T.C. sanction of loans of £7,047 for mains; £1,286 for poles, &c., for overhead cables; £4,491 for rotary converters, &c.; £830 for static transformers; £1,626 for services; and £656 for buildings, intimates that it views with great dissatisfaction the action of the Council in incurring expenditure in anticipation of sanction, and again warns the Council to avoid such irregular procedure in future.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Year's Working.—The annual report on the working of the Corporation tramways for the last year shows that the cars ran 1,909,009 miles, and carried 24,048,816 passengers, producing a revenue of £88,002. The working expenses were £51,525. The net balance was £26,509, and the profit £11,000, of which, for the first time, one-third will be available for application to the common good, to the reduction of the rates, or towards public improvements. The receipts, the manager points out, are still showing a regular increase. An agreement has been entered into with the electricity department for a period of five years for a supply of energy at the rate of ·85d. per unit for the first two million and ·80d. for any quantity beyond, in one year.

Blackpool.—The receipts for the Corporation tramways for the last month were £7,035, a decrease of £3,651 compared with the same period last year. The total receipts from April 1st to July 15th were £21,232, a decrease of £7,126, and the passengers showed a reduction of 935,197.

Bury.—The B. of T. has approved of the Limefield and Jericho tramways extensions.

Canada.—In connection with the Hudson Bay Railway scheme, attention is being directed to the water powers of the Nelson and Grass rivers, both in the vicinity of the railway. The accessible water power of the Nelson river is estimated at 6,000,000 H.P., and of the Grass river at one quarter of that amount.

Castleford.—The U.D.C. has decided to invite the B. of T. to inspect the tramlines in Pontefract Road, the condition of which is alleged to be unsatisfactory.

Continental.—Italy.—The Società Tramvie Elettriche, recently formed for the construction of an electric tramway between S. Angelo, Mirandola Terme, and Chignolo Po, has entered into negotiations with the Commune of S. Angelo with a view to the extension of the original scheme, in the direction of Milan. The society stipulates that the commune shall bear an adequate share of the expenses, both of the construction and of the study of the new line. The gauge of the tramway line is to be the same as that of the State railways, and goods stations are to be constructed.

A concession has been secured for the construction of an electric tramway between Valle della Versa and Stradella, whence an eventual continuation will link up with Pavia by traversing the new bridge at Becca. The line has a length of 10 km., and its cost is estimated at 918,284 lire for the permanent way, overhead installation, &c., and about 189,000 lire for rolling stock.—*Revistà Tecnica d' Elettricità.*

Switzerland.—The progress of railway electrification in Switzerland is shown by the fact that there are some 3,000 km. of line converted from steam to electric working, the energy being supplied by local water-power. The first section electrified was that of the St. Gothard tunnel, of a length of 108 km. Single phase current is supplied at 60,000 volts pressure to various sub-stations, whence it is stepped down for distribution.

Spain.—It is proposed to construct a narrow-gauge electric railway, with double track, from Fonsagrada to Ribadeo. The line will pass through the valleys of Langreo and Santa Eulalia, and terminate in the basin of the River Eo. The concession for the line has been secured by the Sociedad Hispano-Belga de Ferrocariles, Mineria e Industria.—*Industria e Invenciones.*

Croydon.—Year's Working.—The report of the Corporation tramways for the year ended March 31st, 1915, shows that the total revenue amounted to £88,614; working expenses were £70,307, and £1,974 was absorbed in war allowances to employés, leaving a credit balance of £16,332. From this £7,889 was deducted for interest, £7,414 for sinking fund and £1,586 for income-tax, and the net balance of £191 was placed to the renewals fund. The reserve and renewals fund stands at £41,643. Compared with the preceding year the traffic receipts increased by £2,907, and it was stated that but for the war a net profit of £5,000 could reasonably have been expected. Already the increase in receipts for the present year was over £700. However, owing to the increasing cost of coal there would be an extra £3,000 to find this year for current.

Exeter.—The B. of T. has informed the T.C. that it is not at the present time prepared to sanction the proposed tramway track alterations on the Blackboy Road route.

Formby.—Railway Extension.—An inquiry was held last week by the Light Railway Commissioners into the proposal to run a line to Formby headland, by an additional loop connecting with the existing electric line of the L. and Y. Rly. Co., running between Liverpool and Southport. The total length will be seven miles, and the cost £62,650.—*Manchester Guardian.*

Glasgow.—Female Labour.—The Tramways Committee has had some difficulty in the selection of uniforms for the large number of women conductors now employed. The problem has now been solved and contracts have been placed for a supply of Black Watch tartan skirts (large black and green check) and green straw hats with medium brims, which will, it is thought, harmonise comfortably with the regulation green uniform of the department.

Halifax.—Year's Working.—The total revenue from the Corporation tramways for year ended March 31st was £113,170; the working expenses amounted to £73,504; interest on capital to £10,424; contribution to sinking fund, to £12,106; and the net profit to £16 211. In the previous year the net profit was £13,643, and in 1912-3, £12,681.

Leicester.—For the Corporation tramways the expenses for the current year are estimated at £30,000 more than in 1914, due to war allowances, bonus, interest and sinking fund, and extra generating costs. After deducting the estimated receipts, it is not improbable there may be a net deficiency of £19,000, to meet which the Committee recommends the increase of fares on certain sections of the system.—*Leicester Daily Post.*

London.—L.C.C.—The Highways Committee recommends that grants, estimated at £1,189, be made to certain officers and employés in the tramway department for special services in connection with the recent strike.

The Highways Committee also recommends that the services of Messrs. Kennedy & Donkin, consulting engineers, whose agreement expired on May 31st, 1915, be retained for a further period of one year, and thereafter, subject to three months' notice, to advise and report as to the extension of the Greenwich generating station, and to afford the Council whatever consultative assistance may be required.

The same Committee also recommends that the President of the L.G.B. be informed that, with a view to avoiding the waste in men, materials and money, due to unnecessary transit services in London, the Council is prepared to participate in a conference to be held under the chairmanship of a representative of his department, with the representatives of other traffic authorities and undertakings; and that the Highways Committee be authorised to take all necessary steps in connection with matters arising out of such conference, provided that any arrangement come to be limited to the period of the duration of the war.

Hackney.—In view of the delay in the reconstruction of the existing tramways in Lauriston Road and Church Crescent, caused by the Treasury restrictions on borrowing, the L.C.C. has decided to remove the rails and repair the paving where necessary. If this is done it will prevent the Council from periodically running a horsed car over the route as required in order to retain its powers over the tramways; the L.C.C. has asked the B. of T., under the circumstances, to give an assurance that no order under Sec. 41 of the Tramways Act, 1870, declaring the powers of the County Council in respect of the tramways to be at an end, shall be made while the Council is prevented by H.M. Treasury from obtaining a loan for the purpose of reconstruction, and the B.C. has been asked to support the Council's application.

Newcastle-on-Tyne.—Year's Working.—The annual report on the Corporation tramway undertaking shows total traffic receipts of £281,851, an increase of £30,837 on the preceding year. The income from parcels totalled £1,704, advertising £3,018, and from lighting £7,719, making, with other items, a gross revenue of £293,263, an increase of £32,062. The total working expenditure was £160,457, compared with £147,552, an increase of £12,905, due to £3,970 increased cost of general repairs and maintenance, and £7,437 increase in traffic expenses caused by the concessions granted to the employés in August, but does not include £4,364 paid to dependents of men on active service. Interest charges amounted to £29,574, and £5,411 was paid in income-tax; sinking fund charges were £43,355; £18,000 was allocated to relief of rates; £6,236 for motor-'buses, and other items make a total expenditure of £73,700, leaving £24,822 to be carried to the reserve and renewals fund. At the beginning of the year the reserve and renewals fund stood at £94,337; out of this had been expended £44,505; after adding the present balance the fund stands at £74,655, a decrease on the year of £19,682.

Swansea.—Tramway Extensions.—The Light Railway Commissioners have granted an order authorising the construction of additional tramways in the borough.

Tottenham.—Railless Traction.—The Metropolitan Electric Tramways, Ltd., has informed the U.D.C. of its intention to promote in the next Session of Parliament a Bill to revive the powers under its Railless Traction Act, of 1913.

TELEGRAPH and TELEPHONE NOTES.

British Cable Ship Lost.—The British cable ship *Strathcona*, from Auckland, has been lost in the South Pacific, near the Fiji Islands. The cable-layer *Iris* sent a wireless message, received at Suva on July 14th, to the effect that she was searching for the survivors, and had found one boat-load. A second boat, believed to be making for Tongatabu, is unaccounted for.

Secret Wireless.—The German authorities at Brussels offer £500 reward to anybody who will inform them who is the owner of a mysterious wireless station which is known to be working at some private house in Brussels. For nine months the Germans have searched in vain for the apparatus, which is known to have revealed to people in Brussels important war news.

Swedish Wireless Station.—A Committee has been formed for the erection of a wireless station at Karlsborg, Sweden, for direct communication between Sweden and America, thus escaping the British censorship. The Chairman of the Committee is the general manager of the Swedish State Telegraph Co.

Throat Telephones.—At the Panama Exhibition in San Francisco demonstrations are given daily in the Mines Section of telephone communication between the advance or rescue party and the outside of the mine, in the case of mine accidents. The United States Bureau of Mines rescue crew conducts the proceedings. Each member of the rescue party wears strapped to his throat a small, specially designed transmitter and a watchcase receiver strapped to his ear. The reason for this special equipment is that a man, wearing any of the different types of oxygen helmets which cover his mouth, cannot use the ordinary type of telephone transmitter. The throat transmitter transmits speech practically as well as the standard type of telephone instrument; it is very small and light, and is provided with a soft rubber cup which assists in holding it firmly against the throat.—*Fire.*

United States.—On July 8th the U.S. Government took possession of the Sayville radio-station of the Atlantic Communication Co. in the interest of American neutrality, and to avoid contravention of the Hague Convention forbidding the establishment of a wireless station on neutral soil during a war, as already reported.

Coincidentally with the taking-over of the station by the Government, it was announced that the rate of $1.00 per word to Germany would be reduced one-half and the $1.08 rate to Austria-Hungary to 58 cents a word, plus the land rate in both instances. The Postal Telegraph Cable Co. has been handling the work at the Sayville station. In order to maintain its legal rights, the Atlantic Communication Co. will file a formal protest against the action of the Government.—*T. and T. Age.*

Japan.—Wireless communication has been established between Honolulu and Japan, a distance of 3,400 miles.—*T. and T. Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Adelaide.—August 25th. Dry cells, earth clips, recording counters, and various other instruments and apparatus, for the P.M.G. See "Official Notices" July 9th.

September 1st. Condensers, testing sets, rheostats, Morse sounders, and Wheatstone transmitters for the P.M.G. See "Official Notices" July 23rd.

Perth.—August 25th. P.M.G. One ton of crushed salammoniac, and 1½ tons of steel galvanised wire. See "Official Notices" July 23rd.

August 25th. Common-battery telephones, for the P.M.G. See "Official Notices" to-day.

September 29th. Telephone switchboard parts, for the P.M.G. See "Official Notices" to-day.

Sydney.—September 13th. Council. A.C. and D.C. electric motors. Specification (10s. 6d.) from E.L. Department, Town Hall.*

September 6th. Metropolitan Board of Water Supply and Sewerage. Centrifugal pumps and electric motors at Richmond pumping station.* Acting Secretary, 341, Pitt Street, Sydney.

Melbourne.—August 17th. Electric lamps, caps and sockets, telephone instrument parts, for the P.M.G.*

August 24th. Telephone instruments for the P.M.G.*

August 31st. Switchboard parts for the P.M.G.*

Bristol.—August 23rd. Corporation. One 6,000-KW. three-phase steam turbo-alternator with condensing plant. See "Official Notices" July 23rd.

Darlington.—August 4th. Additions to boiler house, electric power station, for the T.C. Mr. Geo. Winter, Borough Surveyor (returnable deposit of £2 2s.).

July 31st. Corporation. Three or five-ton lorry (petrol, electric, or steam), with end-tipping body. Borough Surveyor.

Middleton.—August 10th. Corporation. Coal for the electricity works. Particulars from Mr. S. Pauls, Electrical Engineer.

New Zealand.—Wellington.—August 11th. 1,500 red and 2,000 white three-conductor cords, 3 tons of bichromate of potash for the Public Service Stores Tender Board.*

Rochdale.—August 4th. Twelve months' supply of paper-insulated cables, for the Electricity Committee. Specifications (£2 2s.) from C. C. Atchison, Engineer and Manager, Dane Street.

Sheffield.—July 30th. Water service conduit screen chamber, penstocks, valves, piping, &c., for the Electric Supply Committee. Mr. S. E. Fedden, General Manager and Engineer.

South Africa.—Johannesburg.—August 25th. 8,600 drawn-wire spiral filament traction lamps, spare parts for tramcars, for the Municipal Council.*

September 25th. For the T.C. Two turbo-alternator sets, condensing plant, switchgear, &c. Specification, &c., on deposit of £2 2s., from Mr. J. H. Dobson, General Manager.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Barrow.—The T.C. has accepted the following tenders in connection with an induced-draught plant:—

Chimney.—John Thompson, Ltd., £340.
Fan.—Davidson & Co., £205.
Motor.—British Thomson-Houston Co., Ltd., £234.
Ash hopper.—Herbert Morris, Ltd., £289, exclusive of the hopper.

Bristol.—The Electrical Committee of the City Council has entered into the following contracts:—

City Foundry Co.—Boiler and furnace castings, £233.
Sykes & Sugden, Ltd.—Joint and junction boxes, £508.
British Westinghouse Co., Ltd.—Alternating-current meters, £1,329.
W. Lucy & Co., Ltd.—Fuse boxes, £148.
Ferranti, Ltd.—Direct-current meters, £365.
Oliver Arc Lamp, Ltd.—Arc lamp carbons, £765.

Coniston.—The new Electric Supply Co., Ltd., has accepted the following tenders in connection with the undertaking:

J. Bell.—Buildings.
J. Usher.—Pipe track.
J. Gordon & Co.—Turbines and water plant.

Glasgow. — The Tramways Committee recommends acceptance of offers for special track work from the Lorain Steel Co. and Messrs. Edgar Allen & Co.

Holyhead.—The U.D.C. has accepted the tender of Geo. Watkinson & Sons, Ltd., for 500 tons of coal for the electricity works during a year, at £1 1s. 6d. per ton for through and through, and £1 5s. per ton for screened steam.

Leith.—Messrs. Siemens Bros. have secured the contract for the supply of Tantalum traction lamps to the B.C. for the ensuing 12 months.

London.—Battersea.—The B.C. is recommended to accept the tender of Messrs. E. Green & Sons, Ltd., for renewal of parts of No. 2 economiser at the electricity station, at £512.

L.C.C.—The Highways Committee recommends that the chairman and vice-chairman of the Committee be severally authorised during the summer recess of 1915 to open any tenders that may be received for the provision of switchgear in connection with the reserve supply of electrical energy for working the Council's tramways.

Nuneaton.—The T.C. has accepted the following tenders for the Electricity Department:—

Nuneaton Engineering Co., Ltd.—House-service joint boxes, without wood plugs, large size, 5s. 8d. each; small size, 4s. 9d each.
C. M. Ayres & Co.—Wood plugs for house-service boxes, £1 1s., £1 2s. 6d., £1 3s. and £1 4s. per gross.

Oswaldtwistle.—The D.C. has accepted the following tenders:—

For lighting the new Free Library.—Messrs. Bland Light Syndicate.
For the repairs to the fire brigade electric bells.—Messrs. W. Rothwell and Sons, Great Harwood.

Rochford (Essex).—The B. of G. has accepted the tender of Mr. R. B. Emerson, of Ashburnham Road, Southend-on-Sea, for the installation of electric bells at the Workhouse, at £13.

Worcester.—The T.C. has decided to purchase from the Erith Engineering Co., a four-retort stoker for the electricity works, at £350, to be paid for at the conclusion of the war.

FORTHCOMING EVENTS.

North of England Institute of Mining and Mechanical Engineers.—Saturday, August 7th. At 2 p.m. At Newcastle-on-Tyne. Annual meeting.

NOTES.

"Overhead Costs."—American articles often contain references to "overhead costs," the significance of which can only be guessed at by English readers. According to Halbert P. Gillette, in the *Electrical World*, several recent decisions of public utility commissions serve to call attention to a rather general lack of knowledge about overhead costs in the United States also. The term overhead costs has no generally accepted meaning, but appraisal engineers usually, although by no means universally, limit the items of construction "overhead costs" to the following:—(1) Engineering and inspection; (2) supervision (other than gang foremen and the profits of contractors); (3) organisation (preliminary to construction); (4) administration, accounting and clerical; (5) legal; (6) insurance (casualty, fire and title); (7) taxes; (8) interest; (9) contingencies, omissions and waste; (10) brokers' fees; (11) promoter's profit.

Diesel Engine Users' Association.—The July meeting was held at the Town Hall, Kingston-upon-Thames. The Mayor, Mr. C. H Burge, attended at the opening of the meeting and addressed the members, referring to the work which was being carried out by the Association, and to the very satisfactory results which had been obtained from the working of the Diesel engine plant at the electricity works of the Corporation.

The question of a suitable allowance for depreciation of Diesel-engine plant in connection with income-tax assessment was then further considered, and, after some discussion, the following resolution was unanimously passed:—"That, in the opinion of this Association, the present allowance made for depreciation by wear and tear on Diesel-engine plant by the Inland Revenue authorities is inadequate, and that an allowance at the rate of at least 15 per cent. per annum should be claimed."

The members of the Association were subsequently entertained at tea by the Mayor and Mayoress, and a visit was paid to the electricity station, where the Diesel engines were seen at work. The next meeting will be held in October. Information concerning the Association can be obtained from the acting hon. secretary, Mr. Percy Still, 19, Cadogan Gardens, London, S.W.

A Tidal Voltage.—Troubled because his lamps grew dim for a few hours each day, and then as curiously regained their brilliancy, a customer recently called on the Boston Edison Co. to ascertain the cause. When the company's investigator visited the premises the voltage was normal, and no perceptible ground could be detected on the circuit. Before long, however, the phenomenon of the previous days repeated itself. The pressure dropped quite rapidly from 110 volts to 60 volts, and remained at that value for several hours, soon rising again, however, in the same mysterious manner. As there were no motors in the vicinity which could cause the drop in pressure, it was decided to connect a recording voltmeter to the line. After this had been left in circuit a few days, the charts revealed the fact that each day the voltage started to fall about 50 minutes later than on the preceding day. As the consumer's property was situated on a wharf, it at once occurred to the inspector that the rise and fall of the tide might in some way be the cause of the trouble. This was subsequently found to be the case, the rise of the salt water having short-circuited the service wires.—*Electrical World.*

Board of Inventions.—The Admiralty announces that the address of the Board of Inventions and Research is Victory House, Cockspur Street.

Engineering Standards Committee.—The first annual meeting, since its reorganisation, of the Sectional Electrical Committee of which Sir John Snell is the chairman, was recently held to approve such work as was completed during the session, and to receive the reports of the work in progress.

As a result of this meeting, it is understood that the following Reports, which have been transmitted to the Main Standards Committee for ratification, will shortly be available to the public :—

1. British Standardisation Rules for Electrical Machinery.
2. British Standard Specification for Electricity Meters.
3. British Standard Specification for Charging Plug and Socket for Vehicles propelled by electric secondary batteries.
4. British Standard Specification for Wall Plugs and Sockets, 5-ampere, 2-pin without earthing device.

As to the progress of the work in hand, it may briefly be stated that the Sub-Committee on Electric Power Cables, of which Mr. C. P. Sparks is the chairman, has under consideration the revision of the Report on Copper Conductors (Report No. 7, revised March, 1910). The Sub-Committee on Electric Lamps will, in co-operation with the Tungsten Lamp Association, in the early autumn, consider the drafting of a Standard Specification for Tungsten Lamps, and the question of Miners' Electric Lamps will also engage the attention of this Sub-Committee.

The Sub-Committee on Electrical Accessories, of which Mr. C. H. Wordingham is chairman, has several Panels at work, and it is hoped that recommendations will soon be forthcoming in regard to Motor-starters, Heating and Cooking Apparatus, and Fuses, as well as other electrical fittings.

A Panel has also been formed to revise the Standard Specification for Ammeters and Voltmeters (Report No. 49, issued in September, 1909), and on this Panel the British Electrical and Allied Manufacturers' Association will be represented by Mr. E. B. Vignoles and Mr. Patrick Hamilton.

Lastly, the Sub-Committee on Electrical Symbols, presided over by Dr. A. Russell, has appointed two Panels, one to draw up a British List of Graphical Symbols for use in installation and power work, and the other to deal with Telegraphs and Wireless Symbols.

The extremely important question of standards for distributing pressures for new systems, which has been brought forward by Mr. C. H. Merz, is to occupy the attention of a Sub-Committee, under the chairmanship of Dr. R. T. Glazebrook, C.B., upon which all interests will be represented.

As a rough gauge of the activities of the Committee, it is noted that during the past year more than 90 meetings have been held, and from the above record of work accomplished and in hand, it will be appreciated that the Electrical Section of the Committee is engaged on work of the highest importance to the industry at large.

Fatality.—Electric 'Bus Accident.—On Thursday afternoon last, a Coroner's inquest was held on Francis W. Dinsdale, who died from injuries received at the York electricity works through being accidentally crushed between an electric 'bus and a wall. From the evidence, it appears that a motorman named Thompson went to the garage on the previous Tuesday morning for the purpose of taking an electric 'bus out for service; the 'bus battery had been charged during the night, and, according to the driver who had the 'bus on the previous evening, the controller was left in the neutral position as required for charging, and the brakes were on. Thompson, while talking to the deceased, who was standing in front of the 'bus, inserted his key into the safety switch, which was in the "off" position, and drew it over for running, when the 'bus jumped forward, pinning Dinsdale against the wall. Thompson immediately jumped on to the platform, and, according to his statement, discovered that the controller was in the forward position, instead of the neutral position, as he had anticipated ; he promptly reversed the controller and released the brakes, when the 'bus moved sufficiently to allow Dinsdale to be released. Thompson said the brake was on so hard that it broke the driving shaft when he switched in ; he admitted that had he looked he might have seen that the controller was not in the neutral position ; when he pulled the controller off the "4 or 5 notches," he put it on to No. 2 reverse, but the shaft was broken, and it would not act ; he did not know how the 'bus came back. The Coroner, in summing up, pointed out that there was no evidence to show who had moved the controller, but there was a possibility of its being accidentally moved ; he thought the driver should verify the position of the controller. A verdict of "Accidental death" was returned.

Electrical Rain-Making.—A correspondent of the Sydney *Sun* says that Mr. J. G. Balsillie, wireless expert of the Commonwealth, believes that he can command rain by a novel invention which will have much the same effect on the clouds as a series of mountain peaks. He is about to begin experiments, which, if successful, will prove revolutionary. Large scale experiments, with the object of causing artificial rain, are to be made at the cost of the New South Wales Government. For four years Mr. Balsillie has been conducting research work with the idea of discovering means of artificially causing rain. He proposes to create at a high altitude a discharge centre of electricity. For this purpose he will draw from a suitable generating plant a supply of current which will be discharged in two forms at a very high potential from a balloon anchored at a height of from 6,000 to 7,000 ft.

To Australia the question of rainfall is of the utmost importance, and any means which will ensure an increase of the rainfall must be of untold benefit. Mr. Balsillie believes that if all the clouds which pass over Australia can be made to discharge their moisture while over the land, the rainfall can not only be increased, but regulated.

Experiments made by him have led him to believe that ionisation through the ultra-violet rays of the sun does not exist in the atmosphere generally any closer to the earth's surface than within 50,000 ft. In the absence of this ionisation the moisture-bearing clouds do not contain the necessary nuclei on which the moisture can condense. If there are no nuclei there can be no condensation.

His problem has been how to provide these required nuclei, and, further, how to electrify the minute drops of moisture in the cloud so that mutual attraction may be set up among them. Assuming this to be done, the result must be that the minute drops of moisture coalesce on the nuclei, and continue growing in volume until gravitation draws them down to the earth.

Mr. Balsillie's suggestion for carrying out experiments on a large scale, to prove his laboratory work, was received with scepticism. However, in Mr. W. A. Holman, Premier for New South Wales, Mr. Balsillie found a sympathetic listener. Mr. Holman, appreciating the immense possibilities of Mr. Balsillie's idea, appointed a Scientific Committee to report on the Balsillie device, and advise the Premier regarding its scientific basis. This Committee had a five hours' discussion with Mr. Balsillie, and unanimously decided to investigate his device. It is anticipated that nothing like a complete knowledge of the new art of rain-making will be gained until the field experiments have been conducted over a long period.

Mr. Balsillie believes that it will be possible, by having a number of stations erected on the lines of the prevailing winds, to secure from all the clouds that come inland the whole of the moisture they contain. One result that he anticipates will follow the establishment of these rain-making stations is that natural thunderstorms and lightning will cease.

Nickel-Chromium Alloy.—The Marsh patent, covering the use of an alloy of nickel and chromium for electrical heating elements, has been the subject of an action at law in the United States Courts at the instance of the owners of the patent (No. 811,859, 1906), the Hoskins Manufacturing Co., who alleged that the "calorite" alloy of the General Electric Co., U.S.A., was an infringement. A District Court supported this contention, and the U.S. Circuit Court of Appeals has confirmed the decision of the District Court. It was shown that the General Electric Co. sought to purchase the patent, and failing in this, produced an alloy containing nickel 65 per cent., iron 15 per cent., chromium 12 per cent., and manganese 8 per cent., which they called "calorite." It was stated that this alloy possessed the same properties of high resistivity and durability as the patented alloy, and answered the same purposes. The Court regarded the additions of iron and manganese as "small and inconsequential ingredients," and decided that the alloys were essentially identical.

In the course of the action the English patent of Placet (No. 202, 1896), was cited as an anticipation, that inventor having pointed out the valuable properties conferred upon alloys by the use of chromium, including high electrical resistance and durability at high temperatures. He had not, however, applied the alloy to electrical heating, and Marsh, the patentee of nickel-chromium for this purpose, while disclaiming invention of the alloy, claimed the discovery of a new use for it as the basis of his patent, which was accepted by the Court.

Magnetos for Ignition Purposes.—A practical step to find a remedy for the preponderating German participation in the French home trade in magnetos for motor-cars has been taken by our contemporary, *La Revue Electrique*. It has invited the contribution of an article by a specialist in this department, Mons. H. Armagnat, which appears in the June issue of that journal. The writer has not only given a succinct historical account of his subject, but shows that the Germans, far from being inventors in this department, are merely patentees of points of detail, the credit of invention belonging mainly to Frenchmen. The author develops a complete theory of these apparatus, supported by experimental data, and sets out the paths which should be followed to perfect the ignition magneto.

Institution and Lecture Notes.—**South African Institute of Electrical Engineers.**—The Council has formed a Committee called the Safety Precautions Committee, with the object of bringing together and assimilating data towards the elimination of risk and electrical accidents.

Mr. Harold Wragg recently read a paper on "Water-Power Plants ; with Special Reference to the Power Plants of the Rezende Mines, Ltd., Penhalonga, Southern Rhodesia."

Canadian Electrical Association.—The Executive Committee decided to dispense with the usual annual Convention, being unwilling to ask the members of the Association to incur any unnecessary expense at this time. In place of the Convention, the Committee called a one-day meeting of representatives of operating companies, which was held in Ottawa on June 26th.

Educational.—City and Guilds of London Institute.—The Council of the Institute has awarded diplomas of "Associate" to the following students who completed a full course of instruction in electrical engineering at the close of the recent session :—

City and Guilds (Eng.) College : B. Hague (Siemens Memorial and Henrici Medals), S. W. Messent, C. Jacovou, C. G. Shaw, H. C. Gibson, W. H. Cable, D. Jacovou, F. F. H. Schroeder.

City and Guilds Technical College, Finsbury : W. J. Jones.

Wireless High-Power Stations.—A correspondent of the *Financial Times* supplies an interesting explanation of the Government's decision not to proceed further, in view of the war, with the chain of Imperial wireless stations decided upon some time ago, but to compensate the company for its outlay in connection with this matter, and adopt an alternative project more in keeping with the circumstances which have arisen since the commencement of the European crisis. The Government at the outbreak of the war took the view, which has since been justified by events, that in all likelihood we should be able to capture the high-power "wireless" stations already erected by Germany, thereby rendering unnecessary some at least of the stations which were to have been constructed as part of our original project. In addition, the Colonial Empire built up by Germany, but now the property of the Allies, will be divided among them under a friendly arrangement, and it follows that the possessions of Great Britain will be substantially added to. It will, therefore, be convenient to erect certain stations not originally contemplated on sites alternative to those fixed upon at the outset, provided that there is no installation near by of German origin, for in that case the enemy installation would be used instead. Thus we arrive at the dual proposition of a less ambitious financial scheme, and also one offering many points of distinction as regards geographical distribution. In the Pacific we are now in a position to establish stations on various islands not previously in our possession, which will add very much to the efficacy of the entirely wireless system. Finally, whereas previously precautions had to be taken against the rival system adopted by the German Government, there is little danger now of any trouble on this score, and, while Mr. Isaacs rightly claimed on Monday last that the Marconi method of wireless telegraphy has been of immense service and assistance to the Government during the crisis of the past 12 months, the war has probably done not a little to render the Marconi patents governing wireless telegraphy the most valuable in the world, owing to the fact that the British authorities are able to give full scope for their development, which no other nation can do on the same scale, if only for the reason that there is no other Colonial Empire equal in size to our own.

Scientific and Industrial Research.—The scheme outlined by Mr. J. A. Pease in May has now taken shape; the *Times* states that particulars were issued on Monday by the Board of Education in a document signed by Mr. Arthur Henderson. The scheme is designed to establish a permanent organisation, and it is pointed out that the research done should be for the kingdom as a whole, and that there should be complete liberty to utilise the most effective institutions and investigators available, irrespective of their location in England, Wales, Scotland, or Ireland. There must, therefore, be a single fund for the assistance of research under a single responsible body.

The scheme provides for the establishment of :—

(*a*) A Committee of the Privy Council responsible for the expenditure of any new moneys provided by Parliament for scientific and industrial research.

(*b*) A small Advisory Council responsible to the Committee of Council and composed mainly of eminent scientific men and men actually engaged in industries dependent upon scientific research.

The Committee of Council will consist of the Lord President, the Chancellor of the Exchequer, the Secretary for Scotland, the President of the Board of Trade, the President of the Board of Education (who will be Vice-President of the Committee), the Chief Secretary for Ireland, together with such other Ministers and individual members of the Council as it may be thought desirable to add.

The first non-official members of the Committee will be :—The Right Hon. Viscount Haldane of Cloan, the Right Hon. Arthur H. D. Acland, and the Right Hon. Joseph A. Pease, M.P.

The first members of the Council will be :—The Right Hon. Lord Rayleigh, Mr. G. T. Beilby, Mr. W. Duddell, Prof. B. Hopkinson, Prof. J. A. M'Clelland, Prof. R. Meldola, and Mr. R. Threlfall, with Sir William S. M'Cormick as administrative chairman.

It is in no way intended that the scheme should replace or interfere with the arrangements which have been or may be made by the War Office or Admiralty or Ministry of Munitions to obtain scientific advice and investigation in connection with the provision of munitions of war.

A great part of all research will necessarily be done in universities and colleges which are already aided by the State, and the supply and training of a sufficient number of young persons competent to undertake research can only be secured through the public system of education.

The primary functions of the Advisory Council will be to advise the Committee of Council on—

1. Proposals for instituting specific researches.
2. Proposals for establishing or developing special institutions or departments of existing institutions for the scientific study of problems affecting particular industries and trades.
3. The establishment and award of Research Studentships and Fellowships.

The Advisory Council will also be available, if requested, to advise the several Education Departments as to the steps which should be taken for increasing the supply of workers competent to undertake scientific research.

Arrangements will be made by which the Council will keep in close touch with all Government Departments concerned with or interested in scientific research, and by which the Council will have regard to the research work which is being done or may be done by the National Physical Laboratory.

It is essential that the Advisory Council should act in intimate co-operation with the Royal Society and the existing scientific or professional Associations, Societies, and Institutes, as well as with the universities, technical institutions, and other institutions in which research is or can be efficiently conducted.

It is proposed to ask the Royal Society and the principal scientific and professional Associations, Societies, and Institutes to undertake the function of initiating proposals for the consideration of the Advisory Council, and a regular procedure for inviting and collecting proposals will be established. The Advisory Council will also be at liberty to receive proposals from individuals and itself to initiate proposals. It is contemplated that the Advisory Council will work largely through sub-committees reinforced by suitable experts in the particular branch of science of industry concerned. On these sub-committees it would be desirable, as far as possible, to enlist the services of persons actually engaged in scientific trades and manufactures dependent on science.

Office accommodation and staff will be provided for the Committee and Council by the Board of Education.

Appointments Vacant.—Shift engineer for duration of war, for Malvern U.D.C.; gentleman to attend to export matters under direction of the secretary, required by the B.E.A.M.A.; mains foreman (£2 10s.), for Newport Corporation; circuit designer and draughtsman (£350), for Victorian State Railways. Particulars are given in our advertisement pages.

Electric Vehicle Co.'s Amalgamation.—A new company has just been formed in the States to amalgamate two of the largest builders of electric motor vehicles—the Baker Motor Vehicle Co. and the Rauch and Lang Carriage Co., of Cleveland, O. The new concern will be known as the Baker R. & L. Co., and has been registered with a capital of £500,000.

Volunteer Notes. — ENGINEERING INSTITUTIONS VOLUNTEER TRAINING CORPS. *Company Orders.*—By Lieut.-Colonel C. B. Clay, V.D., Commandant, for week ending August 7th, 1915.

Wednesday and Friday.—Drills, 6.30 and 7.30 p.m. There will be no drill Monday, August 2nd, 1915.

All applications for enrolment should be sent to the Commandant, Marconi House, Strand, from whom all particulars can be obtained.

E. G. FLEMING,
Company Commander and Acting Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, July 29th, 1915 :—

Ongar Camp.—Thursday, the 29th inst.—The Battalion will parade at 6 p.m., on No. 5 Platform, Liverpool Street Station.

Train arrangements for men not travelling with the Battalion.—An Officer will attend daily (except Sunday), at 8.45 a.m., at the low level entrance, Liverpool Street Station, and conduct to Ongar those men who parade at that time. Members not taking advantage of this opportunity will travel to Ongar at their own expense.

A. G. JOINER, *Captain and Adjutant.*

Competition with Germany and Austria-Hungary.—In connection with the campaign undertaken by the Board of Trade, on the advice of their Advisory Committee on Commercial Intelligence, to assist British manufacturers and merchants to secure trade formerly in the hands of German or Austro-Hungarian firms, the Board continue to receive a very large number of inquiries for the names of sellers or buyers of articles of which the sources of supply or markets have been interfered with by the war.

Special arrangements have been made in the Commercial Intelligence Branch of the Board of Trade for dealing with these inquiries, and the weekly list of articles (No. 31), which inquirers desire to purchase, is ready, and may be obtained by United Kingdom manufacturers and exporters of British goods.

British firms interested, as suppliers, in any of the goods mentioned, should communicate with the Director of the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Disaster in U.S.A.—We regret to note that by the capsizing of an excursion steamer at Chicago on Saturday last, a large number of employés of the Western Electric Co., U.S.A., and their relatives lost their lives. Six vessels were embarking employés of the company at the time, and 2,500 persons were on board the steamer which went down, of whom nearly 1,000 were lost.

Late Legal.—On Wednesday the jury returned a verdict for the plaintiff in the West Ham case (see page 138) for £350 damages, and judgment was entered accordingly, with costs.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On Thursday last week, the borough electrical engineer, on behalf of the staff and employés of the Bootle electricity department, presented MR. E. C. McDONNELL first assistant and mains superintendent, with a handsome marble timepiece and a trousers stretcher, as a token of their esteem, on the occasion of his marriage to Miss M. Ronayne recently. Mr. McDonnell responded, thanking them all for the kindly motive which prompted the presentation.

Mr. J. Arthur has been appointed engineer-in-charge of the electric light undertaking at Llanfair Caereinion.

The Bispham U.D.C. has decided to increase the salary of the electrical engineer, Mr. Hollinrake, by £20 per annum.

The Northampton T.C. has been recommended to appoint Mr. E. Jordan as superintendent at the power station, at a commencing salary of £2 6s. per week, rising to a maximum of £130 per annum.

Lieut. G. C. Milnes (electrical engineer to the Lancaster T.C.), who was recently mentioned in dispatches for his work in connection with the machine-gun section of the 5th King's Own Royal Lancasters, has been promoted to the rank of captain.

The Plymouth Electricity and Street Lighting Committee has accepted the resignation of Mr. W. J. Spark, the engineer of the Newport Street works, and has placed on record its high appreciation of his services. Mr. E. G. Okell, the engineer of the Prince Rock works, has been appointed borough electrical engineer, at a salary of £600 a year, rising by two annual increments of £25 to £650. The Committee has instructed Mr. Okell to present a report on the reorganisation of the staff at the respective works. It is to accept a similar position at Hartlepool that Mr. Spark is leaving Plymouth.

On the 26th inst., at St. Clement's, Ilford, Mr. R. Sellars, of the West Ham Corporation electricity department, was married to Miss Jewell, only daughter of Mr. and Mrs. Jewell, of Ilford, and late of Brixton. Mr. Sellars's colleagues presented him with a handsome timepiece as a memento of the occasion.

Mr. R. M. Jockel, charge engineer at the York electricity works, has been appointed engineer at the Malton power station, and will be succeeded by Mr. Edwards, the present junior charge engineer.

Mr. Radcliffe Wright, district engineer of the Bishop Auckland area of the Cleveland and Durham Electric Power Co., has been the recipient of a present on the occasion of his impending departure to South America, where he is taking up the position of mains engineer under an Argentine railway company.

Mr. Robt. Illingworth, lately with the Middleton Corporation electricity department, has been appointed shift engineer at the Accrington electricity works.

Tramway Officials.—Corpl. W. Entwistle, who prior to enlisting in the Royal Flying Corps (Military Wing) was an apprentice with the South Lancashire Tramways Co., has just been promoted to his present rank for a daring flight over the North Sea.

General.—At Christ Church, Ince (Lancs.), on July 14th, the marriage took place of Mr. Frank Barlow, eldest son of Mr. Frank Barlow, of Higher Broughton, Manchester, and Miss Mabel Ellison, second daughter of Mr. John Ellison, of Kirkless Hall, Aspull.

Mr. Chas. H. Thorpe has resigned his position as engineer-in-charge at the Hammersmith electricity works, in order to take up the position of managing partner in the firm of Morman & Bliss, general and motor engineers, London Road, Hounslow.

Mr. A. S. E. Ackermann has been awarded a silver medal by the Royal Society of Arts for his paper on "The Utilisation of Solar Energy."

We are informed that Mr. Thomas Britten, manager of Messrs. Crompton's works at Chelmsford, has been elected to a seat on the board of the company.

Roll of Honour.—News has reached Glasgow of the death of Captain E. George Tidd, of the (now) 7th Scottish Rifles (T.), who has been killed in the Dardanelles. Mr. Tidd, who had been associated first with the Volunteers, and later with the Territorials, joined the 6th Highland Light Infantry as a Second Lieutenant, and was promoted Captain in April, 1908. During his 14 years' service in the battalion he proved himself a capable and efficient officer. A partner of the firm of Messrs. Morris, Warden and Co., Ltd., engineers and merchants, 68, Gordon Street, Glasgow, Mr. Tidd was well known in electrical engineering circles, and was chairman of the Scottish Local Section of the Institution of Electrical Engineers five years ago. The deceased gentleman's son, Lieutenant Tidd, is serving with the same battalion in the Dardanelles.

Lance-Corporal Bernard Mosey, of the Australian Force, who has died of wounds received in action in the Dardanelles, was formerly an electrician with Messrs. Calvert & Heald, of Lancaster, with whom he served his apprenticeship. He was in Australia at the outbreak of war, and joined the Commonwealth Force at once.

Sergt. D. C. Martin, of the 7th King's Royal Rifles, who was on the staff of Messrs. Willans & Robinson, Ltd., of Rugby, has been killed in action in France. He joined at the outbreak of war as a private.

Second-Lieut. H. G. Rogers, of the 9th Somerset Light Infantry, who has been killed in action in the Dardanelles, was formerly on the staff of the British Thomson-Houston Co., Ltd., Rugby. He obtained his commission last September.

Obituary.—Sir Sandford Fleming.—The death is announced from Halifax, Nova Scotia, of Sir Sandford Fleming, the well-known Canadian engineer. He was born at Kirkcaldy, Scotland, in 1827, and when he was 18 years of age he went to Canada. He was engineer-in-chief of the Canadian Government Railways from 1863 to 1880, and while he held that position the railway system of the Dominion was largely extended. Sir Sandford Fleming was the delegate of the Canadian Government to the Colonial Conference in London in 1887, and subsequently to many Cable Conferences. He was one of the foremost promoters of the movement for securing a Pan-Britannic telegraph service, from which the Pacific Cable took its origin, and up to the time of his death continued to advocate the State ownership of a cable system throughout the Empire.

NEW COMPANIES REGISTERED.

Comparri Wireless Control Syndicate, Ltd. (141,009).—This company was registered on July 17th, with a capital of £5,000 in £1 shares, to take over certain inventions and patents relating to wireless control systems and to electric apparatus and appliances for operating and controlling musical instruments and other things, and to adopt an agreement with Manrico Compare. The subscribers (with one share each) are: W. S. Jackson, 1, Greenhill Road, Harrow-on-the-Hill, financial agent; G. E. Bird, 223, West End Lane, West Hampstead, clerk. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. Qualification, 50 shares. Solicitor: I. John Hart, 33, Old Broad Street, E.C.

Telepad, Ltd. (141,030).—This company was registered on July 19th, with a capital of £4,000 in £1 shares (1,000 preferred, 1,830 ordinary, and 1,170 deferred), to take over the benefit of patent No. 8,973 of 1913, to adopt an agreement with Sir George W. Kekewich, to carry on the business of manufacturers of, agents for, and dealers in telephone attachments and fittings, appurtenances, utensils, novelties, and devices of all kinds for use in offices and buildings, electrical and general engineers, stationers, printers, etc. The subscribers (with one preference share each) are: Sir George W. Kekewich, K.C.B., Feltham, Middlesex; W. J. Cameron, M.B. (Lond.), Two Oaks, Balham Park Road, S.W.; H. W. White, 28, St. James Square, Holland Park, W., merchant. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Solicitor: J. Clarke, 7, New Square, Lincoln's Inn, W.C.

Phœnix Armouring and Cable Co., Ltd. (141,042).—This company was registered on July 20th, with a capital of £1,000 in £1 shares, to carry on the business of cable armourers, cable makers, ironfounders, mechanical and electrical engineers, tube and boiler makers, fitters, etc., and to adopt an agreement with F. Pugsley and I. S. Watts. The subscribers (with one share each) are: F. H. Pugsley, 85, Ullswater Road, Southgate, N., manufacturer; I. S. Watts, 130, Argyle Road, West Ealing, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are F. H. Pugsley and I. S. Watts (managing directors for seven years at £200 each per annum). Qualification, £100. Solicitors: Reginald Bell & Co., 3-7, Southampton Street, W.C.

Smethwick Machine Shops, Ltd. (141,067).—This company was registered on July 22nd, with a capital of £2,000 in £1 shares (500 pref.), to carry on the business of ironfounders, mechanical and electrical engineers, manufacturers of steel and iron tools, implements and machinery, munitions of war, electrical machines and fittings, engines, motor-cars, cycles and accessories, and hardware of all kinds, metal workers, millwrights, machinists, etc. The subscribers (with one share each) are: C. G. Garrard, Goldthorn Road, Wolverhampton, engineer; S. Egerton, 17, Paignton Road, Edgbaston, Birmingham, secretary. Private company. The first directors are C. G. Garrard (chairman) and S. Egerton. Solicitor: A. E. A. Langhorne, 41, Temple Row, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Anchor Cable Co., Ltd. (69,073).—Capital, £250,000 in £10 shares. Return dated May 20th, 1915. 6,500 shares taken up; £10 per share called up on 6,100; £61,000 paid; £4,000 considered as paid on 400 shares. Mortgages and charges: £50,000.

Electro Chlorination Syndicate, Ltd. (109,699).—Capital, £50,000 in 48,000 pref. ord. shares of £1 each and 40,000 def. ord. shares of 1s. each. Return dated December 31st, 1914 (filed May 21st, 1915). Seven pref. ord. shares taken up; nothing called up. Mortgages and charges: Nil.

Pernambuco Tramways and Power Co., Ltd.—Issue on July 6th, 1915, of £50,000 debs., part of a series of which particulars have already been filed.

Porlock and District Electric Supply Co., Ltd.—Debenture and, as further security thereto, a mortgage, both dated June 24th, 1915, to secure £250, charged on Higher Mill, at Hawkcombe Porlock, Somerset, water rights and company's other assets, present and future, including uncalled capital. Holder: C. Blackford, Porlock, Somerset.

Pope's Electric Lamp Co., Ltd. (101,293).—Capital, £25,100 in £1 shares (25,000 pref. and 100 ord.). Return dated October 12th, 1914 (filed May 15th, 1915). 22,579 pref. and 100 ord. shares taken up; £4,254 paid; £18,425 considered as paid. Mortgages and charges, £1 (sic).

Julius Sax and Co., Ltd.—Mortgage debenture, dated July 9th, 1915, to secure £1,000 (ranking *pari passu* with £2,500 issued in 1908), charged on company's undertaking. Holder: P. C. Rowe, Newlands, Leatherhead, Surrey.

Frinton-on-Sea and District Electric Light and Power Co., Ltd.—Particulars of £4,000 third debs., created July 1st, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to first and second mortgage debs., and money secured thereby, amounting to £6,000. No trustees.

National Alloys, Ltd.—Debenture, dated July 2nd, 1915, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Edward le Bas, Dock House, Billiter Street, E.C.

Naylorgraph, Ltd.—Debenture, dated June 24th, 1915, to secure £550, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. M. Hunt, Fairlawn, Park Road, Southborough.

Birmingham Central Supply Co., Ltd.—Particulars of £300 debentures, created July 14th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees.

CITY NOTES.

Electric and General Investment Co., Ltd.

The report of the directors for the year ended May 31st shows that the gross profit on the transactions for the year was £7423. After deducting all general charges, interest on debenture stock, transferring £2,409 to reserve, and adding £3,075, the amount brought forward from last year, there remained a balance of £5,222, which the directors recommend should be carried forward. The amount of £84,000 appearing as a provision for contingencies in the last balance sheet has been debited with the sum of £4,255 in respect of losses incurred, and after transferring thereto the sum of £2,409 from profit and loss, there remained a balance of £82,154, which has been deducted from the value of the company's investments and retained as an investment reserve fund. Mr. Emile Garcke retired from his office as a director by rotation, and, being eligible, offered himself for re-election.

Mr. J. B. Braithwaite presided over the 26th ordinary general meeting, held at Winchester House, Old Broad Street. In proposing the adoption of the report, the Chairman said it was the first time in the course of the twenty-five years' existence of the company that the ordinary shareholders had had to go without a dividend. Of course, the conditions were quite exceptional, and when they looked back over the record of the past twenty-five years he thought they would agree that they had not done so badly. During that period they had paid them the equivalent of £6 for each £1 share, which worked out at an average of about 25 per cent. per annum. He thought they would agree that under the exceptional circumstances they had had to face this year they must be content to take something from their past dividends, and reduce that average a little. For ten months out of their financial year they had had a state of war prevailing, which had entirely put a stop to financial business of almost every kind. The net result of the year was that they had transferred £2,409 to the contingencies fund; they had paid £497 on account of the preference dividend, and they carried forward £5,222, which was within £100 or £200 of the balance of the preference dividend. As they knew, the dividend was cumulative, and they hoped to make a distribution as soon as financial conditions improved. They did not consider it wise to borrow for the purpose of paying the dividend on this occasion, but to reserve their cash resources as much as possible. He regretted that there was no dividend for the ordinary shareholders, but on the whole he thought they had done fairly well under the circumstances in being able to show that the preference dividend had been earned.

Mr. E. Garcke seconded the motion, which was carried unanimously.

Calgary Power Co., Ltd.—The report states that, considering conditions, business has been quite satisfactory. The gross earnings amounted to $231,186, compared with $240.116 for 1913, and the net earnings to $180.207, compared with $188,060. After deducting interest charges ($155,479), $24,728 was transferred to surplus account, leaving the balance at credit of that account $180,383. Both gross and net earnings were affected to the extent of about $27,500 by a fire which caused a suspension of operations for six months in the large cement mill at Exshaw, which is an important power customer. The prevailing economic conditions also prevented customers from taking normal amounts of power. All construction was finished early in the year. The new Kananaskis Falls power plant has given entire satisfaction in operation, as has the system as a whole. In the absence of unforeseen contingencies, the operating expenses during 1915 will be considerably lower than in either 1913 or 1914, notwithstanding that two generating plants are now in operation. Under the existing contracts for the sale of power the company is assured of a minimum income sufficient to meet operating expenses and bond interest, and still leave a substantial surplus. The city of Calgary has constantly taken power in excess of the minimum specified in its contract, and will undoubtedly continue to do so in the future.—*Financier.*

Bristol Tramways and Carriage Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum for the half-year ended June 30th. The dividend warrants will be posted to the shareholders on Wednesday, August 4th.

Metropolitan District Railway Co.—Interim dividend on the 4 per cent. guaranteed stock at the rate of £4 per cent. per annum, on the first preference stock at the rate of £4 10s. per cent. per annum, and on the second preference stock at the rate of £3 per cent. per annum.

Bournemouth and Poole Electricity Supply Co., Ltd.—The directors have declared an interim dividend on the ordinary shares at the rate of 5 per cent. per annum, less income-tax.

Central London Railway Co.—Interim dividend on the undivided ordinary stock at the rate of £3 per cent. per annum, and on the preferred ordinary stock at the rate of £4 per cent. per annum.

City and South London Railway Co.—Interim dividend on the whole of the outstanding 5 per cent. preference stocks 1891, 1896, 1901 and 1903, at the rate of £5 per cent. per annum.

The Rosario (Argentina) Electricity Co. — The accounts of the Société d'Electricité de Rosario, which is a Belgian company, and in which the Berlin Company for Electrical Undertakings is interested, show gross profits of £82,000 for 1914, as compared with £99,000 in the previous year. The less favourable result is attributed by the directors to the reaction of the European war on the economic situation in the Argentine Republic and the resulting diminution in the demand for electricity; whilst the consumption of the company's chief customer—the Rosario Tramways Co.—also declined by about 10 per cent. as compared with 1913. After making provision for depreciation and reserve funds, the balance of net profits permits of the payment of a dividend of 5 per cent. on the ordinary shares, as against 8 80 per cent. in 1913. The "dividend shares," upon which 3s. per share was paid in 1913, receive no distribution for the past year.

Northern Ontario Light and Power Co., Ltd.—The report states that the results would have been better but for the unsettled conditions since August 1st, 1914, which have made a difference of approximately 10 per cent. per month in the anticipated earnings during the past five months. The sum of $142,758 has been paid as dividends at the rate of 6 per cent. on the outstanding cumulative preference stock. The balance of $564,496 (including $316,442 surplus brought forward, after adjustments of $6,598) has been carried forward. The sum of $133,500 has been applied in settlement of the year's instalment of sinking fund on the bonds (against $122,000 in 1913), making the total amount of the bonds in this fund $321,000. During the year $133,500 bonds have been issued, leaving certified but unissued $181,500. In addition, the company is entitled to have certified and issued, because of money expended out of earnings on improvements and betterments, approximately $405,500 bonds.—*Financier.*

Russian Joint Stock Companies.—A German newspaper, referring to the accounts of Russian joint stock companies for the year ended last December, states that the first place from the standpoint of favourable financial results was occupied by the companies engaged in the electrical, metal-working and engineering trades. In particular, the electrical manufacturing works, which had on hand considerable stocks which were purchased at low prices prior to the war, realised record profits. It is contended that the enormous import requirements of Russian industries, especially in regard to raw materials and machinery, will compel the Russian companies also, after the conclusion of the war, to make purchases abroad and take advantage of foreign exchange, notwithstanding all the existing efforts made for the purpose of Russianising industries.

Metropolitan Railway Co.—The result of working for the six months ended June admits of the payment of the dividends on the several issues of preference stock and of an interim dividend at the rate of 1 per cent. per annum on the ordinary stock. The latter payment compares with 1½ per cent. paid in respect of the first half of 1914. The Surplus Lands Committee announces that the balance for the half-year ended June 30th, 1915, will allow of the payment of an interim dividend on the Surplus Lands stock at the rate of 2¾ per cent. per annum.

Aldershot Gas, Water and District Lighting Co., Ltd.—The report states that the total revenue for the year was £51,456, and expenditure £39,784, leaving a surplus of £11,671. After providing for dividends on consolidated preference stock and interest on special loan and debentures, the directors recommend the full statutory dividends of £5 18-20 per cent. per annum on the "A" stock, £4 8-20 per cent. per annum on the "B" stock, and £5 per cent. per annum on the "C" consolidated stock for the half-year all less tax.—*Financier.*

Brazilian Traction, Light and Power.—The directors have declared a quarterly dividend of ½ per cent., as compared with 1½ per cent. a year ago, payable in Toronto on September 1st. In view of the unsettled conditions and notwithstanding that the earnings of the company have continued to increase in a very satisfactory way, the directors have decided on making the dividend on the common stock for 1915 at the rate of 4 per cent. per annum. —*Financial News.*

County of London Electric Supply Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 6 per cent. per annum, less income-tax, for the half-year to June 30th, and an interim dividend on the ordinary shares for the same period at the rate of 5 per cent. per annum, less income tax, both payable on September 15th.

The Roumanian A.E.G.—It is stated that the Roumanian A.E.G., which is the sales organisation of the Berlin company in Roumania, realised net profits £6,000 in 1914, as compared with £6,200 in the preceding year. The dividend is at the rate of 10 per cent. on share capital of £50,000, this contrasting with 5 per cent. in 1913.

National Gas Engine Co., Ltd.—The directors have decided to pay an interim dividend for the six months ended June 30th at the following rates:—5 per cent. per annum on the preference shares, and 7½ per cent. per annum on the ordinary shares, both subject to income-tax. The dividend warrants will be posted on the 31st inst.

London Electric Railway Co.—Interim dividend on the 4 per cent. preference stock at the rate of £4 per cent. per annum, and on the ordinary shares at the rate of £1 per cent. per annum.

Marconi's Wireless Telegraph Co., Ltd.

The report of the directors for the year ended December 31st, 1914, shows that the gross profit for the year amounted to the sum of £371,072, and the net profit carried to the balance sheet to £232,716, showing an increase of net profit over the preceding year of £110,392. The net profit of the year, added to the sum of £76,550 brought forward from the previous year, increases the balance now to the credit of profit and loss account to £309,266. The basis of remuneration from the Government for the use of the company's high-power stations since the beginning of the war and other services not yet having been settled, it has not been possible to include any sum in respect of them in the profit and loss account of last year. These items will, therefore, have to be entered to the credit of the account of the current year. In the balance sheet, shares in associated companies and patents are again taken into account at their cost price, viz., £1,360,126, showing an increase of £61,382. This addition is mainly composed of the company's proportion of the increased capital of the Russian Co. The company's holdings in associated companies, except for these additions, have undergone no change during the year under review. The par value of shares held in associated companies now stands at £2,469,859, exclusive of shares which have no capital denomination. The amount which stood to the credit of share premium account has been transferred to general reserve account, which now stands at £867,530.

The French Company (Compagnie Française Maritime et Coloniale de Telegraphie sans Fil) has declared a dividend for the year 1914 at the rate of 10 per cent. on the ordinary shares and 31.25 francs per share on the founders' shares.

The Marconi International Marine Communication Co. has again shown substantial increase of business and profits. Dividends for the past year amounting to 10 per cent. have been declared, and the sum of £30,747 was placed to reserve and carried forward.

The Russian Company (Société Russe de Télégraphes et Téléphones sans Fil) has made satisfactory progress. A dividend at the rate of 15 per cent. for the year 1914, as compared with 6 per cent. for the previous year, has been declared.

The Marconi Wireless Telegraph Co. of America earned increased profits for the year, but owing to the conditions prevalent in Europe, and the consequent necessity to defer the opening of their trans-Atlantic service, the directors decided meantime not to declare a dividend.

The outbreak of war caused considerable dislocation of the company's affairs as well as of those of the associated companies. Businesses of importance which were on the point of fruition had to be deferred; many negotiations which were in course of successful progress with foreign Governments had for the time being to be abandoned; the opening of the direct public telegraph services between this country and the United States of America and Spain had to be postponed. In some cases, owing to the unfavourable rates of exchange, substantial sums had to be deposited at interest with bankers abroad, and some payments from foreign Governments deferred with interest accruing until after the war. The sum of £4,347 due from the Turkish Government has not been received. In these circumstances the directors recommend the declaration of a dividend of 10 per cent. upon the ordinary shares; to place a further £100,000 to general reserve account, increasing that account to £967,530, and, after deducting the dividend of 7 per cent. paid earlier in the year upon the preference shares, to carry forward the sum of £69,497. The directors do not contemplate that any loss in consequence either of loss in exchange or deferred payments will result. During the current year the company has been engaged to its fullest capacity in supplying the demands of the British, Colonial and Foreign Governments. The orders in hand justify the anticipation that the volume of business this year will exceed that of any previous year. With extreme regret the directors record the deaths of two of their colleagues, General Albert Thys and Major Samuel Flood Page, who were actively associated with the company for some fifteen years. The directors retiring at this meeting were Mr. Henry S. Saunders and Mr. Samuel Geoghegan, who, being eligible, offered themselves for re-election.

Senatore G. Marconi (Chairman) took the chair on Monday, at the Hotel Metropole, at the annual meeting of the company. In moving the adoption of the report, he said he had little doubt that the statement of accounts would be regarded in all the circumstances as satisfactory. In the balance sheet, on the debit side capital remained practically unchanged, bills payable showed a slight increase, and sundry creditors somewhat less than the figures of the preceding year. The reserve account now carried with it the share premium account, which they had transferred. On the credit side, the amount to the credit of temporary investments and loans against securities represented moneys for which they had no immediate need, and which, therefore, had been lent against or invested in first-class securities, earning a better interest than could be obtained by placing the money on deposit at the bank. Sundry debtors showed an increase approaching £250,000 over the figure of the preceding year; practically the whole of this increase was in respect of Government work, and nearly the whole of it had since been received. Shares in associated companies showed an increase of some £60,000, the greater part of which was represented by an increase in their holding in the Russian Co., by reason of the growth of their business and the increase of the capital, of which they took their proportion. The par value of their total shareholding was now close on 2½ millions sterling, but the figure appearing to the credit in the balance sheet represented, as usual, the actual cost to the company. Turning to the profit and loss account, on the debit side there was the substantial balance amounting to £232,716 8s. 11d. profit carried to balance sheet. This figure showed a marked increase over the profit of the preceding year, proportionate, of course, to the increase in contracts, sales, and trading account. The amount of work which had been done for the Government and the services rendered were considerable, and they had very little doubt that the remuneration which would be awarded the company in due course would be proportionate to their value. On the outbreak of hostilities, as was to be expected, wireless telegraph apparatus was promptly declared contraband of war, and for the time being, therefore, their work in many parts of the world practically came to a standstill. Their programme had undergone complete dislocation, and it was quite impossible at the present moment to say to what extent or in what way it would be affected eventually. On the other hand, their factory had been kept very fully occupied in carrying out the very important orders which they had received; the greater part of this work, however, would figure in the accounts of the present year. The American Co. had been deprived of the use of their trans-Atlantic station owing to the stations on this side being required for other purposes. It was hoped that in due course they would receive fair compensation. Their high-power stations, however, at San Francisco and Hawaii had been completed and a telegraphic service was being conducted very satisfactorily. They were daily awaiting information with regard to the opening of the service through to Japan, and arrangements had been made with the Japanese Government for the conduct of a commercial telegraph service. The Canadian Co. had continued to make progress, but the changes which were contemplated had not yet been carried out, owing to the war. The Argentine Co. had had to defer for the present work upon their high-power station. The Belgian Co. continued to conduct its business from their office in Marconi House under the direction of the English directors of that company, Mr. Godfrey Isaacs and Captain Sankey. The business was progressing satisfactorily, but it had been quite impossible to make up any balance sheet. The French Co. had continued to do a satisfactory business and had paid for 1914 a dividend similar to that of 1913. The Marconi International Marine Communication Co., Ltd., had continued to show satisfactory progress, although it had not been altogether free from loss directly arising from the state of war. Their Russian Co. had had a very good year and had paid a dividend of 15 per cent., as compared with 6 per cent. for 1913. They had a considerable amount of work in hand and were doing a very satisfactory business. The Spanish Co.'s negotiations with the Spanish Government, to which reference was made last year, were not facilitated by the outbreak of war. They had, however, continued to make progress, and were approaching an early and satisfactory termination. The development of the Automatic Telephone Co. had not made much commercial progress, in consequence of the war. The name of the company had been changed to that of "The Relay Automatic Telephone Co." as the Swedish name under which it traded was liable to be mistaken, which would not have been to its advantage. They had signed an important contract with the Italian Government, which they contemplated would be put into operation in the early future. With regard to the Imperial chain, they would remember that in the report of last year the directors informed the shareholders that they were permitted to make but slow progress with the erection of the six high-power stations for which they had contracted with His Majesty's Postmaster-General, and the company's interests were being seriously prejudiced thereby. Within a few days of their general meeting war was declared, and at the end of the year the Postmaster-General informed the company that, owing to altered circumstances resulting from the war, the Government had decided not to proceed with the Imperial wireless chain. They were further informed that the governing factors in determining the Imperial scheme would be better met by means other than the construction of stations of the character and in the situations contemplated by the contract for the Imperial chain, and that the amounts disbursed by the company in respect of the contract would be refunded to them. Subsequently, in February, negotiations were entered into with His Majesty's Government for the erection of certain stations on conditions differing from those contained in the original scheme. Negotiations were proceeding on a basis which, if agreed to, would represent to the company a reasonable equivalent of the terms of the 1913 contract. Nothing, however, had yet been definitely decided. Since he last addressed them there had been some important developments in the art of wireless telegraphy, and they had applied for several new patents. The company had received more than one letter of appreciation from the Lords Commissioners of the Admiralty in respect of the work they and members of their staff had done. It would interest them to know that from their companies some 1,100 men were employed in the forces on active service or on special duties, apart from the very large number at the head office and works who had been requested to remain at their posts, where by so doing they could render greater service to the country. On behalf of his co-directors and himself he wished again to place on record their high appreciation of the services rendered to the company, and he might also say to the British nation and her allies, by their managing director, Mr. Godfrey Isaacs. He had continued untiring in his work and activities, and it would be difficult to over-estimate the value of his services. It was very largely due to him that wireless telegraphy had become and had remained a great British industry, of, perhaps, greater value to the nation during war time than in peace.

Mr. **Godfrey Isaacs** (managing director), in seconding the motion, said he proposed to take advantage of the opportunity to tell them something about the company, and something about the competition which the company had experienced, which at no other period had it been possible for him to speak about. He wanted to remind them that he joined the company on January 25th, 1910, at Mr. Marconi's invitation. At that time the company had an issued capital of £547,299. It had practically no cash resources whatever, and it had no credit. It had been extremely difficult to find money in this country for wireless telegraphy. Mr. Marconi had personally made great efforts to find the necessary moneys to conduct the business of the company, and he only succeeded by going to Italy to obtain there a substantial subscription to the preference issue which was at that time made. When he joined the company in 1910, Mr. Marconi personally lent the company £12,000, and he then proceeded to Canada upon the company's business. Within a few weeks of his absence he (the speaker) had to draw a cheque upon his own banking account to pay salaries which were due on the Saturday morning for the preceding month. That day they had a capital issue somewhere approaching 1½ millions sterling, and their balance sheet showed they were in a very sound position and that their assets were sound assets. They had to-day nearly one million sterling to the credit of their general reserve account, and they had very large assets in the shape of cash, first-class securities, and freehold and leasehold property. The leasehold property, although it appeared at cost less depreciation, they could dispose of that day at a very substantial profit, and had received more than one offer. They had in addition a large number of shares in their associated companies, most of which had that day a very substantial value, and all of which they hoped in the future would be of a very big value. He wanted to tell them some of the reasons why the business did not prosper in its first years. He thought it was very desirable that they should have an insight into the history of the company, which heretofore had of necessity, for reasons which they would all understand, been a closed book. Very soon after Mr. Marconi provided the company with this very valuable invention the methods which obtained abroad were adopted with regard to his science, and the very valuable patents which were then their company's property alone were imitated in Germany, and with the great ability of the German people, and their great foresight, a big German company was created. This German company had for its direction some of the most eminent and able commercial men in Germany, who were then the directors of some of the biggest commercial industries in that country. It had, further, the great advantage of the financial aid of some of the principal German banks, and, finally, it had a very large subsidy from the German Government. That was the position of the company against which the Marconi Co. for many years up to the time he joined the company, and subsequently, had to contend. Mr. Marconi personally, with the aid of his managers, had for many years succeeded—in his opinion marvellously—in maintaining something of the position of the English company, notwithstanding the very powerful opposition of the German company. He thought it was largely due to the magnificent support given to the company, or perhaps it would be more correct to say to Mr. Marconi personally, by the Italian Government, notwithstanding that they were the allies of the German company's Government, that the company was able to continue its existence. The German company, no doubt under the direction, to a large extent, of the German Government, proceeded to create powerful agencies in pretty well every country in the world, and they made great headway. With the exception of Italy, France, and this country they did obtain a preponderating position in this industry in practically every part of the world. That was the position he found in 1910. Wherever one went, whatever negotiations one had with foreign Governments, one was always in competition with a powerful German agency. But that was not all. They had not only to contend with the German agents, but they had also to contend with the German ambassadors. They eventually found that their position was impossible under such conditions. He returned from a journey abroad and made an immediate appeal to Sir Edward Grey, and placed the facts before him, and from that time forward he obtained the support of the British Ministers abroad in their different negotiations with foreign Governments, and from that time, also, they commenced to make substantial progress until they reached undoubtedly the preponderating influence in the industry throughout the world. It was easy to understand that a company like the German company, which had the support of the German Government and conducted the greater parts of its business under the direction of the German Government, always with the aim of obtaining contracts and concessions for the construction of wireless telegraph stations in foreign countries, and having in view the importance which they one day would play, and with the prospect that when a German station was built German hands would work that station, that it mattered little or nothing to the German company, with its Government behind it, at what price it entered into contracts for the construction of these stations Under those circumstances, he thought they would agree that it was not easy for the Marconi Co. to maintain its own. Within three months of his joining the company it was evident to all of them that the future of the company lay in a commercial wireless telegraph service round the world, and they adopted the policy of creating such a service, and one of their first acts in April, 1910, was to apply to the British Government for the right to erect high-power stations in all British possessions. They stated at the time that they were determined to create this telegraph service, upon British soil if possible, but they had made up their minds that the stations were to be built. Unfortunately, the Government did not see its way to grant them that right. They asked for no money, but merely proposed that they should be at their own expense in building the stations and in working a commercial service in peace time, and that in case of war they would hand over the stations to the Government for Government purposes. It was regrettable that they were not enabled in 1910 to proceed with that programme. Out of it was born the Imperial chain, and, as they would remember, when that was mentioned in Parliament, it received most hostile criticism on the grounds that it was alleged that the company were receiving terms far too favourable to it. Immediately the matter was mentioned the German Government resolved to build a chain of wireless stations in all German colonies. The matter was not discussed in the German Parliament, but the stations were immediately proceeded with. He was informed, and he believed correctly, that the price the German Government paid for each of these stations was three times the price which their company had asked of the British Government. Besides that price, which provided for a very handsome profit, the German Government gave a subsidy far more than was ever contemplated by the Marconi Co. that they would get from the royalty for Imperial stations; and that subsidy was to be paid, not for 18 years, but for 25 years. The stations were built and, he believed, cost the German Government £2,000,000. In the light of what had subsequently happened, they might say it was a very bad investment, but if they did they would be mistaken. War was declared between this country and Germany at midnight on August 4th. At five o'clock in the evening of August 4th Germany sent out a message to all its wireless stations, and each stations sent it out to sea, covering a radius of 2,000 miles or more, to this effect: "War declared upon England; make as quickly as you can to a neutral port." By that message, which occupied but a few minutes, Germany contrived to save the greater part of its mercantile marine. If it saved only one of its big ships, like the *Vaterland*, it would have paid for the whole cost of its wireless stations. They all knew that it was a great deal more than that, but he did not think he was permitted to go further and tell them any more than he had told them. He had given them that information because he thought it was right that they should understand a little of what the Marconi Co. had had to contend with in endeavouring to maintain its position in the world in this industry. He also had told them because he wanted them to understand the reasons for the conservative policy the board had determined upon at this time. They contemplated, when the war was over, in consequence of the very big value which wireless telegraphy had proved itself to have, there would be a very considerable business to be done with a great many foreign countries, but they were mindful that when that time came it was possible that, owing to financial stress which might reign for a period, many foreign Governments would defer entering into engagements, which otherwise they would be willing to do, if the company were not able to some extent, for some little period, to finance the work which they undertook for them. He did not know what was likely to be the position of their competitors when the war was over, but, in any case, they did not propose to take any chances. They contemplated, therefore, harbouring their resources, so that when the time came they would be able to undertake the business which would be offered to them. Further, they must recognise that they might be called upon to render some financial assistance for a period to some of their associated companies, and there was no doubt the mother company would have to be prepared to be their bankers in case of need. Mr. Isaacs proceeded to refer to the loyal support he had received from the Chairman and his colleagues on the board, from Mr. Bradfield (the manager), Mr. Allen (the assistant manager and secretary), and the engineering staff. He remarked on the Chairman's presence that day, and said that Mr. Marconi in carrying out his military duties for the Italian Government had been nearer to the Austrian shells than he cared to think of. In conclusion, he pointed out that the balance sheets for the past five years showed the company had made a net profit of close on £1,000,000, which, in face of the difficulties they had had, he did not consider a bad result.

Mr. **Lanham** congratulated the board and Mr. Isaacs, and said that he had opposed the managing director in the past, owing to the fact that, in common with other shareholders, "he did not know." He suggested that the board might give some idea of what the company was likely to get from the Government for services rendered.

Mr. Isaacs said he could not form any estimate of the amount likely to be received from the Government.

The report was adopted, and the meeting further passed a resolution for altering the articles of association.

British Electric Traction Co., Ltd.

An extraordinary meeting was held on Friday last, at the Holborn Restaurant, under the chairmanship of Mr. E. Garcke, to consider the proposed scheme, which was outlined in our last issue, for re-arrangement of the capital of this company.

The Chairman, in proposing a resolution approving of the scheme, said the assets of the company stood in the books at £5,056,000. They proposed to write off net £908,000; that was to say they estimated that the assets were short of the capital and liabilities by 3s. 7d. in the pound. The two debenture stocks, representing £1,800,000, were not affected by the scheme. The other capital, amounting to almost three millions, was at present divided into four classes—two preference stock and two ordinary stocks, and those four classes all ranked equally as to capital without any priority one over the other. The capital of the preference stocks was not to be reduced, but it would be re-arranged. The reduction of capital fell entirely on the ordinary stocks—50 per cent. was written off the preferred ordinary stock, and 70 per cent. off the deferred ordinary stock. Then there were the income certificates amounting to £266,000, which, however, had no capital rights. It was proposed to cancel these certificates and give the holders capital stock to the extent of 35 per cent. of the nominal amount of the certificates. It was proposed to convert the four classes of stock and the income certificates into two classes of stock—preference and ordinary. The new 6 per cent. cumulative preference stock would have priority of capital over the new ordinary stock, and would, with its rights of participation in further profits, be in every respect a most attractive stock. The ordinary stock would rank after the preference stock as regarded both capital and dividends, but as a result of the reduction of capital it was hoped this stock would at once become dividend yielding, and that the dividends would gradually increase, which would be an advantage also to the holders of new preference stock, as the market values of the debenture and preference stocks would improve with the improvement in the ordinary stock. The preference stock would be allotted as follows:—To the holders of the existing 6 per cent. preference stock, an amount equal to the present holdings; to the holders of the existing 7 per cent. non-cumulative stock, 35 per cent.; and to the holders of income certificates, 10 per cent. The new ordinary stock would be allotted as follows:—To the holders of the existing 7 per cent. non-cumulative preference stock, 65 per cent. of their holdings; to the holders of the existing preferred ordinary stock, 50 per cent. of their holdings; to the holders of the existing deferred ordinary stock, 30 per cent.; and to the holders of the income certificates, 25 per cent. It was quite possible that some of the stockholders might not approve the scheme in all its details. They had to consider the subject in its broad aspects, and to decide whether or not they wished to have a reduction and re-arrangement of capital, and, if so, whether in principle the scheme was, taking a large view, fair to all interests. In a complex matter of this kind, it was quite natural for individual stockholders to look at it from the particular point of view affecting their special interests, but no scheme of this character could be formulated and carried through if they commenced by trying to satisfy each particular point of view. They must first deal with principles, and then, if they agreed that they were proceeding on the right lines, opportunities would be found for discussing the details. In his circular to the stockholders of July last year, he explained that unless they reduced the capital in order to clear away the depreciation of assets it would be impossible to pay substantially increased dividends, and he explained also why a simple reduction applied equally to the four classes of stock would not meet the case, and why a re-arrangement of capital as well as a reduction of capital was necessary. At the last general meeting he explained the reason why the directors thought it better to go on with the scheme now instead of postponing it. In the opinion of the directors there was no doubt as to the advisability of completing the matter sooner rather than later. For some years to come, not merely during the war, but for some time after the war, all industrial companies would be confronted by exceptional difficulties. It would then be a great advantage to the company in its corporate capacity, as well as to the stockholders personally, if the profits which before a reduction of capital were applied to reserve for depreciation become available for dividend or, alternatively, to strengthen the credit of the company. The next point of principle they had to consider was whether the reduction of capital proposed was adequate for the purpose of completely rehabilitating the company. With regard to this point, he could only refer them to the statements Mr. Tegetmeier and himself made at the annual meeting in 1913. He then said that the depreciation of the investments, having regard to the reserves which had been made by the associated companies themselves, could be met by the existing reserves of the company, supplemented by a sum which approximated to between two-thirds and three-quarters of a million. To be on the safe side, however, the board decided to recommend them to write off £900,000, and in view of the further depreciation caused by the war, the decision was a wise one. At the last general meeting he stated that they saw no reason to alter those valuations. Of course, they all knew that the market depreciation was much larger than this figure—the market depreciation of the capital stocks was about £2,000,000, but a large part of the market depreciation was due not only to the fact that their investments were depreciated, but also to the fact that they were not paying adequate dividends on the whole of the capital. Consequently, if they could by a reduction of capital, to an extent equal to the depreciation of assets, coupled with a re-arrangement of capital, enable the company to pay dividends on the reduced capital, they would in due course recover that part of the market depreciation which was due to their not paying adequate dividends on the present capital. The great merit, therefore, of the scheme was that by a reduction of capital by £900,000 they hoped in course of time, as dividends increased, to remove the whole of the market depreciation of about £2,000,000. There was one misapprehension he would like to remove. It had been said that this scheme had been rendered necessary because the re-arrangement of capital in 1911 was not drastic enough. But the re-arrangement of capital in 1911 was not intended to be at all drastic. It did not involve any reduction of capital whatever. If a reduction of capital had been attempted at that time it would have been a very serious matter indeed; it would have been a very much more drastic reduction of capital than that which they were able to propose now. They did not try to avoid responsibility for any mistakes they had made in the past, therefore they might be allowed to feel satisfaction with the way they had been able to steer the ship out of troubled waters, and were it not for the heavy war clouds, they should now be looking towards a clear horizon. It was very difficult to see into the future at present, otherwise he should have no hesitation in promising a complete recovery of their loss to those stockholders who were able and willing to take their courage in both hands by commensurately increasing their holdings in the company at the low prices now prevailing. How far this deplorable war and its consequences should modify this confidence the shareholders were as well able to judge as he was. He firmly believed that if the scheme was carried out it would place the company in a stronger position to meet the difficulties with which they would all be confronted as a result of the war, and would, he hoped, enable the company when the war was over to start on a new career of prosperity with its optimism tempered by past adversity and its energies guided by long and deeply ingrained experience of both success and failure. He added that the directors had received proxies in favour of the scheme from 1,400 stockholders representing £1,200,000 of capital, while they had only received 77 proxies against it representing capital of between £7,000 and £8,000.

Mr. Alfred Shepherd, a member of the shareholders' committee appointed in 1911, at the time of the previous re-arrangement of the capital, seconded the resolution. He remarked that, on the whole, he considered the scheme a good and reasonable one in the interests of the four classes of stockholders, and unless some such scheme was agreed upon the company would never be able to recover the position it once held.

Replying to criticisms on the scheme, Mr. P. D. Tuckett said he believed that the preference stockholders had as much to gain from it as anyone. For many years he had been in favour of reducing the capital, because he felt that substantial losses had been incurred which it was better to write off than continue to carry on their books.

The Chairman said he thought they might take the discussion as indicating that the meeting supported the scheme in principle, and it could be discussed in detail at the separate meetings which would have to be held later.

On a show of hands the resolution was carried by 34 votes to 4, being more than the requisite three-fourths majority to carry it.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange, these war-days, seems to be always waiting for something or other. It cannot get going. Business has to move at snail's pace because there is this or that particular cloud hanging over, and close over, the financial horizon. Two factors operating at the moment are the opening of the market in the new War Loan and the position of Warsaw. To what price the 4½ per cent. War Loan is likely to settle down is a consideration that imposes a check upon investment in other securities. The fate of Warsaw is keenly watched because the fall of the town might result in the prolongation of the war, and therefore the cost be increased, with its inevitable sequel of more national borrowing, to the detriment of investment securities all round.

Markets, consequently, remain quiescent to dull. Home Railway dividends are not at all bad, and those of the Tube companies are decidedly good. Telegraphs are depressed by would-be realisations of deceased accounts. Home Railway dividend declarations make a tolerably good showing as a whole, while the electrical companies have done well. The Metropolitan is the only one in the latter group to pay a smaller rate than that of a year ago. Central London announces its regular 4 per cent., the District pays 3 per cent.

on its Second Preference—as it did last year, when an improvement of ½ per cent. was established over the 1913 dividend. Underground Electric Income bonds get their full 6 per cent., a somewhat pleasant surprise that has not been reflected in the price so far. The City & South London has declared dividends on all its preference stocks: six months back the 1901 and 1903 issues had to go without distributions.

Central London ordinary has changed hands this week at 73½, and having regard to the stocks behind it which are receiving their full dividends, the 4 per cent. guaranteed interest looks reasonably secure. The non-assented ordinary stock has not been dealt in since May, when the price marked 40. This year's solitary bargain in all four preference stocks was done last March, in the 1903 issue, at 80. London Electric 4 per cent. preference stands about 63; the company is to pay 1 per cent. on its ordinary shares.

Electric Lighting shares are mainly lower in consequence of the outlook with regard to coal. The County of London has declared its accustomed dividend at the rate of 5 per cent. on the ordinary shares, but the price has fallen ½ to 10½, and the preference at the same price are equally lower, while the debenture stocks of this, and of the City company, have been impartially marked down by about five points apiece. South Londons, which have been scarce for a long time past, have been offered to a small extent at 3⅛. South Metropolitans had no difficulty in finding a home at about 15s. 6d., and more could probably be placed at about the same figure. Citys are easier at 13, and the preference at 11, the latter registering a fall of £1 in a fortnight. The market as a whole is slightly inclined to depression.

There is no change worth mentioning amongst manufacturing companies, beyond declines in British Westinghouse preference and Electric Construction shares.

The British Electric Traction resolutions for writing down the capital of the company, and its re-arrangement into two classes of stock, were duly passed at the meeting last week. Business has been taking place in the 7 per cent. preference on the basis of 37½, and in the 6 per cent. preferred at about 10¼, while the 5 per cent. perpetual debenture stock is rather better at 78¾.

Some astonishment is aroused at the action of the Adelaide Electric Supply Co. in asking debenture-holders to consent to a variation which apparently removes the date of the redemption of the stock at 105 from 1936 to about 15 years later. It is difficult to believe that the board can intend to suggest such a course, and perhaps there is a misunderstanding which will be removed by subsequent developments. Meanwhile, stockholders will do well not to send in their proxies until all ambiguity is cleared away.

The Telegraph market is flat, weakness extending from the Anglo-American group to that of the Far East, and embracing the shares of the trust companies. Disinclination on the part of buyers, and a pressing desire to sell on the part of a few executors of deceased accounts, have combined to lower the market. The table of yields which we give in our share list is worth consideration by those who have money left over from the War Loan, for the cable industry will be one of the first to revive after the war, and the best companies occupy sound financial positions.

Telegraph Constructions have fallen £1, and other similar descriptions are disposed to give way here and there. In sharp contrast to this depression in the industrial market, there stands out an amazing gamble now going on in New York in the shares of such American commercial companies as are receiving war orders. Some of the prices have been moving by 10 to 20 points a day. The diplomatic situation between America and Germany is wholly ignored, on the confident assumption that the United States will fight its battles in words, and smother its feelings in dollars—dollars mainly of the Allies, of course.

Three stocks stand out in the markets as easy targets for spasms of nervousness whenever dividend-dates draw near, and the trio is composed of Canadian Pacifics, Underground Electric Incomes, and Brazil Tractions. The last-named has been fluctuating sharply because of the regular quarterly fear that the usual 6 per cent. per annum will have to come down. After keeping fairly steady around 50 for some little while, the quotation broke to 48, although Rio exchange remains in the vicinity of 1s. 1d., at which—so it is understood—the company can do quite well on the basis of present earnings. Maybe the dividend will be out before these Notes, but it has been suggested here on several previous occasions that holders of Brazil Tractions might even prefer to see a modest reduction if it were accompanied by assurances that the rate could be maintained with reasonable certainty.

Anglo-Argentine debenture stocks are a dullish market, and the 4½ per cent. issue shed 5 points to 75, bringing it level with the Fives. The Mexican division goes extremely softly. No further news of consequence has arrived to stir up the market, and everybody waits to see whether the promised pacification is going to turn out in the usual manner.

The Marconi meeting produced an intensely interesting speech from the famous and gallant inventor, whose words may well be recommended to those in high official places. In the Stock Exchange the price keeps steady at 36s. 3d. American Marconis touched 14s. 3d., and lost no more than the pence, while Canadians at 4s. 9d. are beginning to rally. The home armament shares show little variation. Rubber is a quiet market, the tendency being to allow prices to slide back slightly.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend, 1914.	Price July 27, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	8	— ½	£6 5 0
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4	—	6 5 0
do. do. do. 4½ Pref. ..	4½	4	—	5 12 6
do. do. City Pref.	4½	3⅞ xd	—	5 16 2
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4½	—	5 11 1
do. 4½ Deb.	4½	88 xd	—	4 17 10
City of London	9	13	— ½	6 18 6
do. do. 6 per cent. Pref. ..	6	11	— ½	5 9 1
do. do. 5 Deb.	5	100	—5	5 0 0
do. do. 4½ Deb.	4½	85	—5	5 6 0
County of London	7	10½	— ½	6 13 4
do. do. 6 per cent. Pref. ..	6	10½	— ½	5 14 3
do. do. 1st Deb.	4½	90	—6	5 0 0
do. do. 2nd Deb.	4½	85	—5	5 6 0
Kensington Ordinary	9	6½	— ½	6 18 6
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref. ..	6	4¾	— ⅛	6 6 4
do. do. 4 Deb.	4	80	— 2	5 0 0
Metropolitan	8½	8	—	5 16 8
do. 4½ per cent. Pref. ..	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	7	—	7 0 0
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70 xd	—	5 0 0
South London	5	3	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7	—	6 8 7
do. 4½ Pref.	4½	4⅝	—	4 17 4

TELEGRAPHS AND TELEPHONES.

	Dividend, 1914.	Price July 27, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	98	—2	6 2 6
do. Def.	1½	21¼	— ¼	7 1 2
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8¼	—	6 1 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11½	—	*6 19 0
do. 4 Deb.	4	80	—2½	5 0 0
Eastern Tel. Ord...	7	121	—	*6 12 2
do. 3½ Pref.	3½	70	—1	5 0 0
do. 4 Deb.	4	80	—1	5 0 0
Globe Tel. and T. Ord.	6	9¾	— ¼	*7 0 8
do. Pref.	6	11	— ¼	5 9 1
Gt. Northern Tel.	22	33	—1	6 13 4
Indo-European	65/-	52	—	6 5 0
Marconi	10	1 3/16	—	6 3 1
New York Tel. 4½..	4½	96	+1	4 13 9
Oriental Telephone Ord.	10	1⅞	—	5 6 8
do. Pref.	6	1⅛	— 1/16	5 6 8
Tel. Egypt Deb.	4½	88	—	5 2 3
United R. Plate Tel.	8	5¾	—	*7 19 10
do. Pref.	5	4	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	11¾	— ½	*6 16 2
do. 4 Deb.	4	81	—1	4 16 5

HOME RAILS.

	Dividend, 1914.	Price July 27, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented ..	4	74	+1	5 8 1
Metropolitan	1½	24½	— ½	5 2 0
do. District	Nil	13	— ½	Nil
Underground Electric Ordinary ..	Nil	1⅜	—	Nil
do. do. "A"	Nil	6/-	—	Nil
do. do. Income ..	6	75	—	*9 3 0

FOREIGN TRAMS, &c.

	Dividend, 1914.	Price July 27, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Arg. Trams, First Pref. ..	5½	4xd	—	6 17 6
do. 2nd Pref.	5½	3½ xd	—	7 17 2
do. 4 Deb.	4	75 xd	—	5 6 8
do. 4½ Deb.	4½	75 xd	— 5	6 0 0
do. 5 Deb.	5	75	—	6 13 4
Brazil Tractions	6	48	— 1½	12 10 0
Bombay Electric Pref.	6	10¼	—	5 16 10
do. 4½ Deb.	4½	90	—	5 0 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds ..	—	50	—	Nil
do. 6 per cent. Bonds ..	—	80	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	45	—	—
Adelaide Sup. 6 per cent. Pref. ..	6	5	—	6 0 0
do. 5 Deb.	5	99	—	5 1 0

MANUFACTURING COMPANIES.

	Dividend, 1914.	Price July 27, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	2¼	—	6 4 5
British Aluminium Ord.	5	1⅛	—	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	11	—	6 13 4
do. Pref.	6	6	—	5 0 0
British Westinghouse Pref.	7½	83/6	— 1/6	8 19 2
do. 4 Deb...	4	70 xd	—	5 14 4
do. 6 p. lien	6	100	—	6 0 0
Callenders	15	11	— ¼	6 16 4
do. 5 Pref...	5	4⅞	—	5 2 7
do. 4½ Deb.	4½	95	—	4 14 9
Castner-Kellner	15	8¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/6	—	Nil
do. do. fully paid	Nil	1	— ¼	Nil
do. do. 4 Deb.	4	60 xd	—	6 13 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	11/6	— 1/-	10 8 8
do. do. Pref.	7	1 xd	—	7 0 0
Gen. Elec. Pref.	6	9¾ xd	—	6 3 1
Henley	20	14	—	*8 8 8
do. 4½ Pref.	4½	4¾	—	4 14 9
do. 4½ Deb.	4½	95	—	4 14 9
India-Rubber	5	8¾	—	5 14 8
Telegraph Con.	20	32	—1	7 7 6

* Allowance made for dividends being paid free of income-tax.

Underground Electric Railways Co. of London, Ltd.—Interest on the 6 per cent. first cumulative income debenture stock will be paid on and after September 1st, less income-tax, at the rate of 6 per cent. per annum, and coupon No. 15 of the 6 per cent. income bonds will be paid, free of British income-tax, at the rate of 6 per cent. per annum on the same date.

REVIEWS.

Electricity in Mining. By D. R. Shearer. London: Hill Publishing Co. Price 6s. 3d. net.

This is an American publication intended to fulfil, so we are told in the preface, "a demand for a small treatise covering in a general way the many phases of electrical engineering as applied to coal mining," and to "be of use to the investor or the operator in outlining methods of procedure and to the operating engineer in tracing the foundations upon which an electrical power plant may be established and operated in the most efficient manner." The book is divided into 13 short chapters, which deal with the subject, technically speaking, in a very elementary manner and give a minimum of information, but much good advice. For instance, in Chapter V, on the "Selection of Power Plant Equipment," the main point which the author tries to drive home is that an engineer should be employed to design the plant, and much that he says is sound common sense. Evidently conditions in American mines relating to electrical engineering are very similar to those existing in this country previously to the introduction of the last Home Office special rules, for in Chapter I we read "It is a lamentable fact that few mine operators (managers) give to their electrical plant the attention justly due, either as to its layout and equipment or to its operation and upkeep. Frequently in their efforts to secure economy in power plant costs the owners install inadequate machinery in an improper or incomplete manner, and place this equipment in the care of men limited in both training and experience." Again, in the last chapter, dealing with efficient operation, we read: "The trouble with a great many mine superintendents and their electricians is that they have an idea that it is economy to run any machine as long as a wheel will turn, regardless of conditions or the state in which the machine is operating. The writer has seen a motor taken in on a haul when there was almost a certainty that it would burn out on the first heavy pull. This it did, although a half-hour's repair work on one of the coils before it entered the mine would have saved a complete re-winding, several days' labour, and the loss of the use of the machine."

The author apparently is not very favourable to "salesmen," as "too often a manager or superintendent is induced to purchase certain machines by some smooth-tongued salesman who, of course, knows his own line better than any other, and naturally believes it to be the best, regardless of conditions to be met or previous operating experiences with the same machine," and "the supply salesmen are not going to assist the plant toward economical operation, for they wish to sell more supplies," which is true to some extent, but we must not forget that the chief object of the salesman is to obtain a permanent customer for his firm, or to increase the firm's reputation by a recommendation from one customer to another, and to sell unsatisfactory machines or material is undoubtedly the wrong way to do this.

The work is well printed and nicely bound, and the illustrations consist of a few diagrams and photographic views. As already mentioned, the book is not intended as a technical exposition on mining electrical engineering, and therefore too much must not be expected of it; what is dealt with is more in accordance with American than British practice. Electrical haulage, for instance, is confined to "locomotive" haulage, and the coal-cutting machinery described is totally unsuited to the conditions of machine mining in this country.

In spite, however, of its limitations in this respect, we can recommend it as a work full of common sense and sound advice on the question of installing and operating electricity in mines, and one that should be read by all interested either financially or in the management of mines, especially those who are considering the installation of electricity.

Electric Light Fitting. By S. C. Batstone. London: Whittaker & Co. Price 5s. net.

It is no easy task, if one may judge by most text-books on electric wiring, to write a book on the subject which covers the ground sufficiently well, and yet avoids many sections of electrical engineering which are not directly concerned with wiring. Mr. Batstone has been decidedly successful in his book in this respect. He gives a brief but sufficiently complete explanation of electrical terms and of the theory of electricity, using the analogy of the flow of water in pipes with great effect, and then proceeds at once to discuss wiring systems and all the various "accessories" used in connection therewith. This section of the book is copiously illustrated. If there is a fault in that direction, it is that there are too many illustrations, as anyone using the book might be assumed to be familiar with the external appearances of ceiling roses, tumbler switches, metal-filament lamps, and so on. It is, however, a fault on the right side.

In the chapter on wiring systems some suggestions as to the conditions suitable for each system might, with advantage, be added in a future edition.

Following the descriptions and illustrations of accessories comes a chapter on "Transformers, arrangement of Circuits and methods of Wiring." It is doubtful whether Mr. Batstone's implied recommendation to use small transformers would be considered good practice to-day, as high-voltage metallic-filament lamps are now cheap and reliable. It is in reading this chapter that one grudges the space wasted on some unnecessary illustrations of accessories. One would have liked to have had "arrangement of circuits" treated much more fully, with a typical circuit shown wired in various ways to illustrate the opportunities of waste or economy of material that result. This highly important question for the wireman is not mentioned, although the man laying out the circuits has no more important problem.

The remainder of the book deals with the erection of fittings, meters, private plants and supply stations, followed by the apparently inevitable reprint of the I.E.E. Rules and Home Office Regulations. All these subjects are carefully dealt with and well illustrated, though the plans of the private plant general arrangements would be improved by giving the approximate scale to which they have been drawn. They all show, too, the battery arranged in double tiers, which is decidedly undesirable, if it can possibly be avoided.

There are a few further points which might receive attention in a future edition. The remarks as to the use of aluminium as a conductor are rather too sweeping, unless it is made more clear that only internal wiring work is referred to, whilst the table for the ratings of various conductors would be improved by substituting the I.E.E. ratings as the "safe" currents in place of the ratings at 1,000 amperes per sq. in. One of the very few sections of the book in which all details are not very clearly explained is that dealing with the calculations for water power, and a re-drafting of this portion would be advantageous. The use of charge battery meters reading 10 per cent. slow is by no means satisfactory (it gives no means of recording properly the occasional overcharge that is necessary), and it is a pity it has been mentioned without criticism. Finally, the size of plant suggested on page 306 is decidedly large. It is rarely necessary to provide the engine and dynamo larger than would be required to run the normal maximum number of lights, but in this example the plant suggested is over twice this size. There is also some mistake in the figures, &c., as printed, which should be corrected.

These faults are of minor importance, however, and are indicated with an eye on the future editions of the book that are sure to be called for. On the whole, it is well and clearly written, and can be recommended with confidence.

Konstruktion und Prüfung der Elektrizitätszähler. By A. Königswerther. Second Revised Edition. Leipzig: Dr. Max Jähnecke. Price 16 M.

This second edition is a considerable enlargement of the first, and brings the subject of supply meters practically up to date again.

Starting with a consideration of the energy equations for direct and alternating-current circuits, the book proceeds to discuss systematically, and with the aid of good detailed drawings, the construction of practically all the standard types, including recording meters, intermittent registering meters and integrating meters (electrolytic, clock and motor meters). This section takes up about half the book.

Then follows a section on meters used for special purposes, such as accumulator work, traction work, special tariff meters and prepayment meters.

Some additional information as to certain structural details, such as meter cases, terminals, connecting trains, and bearings, are next given, and, finally, the last section of the book deals comprehensively with the testing of meters and test-room arrangements.

The book is clearly written, and explains the mode of operation of the various meters well and with sufficient of the underlying theory to meet most requirements, so that it should prove of great use to those responsible for the inspection and maintenance of electricity meters of any and every type.

THE CENTRAL POWER STATION OF THE RANDFONTEIN ESTATES.

By R. TURNBULL MAWDESLEY.

(*Concluded from page* 102.)

Regarding the application of power, the principal reduction works, which has the distinction of being the largest of its kind in the world, gives a constant load throughout the 24 hours of the day, of about 4,000 kw. The sub-station supplying these works is of 6,000-kw. capacity, and is situated at the west end of the mill. The transformation ratio is 6,600/550, and the current is distributed by 36 ·2-in. three-core paper-insulated cables. The battery motors are in 100-h.p. units, running at 480 r.p.m., and are all of the short-circuited type, the full-load slip being 3 per cent. They are started up with compensators with taps giving 50, 70 and 80 per cent. of the normal pressure. The total number of motors used at the reduction works is 150.

The mine drainage pumps are of two capacities, 12,000 gallons and 6,000 gallons per hour. Current is taken down the shafts at 2,000 volts and transformed to 120 volts at the pumping stations. The pumps are mostly of the horizontal type, running at 40 r.p.m., and either driven by belts or through gearing.

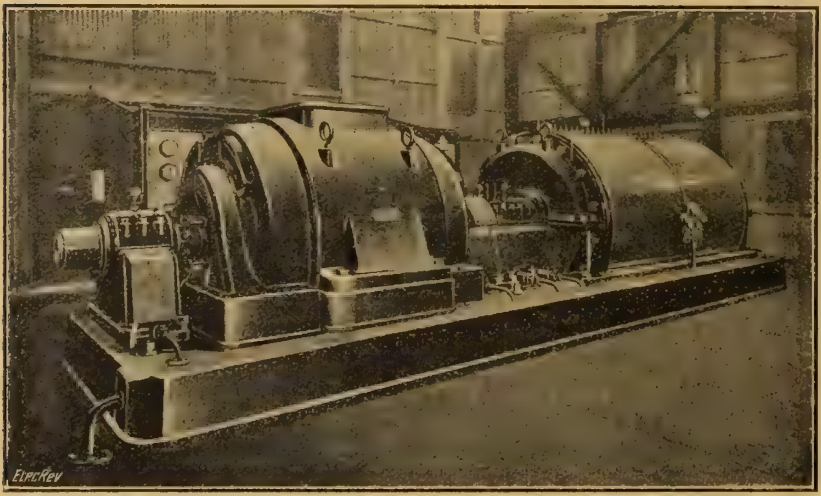


Fig. 12.—Air-Compressor Driven by 2,000-h.p. Motor.

There are six air compressors at present in operation, five being of the reciprocating type, and one being a turbo-compressor driven by a 2,000-h.p. synchronous motor (see fig. 12). This last compressor, together with one of the reciprocating compressors driven by an 800-h.p. induction motor, is situated at the "south" shaft. The larger motor runs at 3,000 r.p.m., and is started up by means of a special starting converter, which consists of a small induction motor driving a three-phase generator. This three-phase generator, as well as the 2,000-h.p. synchronous motor, is separately excited by a small induction motor-generator. The small three-phase generator is fully excited before starting, and the main leads are coupled direct to the stator windings of the synchronous motor. Then the induction motor is started by means of a liquid resistance. When the 2,000-h.p. synchronous motor is up to speed, it is paralleled with the line by an ordinary synchroscope, and the starting set is shut down.

Four of the 800-h.p. motors driving the reciprocating compressors are of the synchronous type, and are started up by means of 100 h.p. induction motors through clutches, the excitation current in each case being supplied by a small induction motor-generator.

Fourteen direct-current hoists of the Ward-Leonard type have been installed on the surface, and eight three-phase second-stage hoists below ground. The general appearance of the Ward-Leonard hoist is shown in fig. 13.

The Ward-Leonard hoists are each operated by two six-pole d.c. motors provided with commutating poles and connected to the drum shaft. These motors each have a continuous rating of 350 h.p., and an intermittent rating of 700 h.p., thus giving a total of 1,400 b.h.p. per hoist at the peak loads. Direct current for each hoist is supplied from a converter set driven by a three-phase induction motor, having a normal rating of 800 h.p., and a maximum of 1,700 h.p., the breakdown torque being 2·5 times the normal, and the speed being 485 r.p.m.

The d.c. generator is provided with compensating windings, the normal rating being 670 kw., and the maximum 1,400 kw. The exciting generator is compound-wound and is mounted on an extension of the converter shaft. It furnishes current at 220 volts, and supplies the d.c. generator fields, the hoist motor fields, and the brake-magnets.

The hoist controller is of the commutator type, and as it only handles the excitation current, it is not very massive.

Automatic acceleration and retardation of the hoists is provided for by interconnecting the controller lever mechanically with the depth indicator, which is of the pillar type.

The winding drums are cylindrical, 10 ft. in diameter × 4 ft. wide. Both drums are loose on the shaft, and are driven by multi-tooth jaw clutches sliding on polygonal seatings.

The brakes are of the post type, released by compressed air, the braking being performed by a dead weight. The air supply is from the ordinary compressed-air mains, but an auxiliary compressor is installed, which starts up automatically when the mine compressed-air pressure falls below normal. There is also a magnetic brake, connected in series with the motor fields. If the power fails, the weight of the falling magnet core opens the exhaust of the brake engine.

The three-phase second-stage hoists offer no special features, the speed variation being obtained by means of resistances inserted in the rotors.

A characteristic station load curve is shown in fig. 14. The peaks at 10 a.m. and 12 noon are slightly abnormal, the general shape of the curve assuming almost a straight line on an ordinary week-day. The exceptionally high load factor which the Randfontein Estates power station enjoys must be, for an isolated station, almost a record. Of course, with several stations operating in parallel, it is possible to adjust the output and load factor of any particular station as desired, but in the case of one station supplying the total power, the load factor is, *ipso facto*, beyond the control of the operating staff; for this reason, the load curve at Randfontein must almost stand alone.

The average power factor is about ·85, and can be adjusted within limits by the excitation of the synchronous compressor-motors. It will be observed that although the whole of the Estate buildings, shafts, workshops, mills, &c., are illuminated electrically from the power station, the lighting load has no appreciable effect on the load curve.

A portion only of the Reduction Works load curve is shown—sufficient only to demonstrate its constancy. On Sundays and "clean-up" days this load falls off, and this is the only period in which it is necessary to take off boilers from the range, the same number of boilers remaining on the range from Monday morning to Sunday morning. Regarding the capacity of the station, there is, comparatively speaking, little changing-over to be done—except at week-ends; and the switching operations, although of necessity calling for highly-skilled operators, are very few compared with, say, a lighting station at home of the same capacity.

The station, as it stands to-day, has the largest installed capacity of any in the British Empire, *i.e.*, taking plants generating current for private use for industrial purposes, and not selling power in bulk or otherwise. The high load factor is, of course, chiefly responsible for the low cost of production, and this cost would be considerably reduced were the power station nearer to the coal supply. The cost of condensing is another item, which would be eliminated could the station have been erected near a river or mine dam.

The station site was chosen by Mr. Butt in 1907, and was determined by the centre of gravity of the load to be expected. No other consideration could influence the selection of a site, since no coal mine, river or lake existed within such distance as could affect this point.

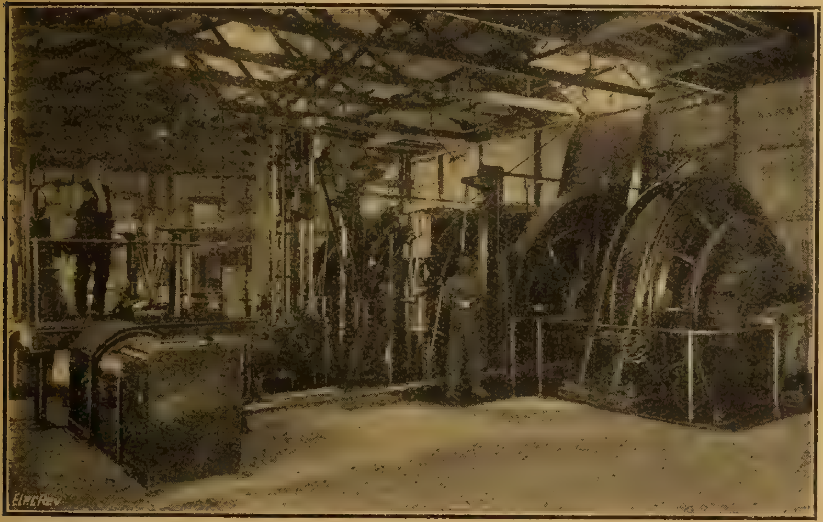


Fig. 13.—Ward Leonard Hoist at No. 8 Shaft.

The whole of the power station plant, as well as all electrical equipment outside on the mines, has been laid down to the design and specification of Mr. T. P. E. Butt, the consulting engineer for the Randfontein Estates and Associated Companies, on all matters appertaining to the generation and application of electric power. The writer's thanks are due to Mr. Butt for permission to publish these details, and also for facilities granted in connection with the views, which were taken by Mr. G. A. Watson.

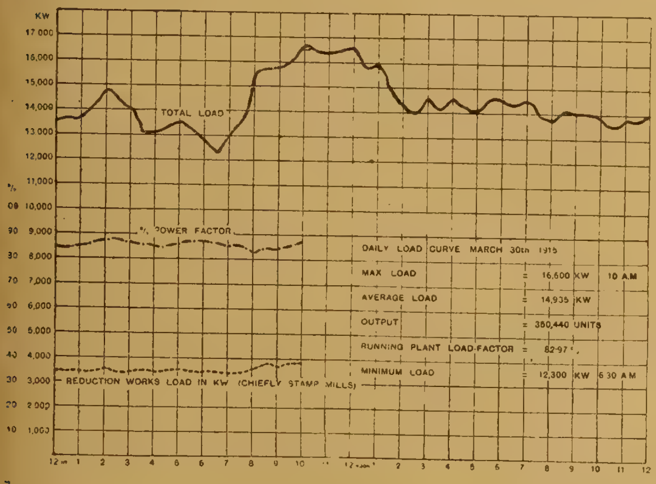


Fig. 14.—Power Station Load Curve.

The general information on the power station is from the writer's personal association with the plant, but the writer also desires to acknowledge as a source of information, particularly regarding the distribution and application of power, a paper read by Mr. Butt before the South African Institute of Engineers in May, 1911. In this paper—"The Electrification of the Randfontein Central"—Mr. Butt described the plant at that time installed, and exhibited a wealth of detail and data altogether beyond the scope of this article.

A SIMPLE RADIOGRAPHIC METHOD FOR LOCALISING BULLETS.

By L. CROUCH.

Useful as radiography is in times of peace, it is simply invaluable in time of war, and X-ray apparatus forms part of the standard equipment of every military hospital of any importance. By far the most frequent application of the rays is to the precise localisation of bullets and shrapnel fragments, &c. The almost complete opacity of the latter permits a sharp image to be obtained easily and quickly, and, under present conditions, unhappily, speed is a consideration second only to that of reliability.

Before the Académie des Sciences, Dr. E. Colardeau described recently a simple and exact method of radiographic localisation which has been used successfully in several French hospitals, notably in the military hospital at Trouville. This method possesses the very desirable, if not indispensable, attribute that only the simplest accessory apparatus is required, over and above the standard radiographic equipment. By additions which can be "home made," or, what is more important, made in the field, the most modest X-ray equipment can be converted into a precision installation.

To determine completely the position of the projectile in a wounded person is a problem in elementary solid geometry. If we mark on the surface of the flesh (near the point where we have reason to suppose the projectile is to be found) a small cross defining a point O, which we take to be the origin of a system of three rectangular co-ordinates (axes running x—right and left; y—head and foot; and z—front and back), we have only to determine the co-ordinates (X, Y, Z) of the projectile with reference to these axes, in order to know just where to operate for its removal.

Two consecutive radiographic exposures are necessary and sufficient to give the desired information. Referring to fig. 1, C represents a section of that part of the body (thorax or leg, for instance) in which is a projectile P. The photographic plate S is placed in a slide B (fig. 2) and can be replaced by a second plate without requiring the patient or the slide to be moved. In the cover of the slide are four small nails, x, x^1, y, y^1, set on two (imaginary) lines at right angles; these nails are printed, together with the bullet and bones, &c., on the negative, and permit axes x, x^1, y, y^1 to be drawn on the latter, intersecting at the centre O of the plate.

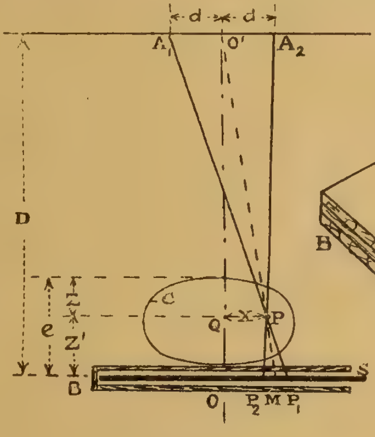


Fig. 1.

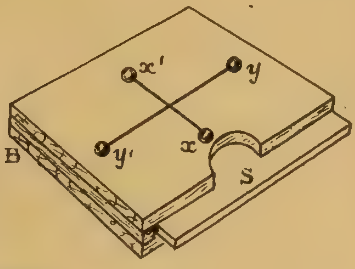


Fig. 2.

The exposure box is placed beneath the X-ray tube, with its sensitive surface 50 cm. from the point of emission. A plumb-line is used to get the centre point O in the vertical through the point of emission, this vertical being the axis of Z in the system of reference co-ordinates. This preliminary adjustment of the plate takes but a few seconds, and the patient is then so disposed that the region where the bullet is supposed to be is approximately centred over the plate. A small gummed label, previously placed at the point O on the exposure box, adheres to the patient's body, and thus marks on it one datum point from which measurements, determined as below, are to be made. A second point on the Z-axis is obtained from the plumb line already mentioned; this is adjusted to graze the patient's flesh, and the point of contact is marked in dermographic crayon by two lines running in the directions $x\ x^1$, $y\ y^1$ of the exposure box axes.

Two exposures are now made with the emission point of the X-ray tube displaced a distance d to right and left respectively of the centre point O^1 along the axis $x\ x^1$ (fig. 1). Images P_1 P_2 of the projectile are thus obtained on two plates, corresponding to settings A_1 A_2 of the X-ray tube. It is, of course, important that the patient should not move during the short period required to make the two exposures after the preliminary adjustments are completed.

The two negatives obtained show the projectile in different positions with regard to the reference points $x\ x^1$, $y\ y^1$ (fig. 3), and if the distance $2d$ (fig. 1) between the points A_1 A_2 be made 64 mm. (ca. 2½ in.), *i.e.*, the mean distance between the eyes, one can observe the two plates in a stereoscope in exact relief, which is often convenient. The axes $x\ x^1$, $y\ y^1$ being pencilled on the negatives, one measures:—The distance x_1 of P_1 from $y\ y^1$ on plate C_1; the distance x_2 of P_2 from $y\ y^1$ on C_2; and the distance y of P_1 or P_2 from $x\ x^1$ on either plate. Then in the two similar triangles $A_1\ P\ A_2$; $P_1\ P\ P_2$ fig. 1:—$Z^1/(D\text{-}Z^1) = (x_2 - x_1)/2d$, whence—

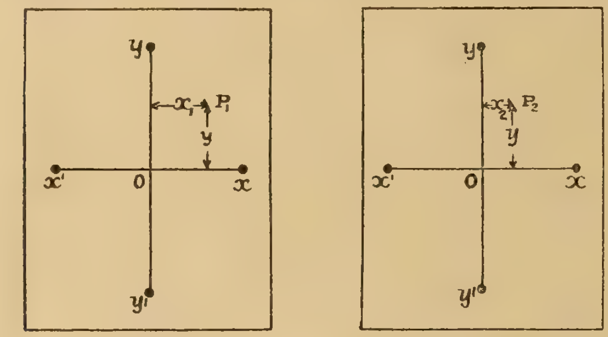


Plate C₁. Plate C₂.

Fig. 3.

$$Z^1 = \frac{D\,(x_2 - x_1)}{(x_2 - x_1) + 2d},$$

and, if $D = 500$ mm. and $2d = 64$ mm.: $Z^1 = 500\,(x_2 - x_1)/(x_2 - x_1 + 64)$ If it is more convenient to know the depth Z of P measured from the point marked by the plumb-bob, it is only necessary to measure the thickness e between the datum points; then: $Z = e - Z^1$.

Again, in the similar triangles, $O^1\ Q\ P$, $O^1\ O\ M$, fig 1:—

$$X/\frac{x_1 + x_2}{2} = (D - Z^1)/D, \text{ whence}$$

$$X = \frac{(500 - Z^1)\,(x_1 + x_2)}{1{,}000} \text{ mm.}$$

and similarly, $Y = (500 - Z^1)\,y/500$ mm. Knowing the co-ordinates X, Y, they are "plotted" on the patient's body from the origin O, and the point (X, Y) thus obtained is marked clearly by, say, a cross in a circle, and a note is made alongside as to the depth (Z) at which the projectile will be found beneath this point. To prevent accidents, the "origin" O is effaced, and the patient is then ready to go before the operating surgeon.

Using a ready-reckoner, which can easily be compiled from the above formulæ, using the particular values of D and A_1 A_2 which are found most convenient, the surgeon can operate within five minutes or less of the time of making the radiographic exposures and with the certainty that he will recover the bullet quickly and with minimum pain and injury to the patient.

ON AN UNBROKEN ALTERNATING CURRENT FOR CABLE TELEGRAPHY.

By Lieut.-Colonel GEORGE O. SQUIER, Ph.D.

(*Abstract of Paper read before* The Physical Society of London, *June 25th*, 1915.)

The object of this paper is to propose a new angle of view in the method of transmission of signals in the submarine telegraph cable, and to describe some apparatus for operating on the general principles involved.

Experiments have been conducted during the past two years at the works of Messrs. Muirhead & Co., Ltd., with a view to determining the practical application of the sine-wave type of E.M.F. for cable signalling. The results thus far obtained have only been made possible through the wide range of experience and practice which this distinguished firm of cable engineers have been able to bring to bear on the subject, and they have taken a leading part throughout the experiments that have been carried out.

Sixteen years ago Dr. Crehore and the author conducted some experiments on an Atlantic cable from Waterville, Ireland, to Nova Scotia, Canada, using a special form of dynamo as a source of power for operating the cable.

A transmitter was also devised, in which a special feature was the cutting out or suppressing from the alternating current of certain definite semi-waves of current which enabled the cable code to be transmitted.

At that time the demand for increase of speed over ocean cables was not pressing. In fact, the particular cable used was idle for several hours each day, which fact, however, greatly facilitated the opportunities for experimenting. Wireless telegraphy did not then exist, and the cable relay or amplifier had not appeared, so that very accurate balancing of the duplex bridge was not required.

Conditions have changed materially since 1899, until at the present moment it may be said that the matter of obtaining increased speed on ocean cables with present apparatus is largely controlled by the accuracy with which the duplex-bridge may be balanced.

If an engineer were required to design a system for operating an electric motor through an Atlantic cable, no form of generator could be proposed at present other than a single-phase alternating current of the sine-wave type. This form, we know, will deliver power at the receiving end of the cable more efficiently than any other shape of wave. Furthermore, during the operation of such a motor, the generator would be allowed to run smoothly and regularly, and, in particular, the generator circuit would never be metallically opened or closed during operation. The opening and closing of an alternating-current circuit is well known to produce disturbances of a more or less pronounced character, depending upon the angle of phase at which the current is opened or closed.

Since improvement of the duplex-bridge balance, as stated above, is really at present a most important desideratum, experiments were made using the Muirhead artificial cable to compare the present forms of battery transmitters with various modifications of the sine wave of E.M.F.

In the last analysis it was always the opening and closing of the transmitter circuit which produced the final kick or "jar" in the balance. This is not surprising when we remember that, from an electrical standpoint, few things can be done to a circuit more severe than suddenly to introduce an infinite resistance into it.

It was only after many variations of the simple alternating current had been tried in the course of experiments to perfect the duplex-balance of the bridge that the fundamental principle of never breaking the transmitter circuit became impressed.

Continuing the analogy of the power plant, it may be remarked that practically every form of cable recorder, amplifier or relay is essentially an alternating-current motor. Its field magnets, armature coil, and the counter E.M.F. of damping are subject to the same laws as in the motor for power purposes.

Let us assume, therefore, as a starting point, the standard type of circuit for operating a cable simply as a power plant as the ideal solution of the problem, and then determine by experiment how near this solution may be retained in practice for the purpose of transmitting cable signals according to the present alphabet. In this plan it will be the continued experimental purpose to determine the minimum possible variations in such a system to enable the alternating current received to be interpreted into dots, dashes and spaces.

A siphon recorder placed in the receiving end of such a cable plant would trace on the recording slip an uninterrupted sine-wave of current which may be considered as the theoretically perfect form of siphon record always to be aimed at, although never to be actually attained in practical telegraphy.

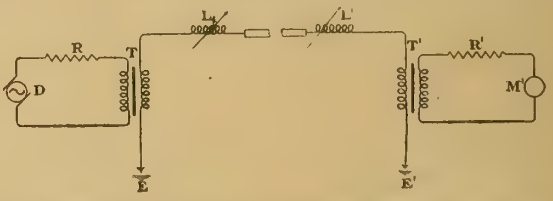


Fig. 1.—Simplex Circuit for Ocean Cable Considered as a Power Line.

In fig. 1, D represents a single-phase alternating-current dynamo, R and R' are resistances and M' is a motor to be operated.

Since a circuit comprising an ocean cable is largely overloaded with capacity, and already includes a large ohmic resistance, it will be in the direction of increasing the resultant harmonic current flowing in such a circuit, to insert in the sending end of the cable a variable inductance, L_1. For symmetry, L' is a variable inductance similar to L_1.

T and T' are iron-cored transformers or auto-transformers, the coils of which are of low resistance, and connected directly to the earth at E and E'.

The circuits in fig. 1 are closed circuits throughout.

For duplex working fig. 1 becomes fig. 2, in which L_1, L_2, L_3, L_4 are the inductance arms of the bridge, and the motors M and M' are inserted in the usual manner for cable working; Al and Al' are the artificial lines.

It now remains to inquire as to what modifications must be made in the typical duplex power circuit in fig. 2 to enable the motor recorders to indicate the elements of the cable alphabet. These elements are three in number, and only three—*i.e.*, the dot, the dash and the space—and each of them is equally important in interpreting the record, and for this reason they will each be considered in the general sense as signal units, rather than the usual way of regarding only the dots and dashes as the signals, and not the spaces.

It is also usual to speak of cable speeds in terms of standard letters per minute transmitted ; but for our present purposes it will be more convenient to convert this speed into terms of the frequency of the dynamo. The graph (fig. 3) exhibits the linear relation between n, the frequency of the dynamo, and letters per minute transmitted, based on the assumption that the average cable letter, with its space, requires four units of alphabet time.

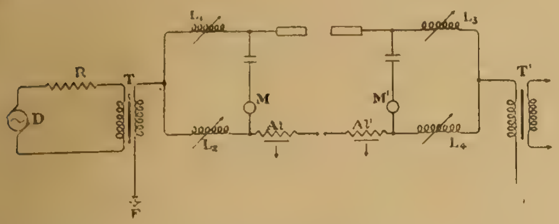
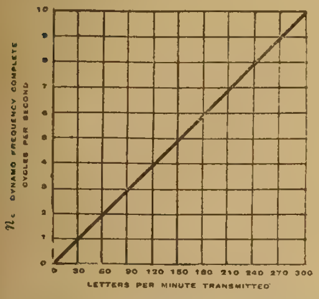


Fig. 2.—Duplex Circuit for Ocean Cable Considered as a Power Line.

Careful experiments on an Atlantic cable confirm the theory of the subject—that, no matter what the shape of the alternating current transmitted, approximate sine waves are received at the distant end of the cable. Battery reversals produce just as accurate sine-wave signals on the receiving recorder as does the alternator itself. In other words, it is the fundamental term of the Fourier analysis which is alone concerned in making the record at the receiving end of the cable.



4 signals = average letter with its space,
n = dynamo frequency in complete cycles per second.

Fig. 3.—Speed of Cable Signalling in Letters per Minute in Terms of the Frequency of the Alternator.

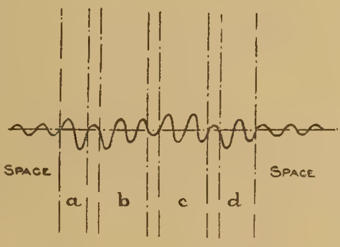


Fig. 4.—Current Waves for Transmitting the Letters *a*, *b*, *c* and *d* by the Alternating Current.

Since, therefore, both theory and experiment show that a sine form of wave is the only one which can pass through the cable without changing its characteristic shape, it should be an advantage so to alter the typical power circuit in fig. 2 as to preserve the sine characteristic as far as possible.

This can be done in a simple manner by operating upon the primary circuit of the transmitter containing the generator, to alter the impedance of the circuit in synchronism with the generator itself. The problem is the more simple from the practical standpoint, because we are dealing with frequencies from about 4 to 10 cycles per second, and, therefore, it is easy to operate with great accuracy on this primary current at any angle of phase. If the change of impedance of the primary circuit always takes place at the instants when the current flowing in the circuit is naturally zero, the fundamental frequency of the current will not be changed, and the sine characteristic of the wave will be very approximately maintained. Varying the impedance of the primary circuit will change the amplitude of the individual alternations of the current.

Another way of stating the effect is that the voltage between the end of the cable and the earth is made to vary by this process, to indicate the three elements of the cable alphabet. It should be noted that this plan transmits alternating current for the spaces between letters and words with exactly the same regularity and integrity as for the signals themselves.

Dots, dashes and spaces are each transmitted by impulses of either sign, differing from each other only in amplitude.

Fig. 4 shows diagrammatically the form of current waves transmitted for the letters *a*, *b*, *c*, and *d*, with the accompanying spaces required.

Although an alternating current operated upon as above outlined could be read directly from a standard siphon record, yet it would be considered an advantage if the final received record could be printed in Morse characters on the usual receiver slip. To accomplish this it will be necessary to provide an apparatus which operates solely by the amplitude of the current waves received, and not by their sign. Furthermore, since the impulses transmitted and received for the spaces are not required on the printed slip, the apparatus should be capable of sorting out and omitting these parts of the record automatically.

Fig. 5 shows diagrammatically one form of circuit arrangement based on the above principles for transmitting and receiving messages. The usual transmitting condensers are shown in the arms of the duplex bridge, instead of the inductances L_1, L_2, L_3, L_4. The ordinary transmitting tape is caused to move synchronously with the generator by being geared directly to its armature shaft. The perforations in the tape are of such a size that the tape advances a distance corresponding to one semi-cycle of the alternator for each individual perforation.

Since in a circuit comprising an ocean cable on which is impressed an alternating E.M.F. the current leads the E.M.F. by an angle, which in an infinite cable is constant at 45°, it is necessary to provide in the transmitter, mechanism for moving the tape carriage longitudinally relative to the perforations in the tape. A micrometer screw is provided for this purpose, and by its use the current can be operated upon accurately at any angle of its phase in practice it is so adjusted that the impedance of the primary circuit will be changed at the instants of zero phase of the current. Since also the angle by which the current leads the E.M.F. is dependent upon the resistance of the primary circuit, there is provided in addition an adjustment of the transmitter for the very slight difference of phase for the dot-and-dash conditions, so that in effect all operations on the primary current, whether for a dot, dash or space, are adjusted to take place at the zero point of current.

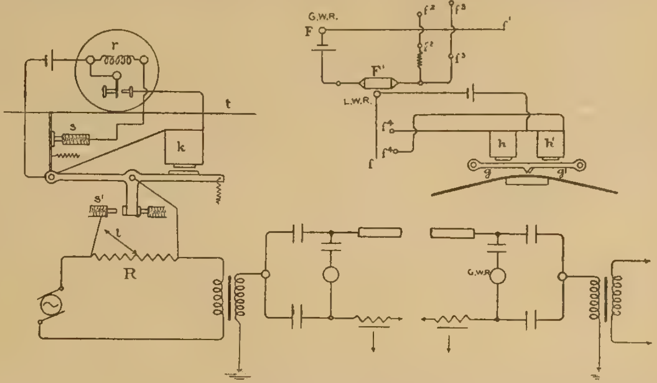


Fig. 5.—One Form of Duplex Circuit Arrangement for Transmitting and Receiving Messages by the Alternating Current.

The general operation of the transmitter mechanism is as follows: When no holes are perforated in the tape *t*, the whole resistance R is in the primary circuit and an alternating current is transmitted, which corresponds to spaces between letters and words ; when a perforation in the tape is on the dot side, part of this resistance R is short-circuited, and when a dash perforation occurs, all of this resistance is short-circuited. The relative values of these resistances being adjustable, the amplitudes of the individual alternations are under complete control by the ordinary transmitting tape.

In the figure is shown diagrammatically the arrangement for causing a dash impulse to be sent by the transmitter by short-circuiting the whole of the resistance R for a time corresponding to one semi-cycle of the alternator. *r* is an ordinary relay ; *k* is an electromagnet which operates at the end of each signal or group of signals. The line *l* leads to an exactly similar arrangement which is provided for the dot impulse by which a certain proportion of the resistance R is short-circuited. In practice these two arrangements are side by side, and in the figure the dot arrangement would be immediately behind the one shown for the dash.

The tape carriage can be moved longitudinally by a micrometer screw which is not shown in the figure, and has an adjustment over a range of a complete semi-cycle. The contacts *s* and *s'*, and similar ones for the dot mechanism, are adjustable by slow-motion screws, so that the instants of contact for a dot and for a dash have an adjustment relatively to each other.

A convenient method of observing the wave-form produced by the transmitter, and for making the above adjustments, is to include an ordinary siphon recorder in the transmitter circuit, or, better, in the cable itself at the transmitting end, by connecting it at the terminals of a very low resistance in the circuit. At the very low frequencies involved, the siphon recorder becomes a most useful and accurate current curve-tracer, and enables the experimenter to observe exactly the shape of wave being transmitted into the cable for any adjustment of the transmitter. Once these adjustments are made for any particular cable they remain unchanged.

One practical arrangement for receiving the signals on a Morse printer is shown diagrammatically in the upper part of the figure. F is an adaptation of the well-known Muirhead gold-wire cable relay, in which f^1 is the gold wire which oscillates between the platinum contact posts f^3f^3, about a fixed point at F. A second pair of posts f^2f^2 is provided, and each of these pairs has an adjustment for altering their distance apart, and also for moving them longitudinally along the gold wire, and relatively to each other. Instead of being separate contacts, as in the usual case with this relay, each of the pairs are electrically connected, as shown. F′ is a local wire relay of similar principle, and f is its moving part, which in its oscillations makes contact with the posts f^4f^4, adjustable, as above; h and h' are electromagnets for operating the dot and dash arms of the printer; g and g' are two arms pivoted at their outer ends, adapted to make a siphon record at their free ends in the centre upon the moving tape shown beneath. The arm g' is forked to record two ink marks on the tape symmetrically on either side of the central mark made by the arm g, and in line with it across the tape, so that both arms can make a record simultaneously on the tape for a dash.

The incoming alternating current thus causes the gold wire f^1 to oscillate back and forth with different amplitudes depending upon whether dots, dashes or spaces are being received, and the posts f^2f^2 are adjusted so that the space amplitude just does *not* make contact, but a dot amplitude of either sign does make contact. In like manner the posts f^3f^3 are adjusted so as just *not* to record a dot impulse, but to make contact for the larger amplitude of a dash of either sign. It is seen that both a dot and a dash contact are made whenever a dash amplitude is received. The flexible gold wire f^1 in its motions about F first strikes the posts f^2f^2, and there is a bending or wrapping effect produced in the wire, which for the stronger dash impulses causes contacts with f^3f^3 also. The relay F′ operates similarly through a moving arm, making contact with the posts f^4f^4 separately or both together, depending upon the amplitude of its swing.

The printer itself becomes an apparatus of marked simplicity, and is nothing more than two small siphons adapted to mark on the slip in the usual manner.

In practice, all adjustments are so made as to provide for transmitting for the spaces as large an amplitude as possible instead of as small an amplitude as possible, in order to approximate more nearly to the ideal electrical conditions for transmission through the cable itself.

In case a cable magnifier such as the Heurtley instrument is used instead of a gold-wire relay, it would be inserted in fig. 5 in the recorder arm of the bridge, and operate a local wire relay and printer instead of the usual recorder. Since the relay operates on difference of amplitude of the waves, and not on their absolute values, a cable magnifier would serve to exalt the value of this difference and furnish a greater margin for practical working.

(To be continued.)

CALORISING: A PROTECTIVE TREATMENT FOR METAL.

By H. B. C. ALLISON and L. A. HAWKINS.

In connection with the article on "Sheathed-wire Heating Units" printed in our issue of July 9th, the process of "Calorising" was mentioned. The following is an abstract of a description of the process, which appeared in the *General Electric Review* for October, 1914:—

Mr. T. Van Aller has discovered a process of heating metals in revolving drums with mixtures containing, among other things, finely divided aluminium, by which a surface alloy containing aluminium is produced. In the case of copper, this alloy is of the nature of an aluminium bronze, but richer in aluminium than the ordinary alloy of that name and more resistant to heat, so that copper thus treated is protected up to the melting period of the alloy from the scaling which occurs when untreated copper is heated above 300° C. The same general result was obtained in the case of iron and steel. Some use was made of this process, which has been called "Calorising," for treating copper soldering irons and iron resistance wires for heating devices.

Modifications of the process, extending it to further applications, were made by Mr. E. G. Gibson, of the Schenectady Research Laboratory. Pieces which, because of their shape or size, are not adapted for tumbling, may be calorised by packing them in, or painting them with, a suitable mixture, and heating them. Thus, the size of the heater is the only limitation on the size of the piece that may be calorised. Wire or ribbon may be treated by a continuous process, by passing it through a heated pipe containing the proper calorising mixture. There appear to be many places where it is desirable to use iron vessels or apparatus at temperatures above red heat, and at such temperatures ordinary iron rapidly oxidises and scales away. After iron is calorised the effect of heating is slight. Instead of burning and the scale falling off, as in the case of untreated iron, practically no effect can be detected after a considerable time—certainly none which injures the surface. This is well illustrated by the two pieces of iron pipe shown in fig. 1, both from the same kind of pipe, but one of which (b) was calorised; the two were heated side by side, with an ordinary laboratory blast lamp to a temperature of about 900° C. for a period of four hours, then cooled, and the heat once more applied for another period of four hours. At the end of that time the untreated pipe (a) was badly burned, the point where the flame was directly applied having been reduced to one-half the original thickness, while the whole surface was blistered. The contrast between this piece and that which was calorised (b) is very marked, for even upon close examination the calorised pipe appears to be unchanged.

The piece of calorised pipe used in this experiment had previously been used in other work, where it had been alternately heated to 1,000° C. and cooled, in an electric resistance furnace open to the air. The total time during which the maximum temperature was maintained was about 50 hours. A rather extreme test has been applied to this same piece lately, by heating it to about 900° C. and plunging it into cold water, after it had cooled to a dull red. This has been repeated three times, and the surface shows no signs of cracks or any tendency to scale.

Fig. 2 shows a similar comparison between two pieces of sheet iron tube, one calorised and the other not, which were both subjected to a temperature of 800° C. in a gas furnace for 100 hours. The uncalorised piece is practically destroyed, while the calorised piece is unharmed.

Another application of this process is to iron wire or ribbon such as is used in electrical heating units. An untreated piece of this ribbon will burn out in four or five hours at the most, whereas tests upon calorised pieces have shown that the life is increased at least fifty-fold, and in the best instances, over one hundred-fold. The results of tests made at Pittsfield indicate that a life of over 500 hours may be expected from calorised heating units run at a temperature of 800° C.

The above facts seem to indicate that this is a simple method for extending the use of iron under oxidising conditions at high temperatures, and for greatly prolonging the life in those instances where it is now used, but must be renewed at frequent intervals. While the life of the coating depends on the temperature at which it is used, as well as on the duration of time taken in its preparation, *i.e.*, the quantity of aluminium which alloys with the surface of the iron, it does not permit of long use at temperatures much in excess of 1,100° C.

Copper parts also, which are exposed to high temperatures, can have their life increased by calorising. In some cases calorised copper may be used advantageously in place of aluminium bronze. For instance, a large power station had trouble from early corrosion of its condenser tubes. These tubes were aluminium bronze and were supposed to last at least a year. As a matter of fact, while occasionally tubes would last as long as six years, other tubes would fail in four to six weeks after they were installed. About two and a half years ago a set of calorised copper tubes was installed, and so far not a tube has failed.

In some cases the life of copper contacts can be increased by calorising. For instance, a set of railway controller contacts which were calorised showed double the life of the ordinary untreated contacts.

As has been said, the effect of calorising is to produce a surface alloy containing aluminium. The thickness of this alloy varies with the length of time to which the piece is subjected to the calorising process, and the percentage of aluminium varies through the coating being greatest at the surface. This is shown clearly by a cross-section of a calorised

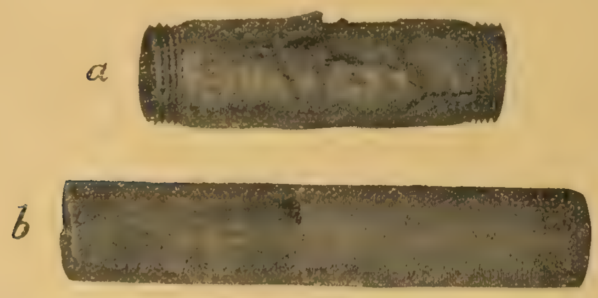


Fig. 1.—A Piece of Plain Iron Pipe (*a*) and a piece cut from the same Tube, but calorised (*b*), after being subjected to the same degree of temperature for the same length of time.

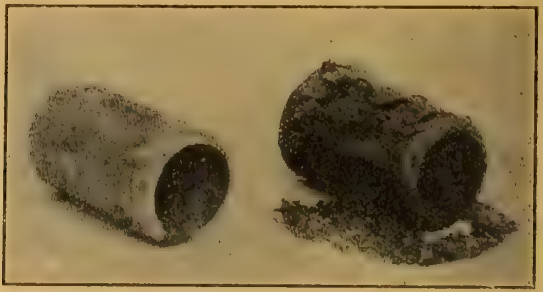


Fig 2.—Effect of 800° C. in a Gas Furnace for 100 hours on Calorised and Uncalorised Sections of Sheet Iron Tubes.

copper rod. The line between the alloy and the unchanged copper is sharp, but the colour of the alloy varies from a rich golden-yellow next to the copper to a silvery-white at the surface.

When an iron pipe or ribbon is calorised for a heating unit, a portion of the iron becomes alloyed with the aluminium. Naturally, this results in changing both the resistance and the temperature co-efficient. The thicker the calorising coat the greater is the change. This is shown by the following table, in which No. 1 was given a lighter coat than No. 2.

Sample.	Ohms per M. (19°)	Temp. Co-ef. Elec. Resis. (0-150°) × 10^3
Iron ribbon	0.905	5.61
Same calorised, No. 1 ...	2.45	1.72
Same calorised, No. 2 ...	7.6	0.151

A thin ribbon may easily be calorised all the way through, and then becomes quite brittle.

The dimensions and weight of either a copper or iron piece are slightly increased by calorising. The increase of dimension is much less than the thickness of the alloy coat, the greater part of which simply takes the place of the original metal. The dimensions may, however, increase several mils and there is a tendency to a greater increase at the edges than on flat surfaces.

For iron, calorising is intended only for protection at high temperatures. It does not compete with galvanising, sherardising, and other similar processes for protection against oxidation or corrosion at low temperatures. Its usefulness lies within a range of temperature much higher than a galvanised or sherardised coat could stand. For copper, calorising is effective against corrosion at low temperature as well as against oxidation at high temperature. The upper limit is determined by the melting point of the alloy, which is somewhat lower the heavier the calorising treatment, since that means an alloy with a higher aluminium content.

The probable explanation of the effect of the aluminium in the surface alloy is that a thin coat of alumina forms which prevents further burning of the metal beneath. It is well known that a pure aluminium wire may be heated in the air to a temperature several hundred degrees above its melting-point, without flowing, when the thin alumina shell which surrounds and supports the molten metal is easily seen.

INDIAN NOTES.

[From our Special Correspondent.]

Business among electrical contractors remains brisk in spite of the increase in prices at home and of the irregularity of shipments. The present extraordinary price of home copper —the latest notification from cable manufacturers being that copper is £104 per ton—has raised the local price of insulated wire about 35 per cent., and, consequently, petty contractors are having a thin time, and especially those who imported cheap Continental wire, which is now, of course, unprocurable. In fact there is a scarcity of wire all round, and manufacturers' representatives, such as Glover's, Henley's, and Callender's, have been obliged to turn down orders for small sizes of 600-megohm grade wire.

The metallic filament lamp is about the only electrical supply left whose price has not yet been increased due to the war. It is reported that the representatives of the larger agencies —the Osram, Edison & Swan, Mazda, and Wotan—meet occasionally in solemn conclave to endeavour to come to some agreement to maintain rates to a level which will yield them a reasonable profit, or, at any rate, prevent under-cutting. At present some outstanding yearly contracts have to be fulfilled at the rate of 14½d. per metallic filament lamp of 225 volts, 20-60 watt, including delivery to mills, railways, and Government stores. This is under-cutting with a vengeance. The agents for the Phillips lamp, made in Holland, are doing good business in half-watt small candle-power sizes, which, apparently, the other firms cannot supply.

Jammu.—The State engineer is calling for tenders for a stand-by plant for the hydro-electric installation to consist of the following :—

Two water-tube boilers to evaporate 3,500 lb. of water.
Two mechanical stokers.
Two Weir feed pumps.
Feed-water heater.
Steam, exhaust, and feed mains.
Two steam alternators, 130 KW., 3,000 volts, 50 cycles, at 428 R.P.M., p.f. .8, temperature rise not to exceed 60° F. above an initial temperature of 95° F. at 1,200 ft. above sea level.
Switchboards and the necessary transformers.
Overhead travelling crane, 4 tons, 25 ft. span.
Steel chimney.

All above to be in working order on site by June, 1916. Probably inquiries are being sent home by this mail (July 1st) to the various manufacturers from their agents in India.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NEWFOUNDLAND.—The Customs Authorities have decided that the surtax of 10 per cent. provided for under Act No. 25 of 1914 is to continue in force.

EAST AFRICA PROTECTORATE.—The free importation of the following goods has been provided for : Electric cable or wire, the posts for carrying the same, and all other material for the purpose of generating, storing or distributing electric energy, whether for power or lighting, on satisfactory proof to the Chief of Customs that such articles and materials are imported solely for such purposes. Such exemption is not to include lamps and their fittings or material other than industrial machinery required for the purpose of using electric energy. The above replaces the following item in the free list, which is now repealed :—Apparatus and appliances used in connection with the generation and storing of electricity, but not including electric cable or wire, or the parts for carrying the same, and not including lamp-posts or lamps or their fittings.

NEW ZEALAND.—The Customs Authorities have issued the following decision : "Pipes (iron) and fittings for same (conduit for electric wiring), with or without inspection lids," dutiable according to size at 30 per cent. and 20 per cent. *ad val.* if of foreign origin, and 20 per cent. and free if of British origin.

PORTUGAL.—The exportation of the following articles to foreign countries from the mainland of Portugal and from the adjacent islands has been prohibited : "Carbons for electric light; ferro alloys; articles of copper or brass partly or wholly manufactured. Prohibition is not applicable to commercial operations carried out in virtue of contracts already entered into. Such contracts must, however, have been confirmed within 15 days of June 5th before the Commissao de Subsistenciao, and the goods in question be withdrawn within one month after permission has been given by the Ministry of Finance as a result of the decision of the Commissao.

ASHANTI.—The tariff on goods imported, which is in force in the Gold Coast Colony, has been made applicable to goods imported into Ashanti, but it has been provided that the Chief Commissioner may, by order in writing, permit any goods to pass through Ashanti in transit to the Northern Territories without payment of duty in Ashanti.

RUSSIA.—The Board of Trade have been notified that certificates of origin for goods shipped to Russia will be dispensed with in the case of goods which arrive in Russia direct from Allied countries, nor will such certificates be required in the case of foreign goods dispatched to Russia from Allied countries by parcels post. When goods from Allied countries are imported into the Empire after passing in transit through other countries, or after trans-shipment at intermediate ports, certificates of origin issued at the place of dispatch only will be required. Russian diplomatic and Consular officers will certify only the signatures on the certificates, and not the accuracy of the statement regarding the origin of the goods covered by the certificate. Certificates of origin will not be required for the undermentioned goods, among others, imported into Russia : Aluminium, asphalt, copper, gutta-percha, rubber.

HOLLAND.—The exportation of electric pocket lamps, parts thereof, and raw materials for the manufacture thereof, from Holland has been prohibited.

SWITZERLAND.—The exportation of the following goods has been prohibited : Carbon stems for pocket electric lamps; copper, lead, zinc, tin, or metal manufactures wholly or partly finished, except machines, mechanical contrivances, instruments, and apparatus; electric transformers and detached parts thereof; electric pocket lamps and cases, and other detached parts thereof.

RHODESIA.—The "general" tariff on goods unspecified in the Rhodesian tariff (which includes many kinds of electrical goods) has been increased from 15 per cent. to 20 per cent. *ad valorem;* the tariff on British goods remains the same, viz., 9 per cent. *ad valorem.*

ST. LUCIA.—Irrigation, mining, and other machinery for industries of all kinds, except agriculture, have been removed from the free list, and are now subject to duty.

SPAIN.—The exportation of manufactures of aluminium has been prohibited.

SERBIA.—The importation, except by the State, of the following is prohibited : Apparatus and accessories for electric signals, etc., and wireless telegraphy apparatus.

SALVADOR.—The Board of Trade are informed that when the total value of goods shipped to Salvador, as declared in Consular Invoices, is inferior by more than 15 per cent. to the value for which they are insured, Consular fees will be charged on the insured value, and the original policy must be produced as evidence of the insured value.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

10,117. "Manufacture of tungsten." J. C. Butterfield. July 12th.

10,121. "Incandescent electric lamp of two zig-zag metallic filaments giving three grades of light." T. P. Casotti. July 12th. (Complete.)

10,130. "Electrically-controlled electric circuit breakers." British Westinghouse Electric & Manufacturing Co., Ltd. July 12th. (Convention date, July 11th, 1914, United States.) (Complete.)

10,131. "Arrangement for supplying electrical energy to direct-current electric motors." British Westinghouse Electric & Manufacturing Co., Ltd. July 12th. (Convention date, July 11th, 1914, United States.) (Complete.)

10,133. "Process for the electrolytic deposition on all metals of aluminium, tin, nickel, copper, zinc, iron, steel, or alloys thereof." P. Marino. July 12th. (Complete.)

10,134. "Process of electrolytically depositing lead or tin on galvanised iron or alloy of zinc-lead or zinc-tin or iron or steel surfaces." P. Marino. July 12th.

10,137. "Primary cells." F. A. Wilkinson. July 12th.

10,192. "Centrifugal compressors." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 13th.

10,199. "Electrical apparatus for producing hot and cold currents of air." E. B. Wright. July 13th.

10,204. "Sparking-plugs for internal-combustion engines." Daimler-Motoren Ges. July 13th. (Convention date, July 20th, 1914, Germany.) (Complete.)

10,214. "Casings of ammeters and voltmeters." Walsall Electrical Co., Ltd. July 14th. (Divided application on 9,023/15, June 19th.)

10,226. "Inter-connecting the electrical conduits of two railway cars." J. Wollenmann. July 14th. (Complete.)

10,228. "Telegraph systems." O. Srnka. July 14th. (Conventino date, June 15th, 1914, Austria.) (Complete.)

10,229. "Telegraph systems." O. Srnka. July 14th. (Addition to 10,228/15.) (Complete.)

10,231. "Vibrators for induction coils and the like." A. E. Beattie. July 14th.

10,242. "Shaft packings." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) (July 14th.)

10,245. "Thermostats." H. H. Grundy. July 14th.

10,251. "Electric condensers." W. H. Wilson. July 14th. (Addition to 19,506/14.) (Complete.)

10,270. "Connection of electrical instruments." J. Roothaan, A. H. Higgs, & Ferranti, Ltd. July 14th. (Complete.)

10,272. "Amplification of wireless signals." A. J. Roberts. July 14th. (Complete.)

10,276. "Electrically-operated relays and the like." C. H. Woodward. July 15th.

10,325. "Electrically-driven luggage track." J. E. Hamilton. July 15th.

10,330. "Protective reactance coils." G. Harlow. July 15th.

10,334. "Electric bells." M. Suwa. July 15th. (Complete.)

10,337. "Electro-deposition and refining of zinc." J. N. Pring. July 15th. (Partly communicated by Urlyn Clifton Tainton, South Africa.)

10,350. "Electric light fittings."' S. Fildes. July 16th.

10,370. "Centrifugal compressors." British Thomson-Houston Co., Ltd. (General Electric Co., United States). July 16th.

10,373. "Detectors for wireless signalling." T. W. Stratford-Andrews. July 16th.

10,374. "Insulation-testing devices for electric lighting and power installations." R. H. Gould. July 16th.

10,412. "Elastic fluid turbines." British Thomson-Houston Co., Ltd. (General Electric Co., United States). July 17th.

10,420. "Electric transmission systems for motor vehicles." N. Shuttleworth. July 17th. (Complete.)

10,421. "Insulators." J. Rothaan & Ferranti, Ltd. July 17th. (Complete.)

10,422. "Electrical connections." J. Wood, H. G. Furlong, & Ferranti, Ltd. July 17th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

24,827. Process for Working a Radiator Heated by Gaseous Liquid or Solid Fuel, or by Electric Current or Steam. H. Frank. October 31st. (Patent of addition not granted.)

25,072. Arrangement and Connections of Electric Switchgear and Switches therefor. Siemens Bros. Dynamo Works, Ltd., C. A. B. D. Koettgen, & R. A. R. Bolton. November 3rd.

25,362. Method and Machine for making Tubing for Conducting Fluids and for Electrical Insulation purposes. P. Menzel. November 6th.

25,479. Cooling Arrangements for Electric Locomotives. Siemens Schuckertwerke Ges November 7th. (May 26th, 1913.)

25,701. Device for Discovering Fractures in Wire Cables. R. Wahn November 10th. (November 11th, 1912.)

1914.

313. Electric Switches. H. Wade (C. Kaisser). January 5th.

683. Means for Collectively Actuating and Controlling Alternating-current Motors. J. L. Routin. January 9th. (Patent of addition not granted.)

953. Electric Switchboards. S. A. Green. January 13th.

1,871. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt. Ges. January 23rd. (January 25th, 1913, addition to 28,751/12.)

3,912. Arrangement for Regulating the Phase Displacement between the Main Current and Voltage Fields of a Ferraris Meter. Allgemeine Elektricitäts Ges. February 14th. (February 15th, 1913.)

3,986. Electro-magnetic Shaking Feeds or Jiggers for Electro-magnetic Separators. Maschinenbau Anstalt Humboldt. February 16th. (February 18th, 1913.)

7,589. Dynamo-electric Generators. J. Stone & Co., Ltd., and A. H. Darker. March 25th.

7,590. Dynamo-electric Machines. J. Stone & Co., Ltd., and A. H. Darker. March 25th.

7,922. Microphones, Relays, and the like, especially suitable for use in Radio-telephony. A. F. Sykes. March 28th.

8,280. Electric Distribution Systems. R. Arno. April 1st.

8,504. Electric Time Switches. P. Dresla. April 3rd. (April 3rd, 1913.)

8,794. Reciprocal Connection for Two Telephone Lines, connected with a Relay for Reinforcing Telephone Currents. P. L. M. Drumaux. April 7th. (October 23rd, 1913.)

9,686. Wave Detector for Wireless Telegraphy of a Mercury and Crystal Type using Carborundum or other Crystals. Kuhr & Bridges. April 20th.

11,222. Telegraphy. A. Oglivie & Creed, and Bille & Co., Ltd. May 6th.

12,941. Motor Control Systems. British Thomson-Houston Co. (General Electric Co., United States). May 26th.

15,270. Apparatus for Transmitting Pictures of Moving Objects and the like to a Distance Electrically. S. L. Hart. June 25th.

15,338. Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co., United States). June 26th.

15,485. Electric Arc Lamps. Planiawerke Akt. Ges. für Kohlenfabrikation. June 27th. (March 6th, 1914.)

15,727. Intercommunication Telephones. H. G. White & J. H. Parsons. July 1st.

16,007. Incandescent Electric Lamps. W. W. D. Knight & H. E. Clerk. July 4th.

16,027. Insulation of Dynamo-electric Machinery. Micanite & Insulators Co., Ltd., and J. Allan. July 4th.

16,126. Apparatus for the Electric Soldering of Thin Objects by means of Indirect Heating. Allgemeine Elektricitäts Ges. July 6th. (August 12th, 1913.)

16,327. Electric Circuit Controlling Devices. British Thomson-Houston Co., Ltd. (General Electric Co., United States). July 8th.

16,380. Receiving Arrangements for Wireless Telegraphy. R. C. Galletti and Galletti's Wireless Telegraph & Telephone Co. July 9th.

16,424. Apparatus for Calling Attendants. Sterling Telephone & Electric Co. and F. G. Bell (Telephon Fabrik Akt. Ges.). July 9th.

16,575. Electrical Relays. A. H. Railing & C. C. Garrard. July 11th.

17,399. Telautographic Apparatus. A. G. Bloxam (Telepantograph Ges.). July 22nd.

18,761. Terminal Boxes for Electric Cables. W. B. Woodhouse and Callender's Cable & Construction Co., Ltd August 17th.

19,344. Electrical Connections. H. Lucas & W. H. Edwards. September 2nd.

19,484. Devices for Supporting and Insulating Conductors applicable for Electric Resistances and Heaters. P. Good & A. E. Woodhouse. September 5th.

20,330. Magneto-electric Machines for Ignition in Internal-combustion Engines. M. S. Conner. September 30th.

20,580. Electric Lampholders. J. H. Collie. October 6th.

21,794. Circuit Arrangements for Telephone Installations. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges.). October 30th.

21,936. Electrical Relay Apparatus. C. B. Burdon (Siemens & Halske Akt. Ges.). November 3rd.

22,047. Electric Advertising Devices and Signs. F. C. Reilly. November 5th.

23,686. Driving Arrangements for Dynamos. G. Kocsis & J. Lücö. December 7th.

23,884. Electrically-actuated Tools. W. J. Mellersh-Jackson (Commonwealth Electric Tool Co.). December 10th. (Divided application on 18,738/14, August 17th.)

1915.

945. Electric Switch and Fuse Service Boxes. H. F. Reason. January 20th.

1,085. Controlling and Indicating Electric Motors from a Distance and the application thereof to Weighing Machines. Stothert & Pitt, Ltd., and E. S. Franklin. January 22nd.

1,468. Starting Means for Vapour Electric Devices. F. Conrad. January 29th. (January 30th, 1914. Addition to 37/12.)

5,676. Alternating-current Voltmeters. H. S. Dransfield. April 15th.

5,866. Lanterns for Electric Lamps. R. Bosch (firm of). April 19th (June 15th, 1914.)

7,013. Dynamo-electric Machines particularly applicable for Engine Starting Systems. C. F. Kettering & W. A. Chryst. May 10th. (July 14th, 1913. Divided application on 13,022/14, May 27th.)

The Ideal Light Source.—A paper read at the annual meeting of the American Electrochemical Society, by Dr. Herbert E. Ives, dealt with the ideal light, which, according to the viewpoint of the illuminating engineer, is not a brilliant point, but a surface of low intrinsic brilliancy, perhaps a surface of a window square. Dr. Ives pointed out that the vacuum-type tungsten lamp is 300 times as bright as the brightest object by day, namely, a white surface in the sun. The nitrogen-filled tungsten lamp is 1,000 times as bright, and it becomes necessary to employ reflecting and diffusing media. What is required is a surface source of an intrinsic brilliancy of not over 0·001 c.p. per sq. cm. A true luminous paint which could be easily excited at will would meet this idea. A low intrinsic brilliancy is in great demand. The efficiencies of modern illuminants are surprisingly low. If we figure from coal, 1 per cent. is the best figure obtainable to-day. Light is actually only a small by-product. Dr. Ives gave the accompanying figures of recent measurements made by him of total luminous efficiency based on 50 c.p. per watt as the mechanical equivalent of light.

Luminous Efficiency of Various Light Sources.

	Luminous efficiency of the radiation, per cent.	Total luminous efficiency, per cent.
4-watt carbon lamp	0·45	0·42
Vacuum tungsten lamp at 1·25 watts per candle	1·65	1·3
Nitrogen-filled lamp at 0·70 watt per candle	2·93	2·4
Welsbach mantle, 0·75 per cent. "Ceria"	1·2	0·19
Open-flame gas burner	0·19	0·036
Yellow flame arc	...	7·2

THE

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Vol. LXXVII.] CONTENTS: August 6, 1915. [No. 1,967.

Page
New Methods in Submarine Telegraphy 161
Missing the Point 162
Rubber 162
The Wire-Drawing Trades 162
The Case for the Electrification of Cane Sugar Mills and Refineries, by E. P. Hollis 163
Trade Statistics of Brazil 164
Gear-Driven Direct-Current Turbo-Generator Set (*illus.*) ... 165
New Electrical Devices, Fittings and Plant (*illus.*) 166
Legal... 168
War Items 170
Correspondence—
Branch Offices... 170
Reviews 171
Over Specialisation, by J. Marks... 172
The Suspension of a Contract 173
Business Notes 174
Notes 178
City Notes 181
Stocks and Shares 183
Share List of Electrical Companies 184
Market Quotations 184
The Electrical Trade Position in China, by G. R. Archdeacon 185
Stroboscopic Frequency Measurements (*illus.*)... 186
On an Unbroken Alternating Current for Cable Telegraphy, by Lieut-Colonel G. O. Squier (*concluded*) (*illus.*) 187
Four Years' Operating Experience on a High-Tension Transmission Line (*illus.*) 189
New Patents Applied for, 1915 192
Abstracts of Published Specifications 192
Contractors' Column ... ... Advertisement page xvi

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NEW METHODS IN SUBMARINE TELEGRAPHY.

THE immense value to this country, and to the Empire generally, of the vast network of submarine cables that has been woven beneath the seven seas by British industry and enterprise was never more convincingly demonstrated than during the present war. How many reams have been written in pre-war times in anticipation of a European war in which we should be involved, and in which the preservation of our submarine communications would be of supreme importance to our welfare, we should find it difficult to estimate. Happily for us, our Navy soon swept the seas clear of hostile cruisers and freed us from anxiety on this score for the time being, but it is obvious, as we remarked last week, that had we been opposed by a different combination of foreign powers, our position with regard to the safety of our cables might have been very gravely imperilled. Even now it is not impossible that attempts will be made —perhaps they have been made—to interrupt our communications by certain means; though such attempts are not likely to succeed, the possibility should not be ignored.

Meanwhile, aloof from war's alarums, the scientist pursues his tranquil way and seeks to improve upon existing methods, with the success to which our columns have repeatedly borne witness. Amongst the most remarkable developments of recent date is that which Lieut.-Col. Squier describes and explains in his paper, read before the Physical Society of London, of which a very full abstract is concluded in this issue. The fundamental idea of his invention is revolutionary in character, though not absolutely novel in conception. We have been accustomed to look upon a long submarine cable as a great reservoir of capacity, like, say, a long but narrow canal; we start a comparatively huge wave at one end of it, which arrives at the other end in the form of an attenuated ripple, barely perceptible with the aid of the most refined and delicate instruments; and various ingenious devices have to be employed to wash out the undesired and useless effects of the original disturbance, in order to clear the way for the following signal. Col. Squier, who has worked on the subject of trains of waves for many years, conceived the idea that if a regular succession of waves were sent into the cable *in unbroken sequence* and of the most efficient form (sinusoidal), the irregular and ungovernable effects met with in the existing system would be eliminated; instead of a series of abrupt and violent impulses, charged with innumerable harmonics, being impressed upon the cable at one end, with the result that the conditions in the cable differed from point to point throughout its length, the cable would be kept in a state of continuous gentle electrical oscillation at every point, the only variations being the slight differences of amplitude corresponding to the signals and spaces. Thus order would be brought out of chaos; sending conditions would be immensely improved, and the speed of transmission greatly accelerated.

How this can be done will be found explained in Colonel Squier's exceedingly interesting paper, not the least significant and noteworthy feature of which is the fact that he approaches the question from the standpoint of the electrical engineer transmitting power to a great distance, and seeking to accomplish this in the most efficient and workmanlike manner. We heartily congratulate the inventor upon his achievement, which seems likely to revolutionise practice in connection with long cables.

At first sight it may seem a small thing to increase the speed of transmission by, say, 50 per cent.; but when it is remembered that an Atlantic cable costs something like £500,000, and that a 50 per cent. increase of speed means that two such cables will do the work of three, the enormous importance of the matter to the cable world and to those who telegraph will be appreciated. We believe that Col. Squier's invention is expected to produce a far greater improvement even than this.

Missing the Point.

A leaderette in the *Electrical World*, of July 10th, dealing with the "Point Five Tariff" discussion at the I.M.E.A., curiously misses the point of the matter in a double sense—in the first place by explaining that the tariff involves as a secondary rate "$\frac{5}{10}$ths penny per kilowatt hour," and in the second by making the following comment:—"As regards the load, the new tariff in the case of two cities specially described quite doubled it, but in both cases the gross revenue from residences did not rise proportionally, so that the average price per unit was quite cut in half. As the usual English city plant is municipally owned, the 'point five' tariff may perhaps not unjustly be regarded as a sop to the rate-payer."

We can assure our contemporary that the rate-payer, as such, keeps a very keen eye on the tariff question, and would strongly resent any sort of "sop" to the consumer if he thought it involved supplying the latter at less than cost price. But the point that has been missed is the fact, which we should have thought no electrical editor could overlook, that while the load was increased by the adoption of the tariff, the additional units were mainly "off the peak," and consequently cost less by far than the original demand. The average price per unit was reduced, as a matter of course—but it by no means follows that *the average profit per unit* was decreased, and even if it were, it still by no means follows that the *net profit per consumer* was decreased. On the contrary, the results on a commercial basis have been eminently satisfactory to the managers who have adopted the tariff in one form or another. Mr. Roles's reply to the discussion, of which we published the gist last week, will help to convince our contemporary that its rather superficial appraisal of the system was erroneous. It is not, as stated, a "cut-rate scheme."

Rubber.

Some temporary irregularity was seen recently in rubber, which arose mainly from the fact that spot and near parcels were held for pretty high figures, while, on the other hand, there were some interests having fair lines at their disposal who seized the opportunity to dispose of their contracts. On the whole, however, the tone has been fairly good, and undoubtedly fair quantities of the plantation product have been disposed of to the consuming trades, although activity has scarcely been up to the level of that experienced some few weeks ago. The consuming sections, however, are exceedingly busy in all parts of the country, and the tire factories and kindred works are running night and day, their output being limited only by the labour forces available. There seems no disposition, however, on the part of consumers to rush heedlessly into the making of fresh purchases, though this need arouse no concern in view of the remarkable activity prevailing in all consuming connections.

The arrivals which have come to hand have been pretty fair, and they are expected to show a material increase during the next few months. From estimates which have been prepared, it is believed that the output of the Federated Malay States this year will show a considerable increase. Last year the yield, taken over a wide range of estates, varied from 230 to 447 lb. per acre, the average being somewhere between 300 and 350 lb.

There has been some searching of hearts regarding the way in which Germany has been getting supplies of rubber. Undoubtedly a portion of the rubber which has entered the country since the war was smuggled in from the United States, and this in spite of all the efforts made to lock the door. The matter is being very seriously considered by the Rubber Growers' Association, which influential body as soon as war broke out directed the attention of the Government to the fact that Germany was trying to buy rubber here. Restrictive steps were taken, and it is the general impression that these have been very successful. At all events, private information which leaks through from the Continent suggests that Germany is beginning to want rubber pretty badly, and there can be no doubt that everything possible will be done as far as British interests are concerned, to starve out the Huns.

Official advices announce that the exports of plantation rubber from the Straits Settlements during June totalled 2,249 tons against 3,588 tons in May, and 1,480 tons in the corresponding month of last year, details being as follows:—

	1913.	1914.	1915.
January...	784	1,181	2,576 tons.
February	743	1,703	2,741 „
March	898	1,285	2,477 „
April	762	1,548	1,978 „
May	814	1,309	3,588 „
June	812	1,480	2,249 „
Total	4,813	8,506	15,609 „

This figures include transhipments of rubber from various places in the neighbourhood of the Straits Settlements, such as Borneo, Java, Sumatra and the non-Federated Malay States, as well as rubber actually exported from the Colony, but do not include rubber exports from the Federated Malay States.

The Wire-Drawing Trades.

The demands for copper, bronze, and steel wire, &c., during the last month have maintained the substantial level recorded in previous months of the war, and the conditions ruling throughout the trades are much the same as before. The demands for electrolytic copper have continued to be heavy, particularly in the fine wires, in which section probably the productive capacity of every machine in the country is being taxed to the utmost. The chief sources of trouble are undoubtedly the skilled labour problem and the inability to obtain new machines from the makers, whose output is also subjected to similar restrictions. In other instances entire sets of machines are standing for want of skilled labour to work them.

In regard to the question of the re-exportation from Holland into Germany, &c., of copper goods originally shipped from this country, the probabilities are that the actual facts have been somewhat exaggerated by statists and others. According to the authority of the Dutch Government officials, very little, if any, copper goods from England are being allowed to be re-exported into Germany and elsewhere. The deduction appears to be, therefore, that trade between Germany and Holland must have practically ceased. In 1912 the exports from Germany into Holland, it is interesting to note, amounted to £180,500. Between them, England and America, as far as trade conditions will allow, are supplying almost the entire overseas demands of Holland, as well as Denmark and other European markets which were very largely dominated in the past by German influence.

It is generally well known among wire manufacturers in this country, and in America, that the productive capacity of the German firms, all of which are working under the greatest difficulties, is being largely anticipated by Government requirements, and the small surplus left over is eagerly absorbed by local requirements. The exports of copper goods from Germany during the past month or so must have been exceedingly small, even allowing for the labour difficulties in that country. In 1912 Germany exported into this country alone copper goods to the value of £317,800. Here, at least, we know of one market which can with confidence be said to be entirely free, for the present, at any rate, of German influence.

THE CASE FOR THE ELECTRIFICATION OF CANE SUGAR MILLS AND REFINERIES.

By ERNEST P. HOLLIS, A.M.I.E.E., A.Am.I.E.E.,
M. Assoc. Mining Elec. Eng.

Sugar is manufactured from three main sources:—(*a*) from sugar cane; (*b*) from beet; (*c*) from starch. The first, which was the earliest process, has now been strongly challenged in recent years by the second, and competition between the two has had the inevitable result not only of bringing about a reduction in prices but also of compelling the rival manufacturers to install the most modern plant in order to make their competition effective. With regard to these three sources, it may be remarked that sugar produced from starch is the impurest and the cheapest. It is largely used for sweet-making and for adulterating the better classes of cane and beet sugar.

Recent events have had the effect of considerably improving the situation of the cane sugar manufacturer, with the result that one hears from the various sugar manufacturing centres that increasing interest is being taken in proposals for improving the sugar-making plant, in consequence of which electrification looms largely in the mind of the manufacturer. At the present moment two of the largest beet sugar producing areas in the world are in the grip of war—Germany and Northern France. Sugar is not now exported from Germany overseas, and, in addition, many of the sugar refineries in the North of France have been completely destroyed. In fact, it is known that the German armies have paid special attention to the destruction of these factories in order to remove competition with their own. Further, when the actual fighting is transferred to Germany, the German beet sugar refineries are bound to suffer severely. In consequence, the cane sugar manufacturer looks forward to the near future with considerable confidence, and it is known that capital is to be extensively employed in the improvement of the cane sugar manufacturing plants in various parts of the world.

The present remarks relate solely to the manufacture of cane sugar, and a brief conspectus of the process will now be given.

Manufacture of Cane Sugar.—Sugar cane is a grass attaining a height of as much as 15 ft. It is cut by natives and loaded into carts for conveyance to the factory. On arrival there it is handled by endless conveyors and delivered to large crushing mills, in which it passes first through a crusher proper and then through several sets of rolls. There may be as many as six sets of rolls, each unit composed of three rolls arranged with their centres of rotation forming a triangle. At each set a certain proportion of the juice is extracted. After emerging from the crushers the cane may be passed along to a second crusher for further treatment, or it may be directly handed over to the furnaces for burning. In any event, the furnace is its ultimate destination.

The juice which has been extracted from the cane is caught in the mill-bed and drains into a collecting tank for straining, after which it is pumped up to defecators, mentioned later. The detached portions of the cane collected in the strainers are returned to the mills continuously. The next step is the neutralisation of the acid juice in alkalisers by adding milk of lime. The raw juice has a tendency quickly to ferment, so that on its way from the alkalisers it needs to be treated in order to stay the fermenting processes. A defecator in the simplest form is merely a copper boiler surrounded by a cast-iron steam jacket. Steam is admitted to the jacket and the juice is permitted to simmer. As a result of chemical action with the lime a precipitate forms, and the lighter impurities rise to the top in the form of a scum, while the heavier ones fall to the bottom. The clarified juice is drawn off, leaving the scum and dregs. These are not immediately rejected, but are boiled, filter-pressed, steamed and again washed to extract further remaining juice. The residue from the presses is an excellent fertiliser and is sold for this purpose.

After leaving the defecator the drawn-off juice is then sharply boiled in an "eliminator" and the scum removed. It is then allowed to settle in order to permit the dregs to separate out, or, in the alternative, forced through a filter.

At this stage the liquid is clear and limpid, and the next process consists of boiling in evaporators for the purpose of crystallising out the sugar. To this end an economical multiple arrangement of pans is frequently adopted. The first pan is heated by low pressure steam, and the vapours emanating are passed to a second pan, which is thereby heated up; the vapours from the second pan heat up a third pan, which works under a vacuum. The liquid is passed first from one pan to another, the process in the last being conducted to the point of crystallisation. Sometimes a quintuple evaporator is installed. Here the crystallised sugar is induced to form, in the first place by causing a drop in temperature of the saturated solution. This may be accomplished by shutting off the steam supply or adding cold juice. The crystals formed are in the first place quite small, and need to be built up by introducing fresh syrup. The art in this process is to avoid the formation of small crystals, and when the process is carried as far as possible and the contents of the pan discharged, the mass consists of sugar crystals and sugar solution. If allowed to cool at rest the small crystals are also formed, and therefore the mass is thrown into agitators until it is finally taken to the centrifugal.

By the aid of these centrifugal machines running at about 1,000 R.P.M. the crystals are separated from the molasses. The molasses escapes through holes in the containing vessel or basket, leaving a brown crystal known as "first sugar." To recover the considerable sugar contents the molasses is subjected to a long stirring, and is again boiled down and passed through the centrifugals. "Second sugar" is thus obtained which has to be specially treated to convert it into white sugar. By now the molasses is usually so impure as to be incapable of further crystallisation. Often it is sold as a by-product or, alternatively, it may be chemically treated and freed from the potassium salts it contains, finally being whirled in centrifugals. The residue is then sold as a fertiliser or stock food. The wet sugar from the centrifugals is passed on to granulators, where it is dried by a current of hot air and a revolving steam drum; after this it is cooled by a current of cold air in a revolving tube. It then passes to the automatic sacking machine for dispatch to the refineries, which may or may not be operated in conjunction with the mill.

Sugar Refineries.—Raw sugar emanating from the mill previously described contains so many impurities that it becomes imperative to subject it to a further refinement. The sugar usually leaves the mills sewn up in sacks and in the form of yellow or brown crystals. The refining processes take several forms. In some refineries the colouring matter and other impurities are removed by dissolving the sugar in distilled water. After being boiled down, as in the case of the first molasses, the solution is bleached by sulphur dioxide and filtered through charcoal. The syrup is then crystallised down in vacuum pans heated by low pressure steam in a similar fashion to the crystallising processes described in connection with the sugar mills.

Cube sugar is made by boiling the solution down by steam and leaving it to crystallise out in moulds. The slabs thus formed are cut up by circular saws.

This concludes the description of the technical processes of making sugar, and attention may now be directed to the question of supplying the power for driving the mills.

Present Steam Power Plants in Sugar Mills.—Cane sugar-mills not electrified derive all their power from steam. The cane refuse or "bagasse," as it is technically called, is burned under low pressure boilers (about 80-lb. per square inch gauge pressure), and the steam is distributed through the works by a complex network of steam mains working at a great inefficiency. In many cases the bagasse is burned under the boilers in the state it leaves the crushing mills, and is not dried, as discussed later. The live steam is supplied to the engines in each of the buildings for driving line shafts, as well as to special engines for operating the crushing mills, while the exhaust steam is utilised for the heating processes. The majority of sugar mills are dependent upon a distant water supply, which has to be pumped by special steam plant often situated many miles away from the main buildings. This water is required for irrigation, for the refining processes, as well as for the boiler feed. Owing to the inefficiency of the general arrangement, the bagasse itself is inadequate in amount for supplying the steam, and resort has to be made to oil and coal as supplementary fuels, and these are generally costly in sugar-cane districts. The fuel thus burnt under the boilers generates steam which drives the main auxiliary mill engines, the exhaust steam passing to the steam heating system. Engines of some 200 to 250 H.P. each drive the different rolls and crushers, while other engines drive the smaller plant such as pumps, crystallisers, centrifugals and so forth.

One point deserves particular attention. From the exhaust steam both mechanical power for driving and energy for heating is required. These two requirements bear no fixed relation to one another. At one time of the day more heat may be required than at another time, while again more power may be necessary at one particular moment than at another. But both power and heat are derived from the same steam. If the momentary demand for exhaust steam be small, the exhaust steam must be wasted; it is impracticable to store it. A scheme which permits as much power and as much heat to be drawn as may be momentarily required affords improvements in economy that mean important savings to the manufacturer. Electrification, as will be seen later, effects this economy.

Before proceeding further, it may be advantageous to inquire more closely into the value of fuel economy to the sugar manufacturer. It has been mentioned that purchasing fuel is a costly item to the manufacturer, and an example will be quoted bringing home the importance of fuel economy:—Taking as an example a large mill turning out 35,000 tons of sugar a season, since for every ton of sugar produced there will be about five tons of bagasse, the mill would have available for fuel 185,000 tons of bagasse. Even in the best appointed steam-driven mills, the bagasse only serves for about 85 per cent. of the fuel, so that the equivalent of 32,000 tons of bagasse has to be purchased. Five tons of bagasse are equivalent in heating value to about one ton of coal, so that 6,400 tons of coal must necessarily be purchased during the season. Sugar-cane fields are, in the majority of cases, very inconveniently situated with regard to the coal fields, and Cuban sugar millers, for instance, pay 30s. a ton for their coal in normal times. In the case quoted, nearly £10,000 is the cost of the extra fuel needed.

The question then arises, can electrification with its inevitable economy either partly or wholly eliminate the necessity for buying extra fuel? Experience shows that, without a shadow of doubt, it can eliminate the whole, and can, indeed, carry matters further.

At first sight it might appear a work of supererogation on the part of the electrical engineer to attempt to pursue fuel economy beyond the elimination of purchased coal. But it is not so, and this introduces the point that in sugar manufacture, as in every other industry, electrification means increased production. Production increases of varying degrees of importance are experienced in electrically driven sugar factories in the various departments through the change from steam to electrical drive; but, at one step, in sugar manufacture the increase is of marked dimensions. It occurs in the process known as maceration.

After the cane has been crushed and rolled a certain percentage of sugar remains in the bagasse. It is easy enough to extract it by washing the bagasse in warm water, but then the sugar can only be rendered available by evaporating the water, and this means fuel, coal or oil. At a matter of fact, steam-driven mills find it uneconomical to resort to maceration to any extent, but they know the sugar is there to be extracted, so that if electrification can effect such economies in the mill that exhaust steam is available for evaporating after maceration it can be very usefully employed. Further mention is made of this point later.

(*To be concluded.*)

TRADE STATISTICS OF BRAZIL.

The following figures show the imports into Brazil of electrical and similar goods during the year 1914. The figures for 1913 have been added for purposes of comparison, and notes of increases or decreases, as the case may be, are given:—

	1913. Dollars.	1914. Dollars.	Inc. or dec. Dollars.
Electric cable.—			
From United States ...	162,000	80,000	– 82,000
,, Great Britain ...	408,000	127,000	– 281,000
,, Germany	167,000	77,000	– 90,000
,, Other countries ...	86,000	51,000	– 35,000
Total	823,000	335,000	– 488,000
Insulators.—			
From United States ...	64,000	32,000	– 32,000
,, Germany	104,000	41,000	– 63,000
,, Other countries ...	30,000	17,000	– 13,000
Total	198,000	90,000	– 108,000
Electric machinery.—			
From United States ...	1,596,000	686,000	– 910,000
,, Germany	789,000	272,000	– 517,000
,, Great Britain ...	674,000	421,000	– 253,000
,, France	127,000	123,000	– 4,000
,, Other countries ...	161,000	118,000	– 43,000
Total	3,347,000	1,620,000	– 1,727,000
Electric motors.—			
From United States ...	215,000	99,000	– 116,000
,, Germany	169,000	55,000	– 114,000
,, Great Britain ...	94,000	40,000	– 54,000
,, Switzerland ...	38,000	22,000	– 16,000
,, Other countries ...	81,000	7,000	– 74,000
Total	597,000	223,000	– 374,000
Stationary engines.—			
From United States ...	10,000	21,000	+ 11,000
,, Great Britain ...	75,000	39,000	– 36,000
,, Germany	227,000	37,000	– 190,000
,, Other countries ...	12,000	46,000	+ 34,000
Total	324,000	143,000	– 181,000
Industrial machinery.—			
From United States ...	269,000	158,000	– 111,000
,, Great Britain ...	939,000	398,000	– 541,000
,, Germany	1,252,000	309,000	– 943,000
,, France	940,000	206,000	– 734,000
,, Other countries ...	225,000	94,000	– 131,000
Total	3,625,000	1,165,000	– 2,460,000
Rails, fish plates, and railway accessories.—			
From United States ...	1,958,000	922,000	– 1,036,000
,, Belgium	2,786,000	425,000	– 2,361,000
,, France	3,673,000	365,000	– 3,308,000
,, Germany	2,019,000	215,000	– 1,804,000
,, Great Britain ...	718,000	166,000	– 552,000
,, Other countries ...	77,000	123,000	+ 46,000
Total	11,231,000	2,216,000	– 9,015,000

	Dollars. 1913.	Dollars. 1914.		Dollars. Inc. or dec.
Lighting apparatus.—				
From United States	49,000	29,000	–	20,000
,, Germany	238,000	74,000	–	164,000
,, Great Britain	105,000	39,000	–	66,000
,, Other countries	102,000	17,000	–	85,000
Total	494,000	159,000	–	335,000
Other machinery (except agricultural).—				
From United States	2,187,000	909,000	–	1,278,000
,, Great Britain	2,185,000	1,269,000	–	916,000
,, Germany	2,532,000	782,000	–	1,750,000
,, France	969,000	488,000	–	481,000
,, Belgium	102,000	44,000	–	58,000
,, Italy	199,000	61,000	–	138,000
,, Switzerland	110,000	66,000	–	44,000
,, Holland	39,000	533,000	+	494,000
,, Other countries	265,000	107,000	–	158,000
Total	8,588,000	4,259,000	–	4,329,000
Telegraph and telephone posts, and bridge and fence material.—				
From United States	253,000	62,000	–	191,000
,, Belgium	587,000	92,000	—	495,000
,, Great Britain	431,000	337,000	–	94,000
,, Germany	445,000	197,000	–	248,000
,, France	92,000	39,000	–	53,000
,, Other countries	57,000	17,000	–	40,000
Total	1,865,000	744,000	–	1,121,000
Copper wire.—				
From United States	34,000	12,000	–	22,000
,, Germany	84,000	18,000	–	66,000
,, Great Britain	25,000	13,000	–	12,000
,, Other countries	23,000	10,000	–	13,000
Total	166,000	53,000	–	113,000
Iron and steel wire.—				
From United States	145,000	70,000	–	75,000
,, Germany	1,113,000	390,000	–	723,000
,, Belgium	72,000	16,000	–	56,000
,, Great Britain	109,000	65,000	–	44,000
,, Other countries	105,000	68,000	–	37,000
Total	1,544,000	609,000	–	935,000
Rubber manufactures.—				
From United States	80,000	25,000	–	55,000
,, Germany	188,000	58,000	–	130,000
,, Great Britain	237,000	79,000	–	158,000
,, France	82,000	47,000	–	35,000
,, Other countries	63,000	47,000	–	16,000
Total	650,000	256,000	–	394,000
Hydraulic pumps and accessories.—				
From United States	127,000	51,000	–	76,000
,, Great Britain	130,000	63,000	–	67,000
,, Germany	97,000	56,000	–	41,000
,, Other countries	96,000	46,000	–	50,000
Total	450,000	216,000	–	234,000

	Dollars. 1913.	Dollars. 1914.		Dollars. Inc. or dec.
Scientific instruments.—				
From United States	118,000	61,000	–	57,000
,, Germany	174,000	101,000	–	73,000
,, France	84,000	50,000	–	34,000
,, Great Britain	77,000	27,000	–	50,000
,, Other countries	31,000	13,000	–	18,000
Total	484,000	252,000	–	232,000

GEAR-DRIVEN DIRECT-CURRENT TURBO-GENERATOR SET.

Recent developments in the science of gear cutting have attracted attention, chiefly on account of the introduction of high-speed gearing in the driving of ships, both mercantile and naval, whereby the lightness and economy of a high-speed turbine can be combined with the efficiency of a low-speed propeller.

There is, however, another field which offers great possibilities for the use of gears in combination with turbines, viz., the driving of direct-current generators. Certain mechanical and electrical difficulties, which will be touched on later, appear to be inseparable from the design of D.C. machines of considerable output and running at a speed approaching that desirable for an efficient steam turbine, with the consequence that up to the present D.C. generators have either been driven by reciprocating engines, or, if turbine driven, have been subject to undeniable limitations in speed or output, or in both.

The D.C. generator is essentially a moderate-speed machine, and does not lend itself readily to construction for the high speeds of steam turbines. At the low speeds of gas and oil engines, both direct and alternating-current generators become large and costly for their output, and a good efficiency can only be obtained by further adding to the cost. At the moderate speeds of so-called high-speed steam engines and motor-generator sets conditions improve, and sound, high-efficiency machines can be designed without difficulty.

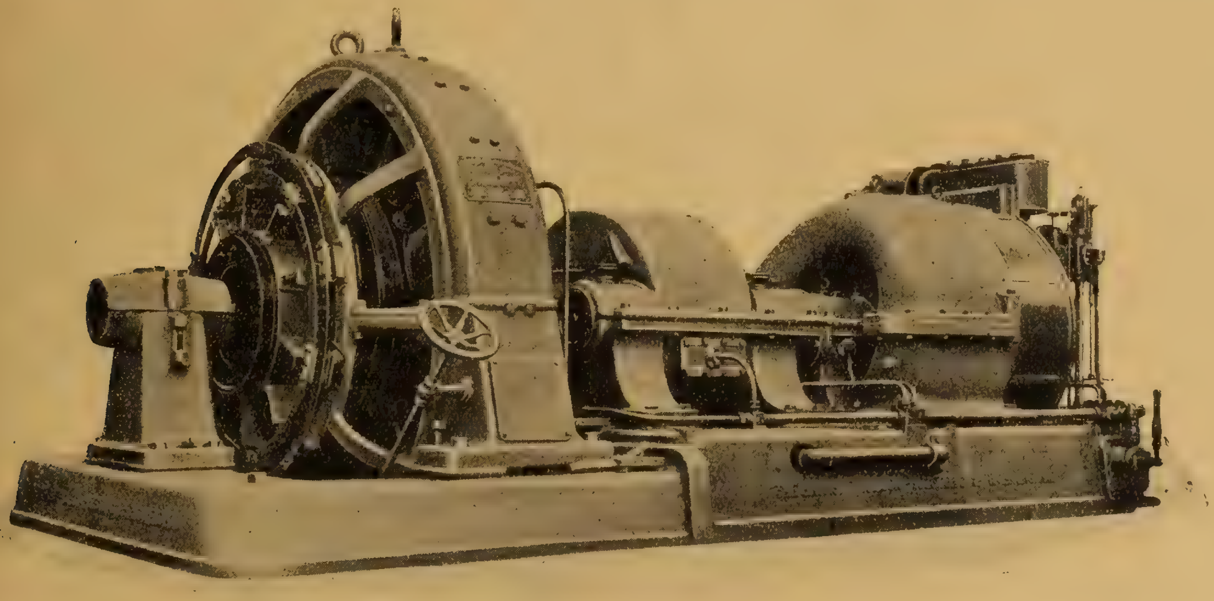

Fig. 1.—B.T.H. Geared Turbo-generator.

In building direct-coupled D.C. turbo-generators, mechanical difficulties arise in the construction of the commutator, in securing the armature windings, and in arranging that the running speed shall not be near the critical speed. Electrical difficulties arise on account of the high reactance voltage of the coils undergoing commutation and high voltage per commutator segment. To ensure satisfactory operation a field structure with compensating windings is usually employed, and the consequent extra excitation losses, together with the rapid increase of core loss, friction, and windage at high speeds, reduce the efficiency considerably in spite of reduced armature copper and shunt field losses. The compensated field construction also considerably increases the cost and the time required to build a machine.

As typical commercial efficiencies for the three types of generators, we may take 91 per cent. for a 250-KW. 440-volt low-speed machine, 93.5 per cent. for a moderate-speed machine of the same rating, and 89 per cent. for a generator running at steam turbine speed. The reduction gear would have an efficiency of about 98 per cent., which gives 91.6 per cent. as the combined efficiency of the generator and gear.

Geared turbo-generator sets can now be built for practically any output to compete in cost, efficiency, reliability, and floor space with either turbo-alternator rotary equipments or reciprocating engine sets.

As indicated above, the gear-driven generator is built on normal lines, and therefore calls for little detailed description. Being designed to run at a fairly high speed, so as to keep the cost of gear and generator at a minimum, all details of design require careful attention.

The practice followed by the British Thomson-Houston Co. to produce a sound, highly efficient, moderate-speed generator may be outlined as follows:—

Thin laminations of special steel are used for armature core and pole faces to reduce the core loss, as the frequency of the armature currents before commutation will be 40 to 50 cycles per second. Armature clamping bolts which pass through the core are insulated to reduce eddy currents. The air gap is made longer than would be the case with a low-speed machine, so that the distortion of the main flux caused by armature reaction is reduced.

The commutating poles are so designed that over the whole working range from no load to the guaranteed overload the commutating flux is practically proportional to the load on the machine. The commutating-pole air gap is adjusted on test so that the reactance volts of the coils undergoing commutation are exactly neutralised. Diverters across the commutating-pole windings are not used, as, although they form a convenient method of test adjustment, the amount of current diverted is apt to vary on account of changes of resistances due to temperature and variation of the resistances of connections, which in the case of low-resistance windings may form an appreciable item. Also, on varying loads, a plain diverter will not take a uniform share of the current, as its inductance is very much less than that of the winding. Inductive diverters are difficult to adjust and are not satisfactory.

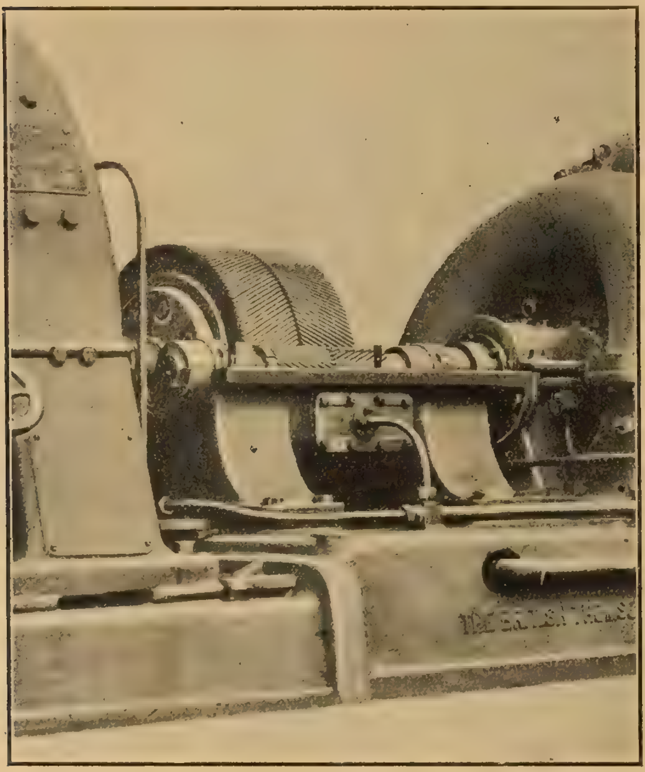

Fig. 2.—View of the Gearing, B.T.H. Turbo-generator.

Even when adjusted to operate perfectly up to heavy overloads, commutating machines are always liable to flash over on heavy short circuits. To minimise the risk of flashing over and to reduce the damage caused by a flash, the clearance between adjacent brush brackets should be kept a maximum and the space between the commutator and the bearing should be kept free from bus rings or earthed metal parts, as the flash always tends to spread outwards from the machine. Reference to the accompanying illustrations will show that the B.T.H. design of brush gear fulfils these requirements.

A substantial brush yoke supported from the magnet frame, brush springs designed to prevent brush chatter, and a carefully balanced armature, eliminate the mechanical causes of unsatisfactory commutation. Graphite brushes reduce the commutator loss to a minimum and rapidly produce a hard polished skin on the commutator, the wear of which is very slight.

Equaliser rings fixed in an accessible position at the back of the armature prevent unbalanced magnetic pulls and equalise the distribution of the load between the several paths through the armature, which is, of course, parallel wound. The choice of a suitable speed and number of poles limits the volts per bar to a reasonable figure. The armature windings are secured against centrifugal force with an ample factor of safety by means of fibre wedges in the slot portion and steel wire binding bands on the ends.

A set recently installed by Mr. Cameron Gibson, the borough electrical engineer, in the power station of the Nuneaton Corporation is an interesting example of a gear-driven set. It consists of a B.T.H. shunt-wound generator having a normal output of 1,500 amps. at from 470 to 500 volts, driven through double-helical gearing by a B.T.H. Curtis turbine of 750 kw. normal capacity. The set has an overload capacity of 25 per cent. for two hours and 50 per cent. for five minutes. The complete set has been constructed by the B.T.H. Co., and the turbine is of their standard three-stage design, as used for driving alternators, and runs at 3,250 r.p.m., the gearing reducing the speed to 600 r.p.m. for the generator. The turbine drives the pinion shaft through a double claw coupling, which allows the pinions to take their correct axial position without any end thrust being transmitted to the turbine shaft. The armature spider is bolted direct to a large flanged coupling on the low-speed shaft, the bearings of which, consequently, carry a portion of the armature weight.

The gears and bearings are completely enclosed, and have a copious supply of oil from the main oil-pressure system of the turbine, which also operates the servo-motor of the governor gear. A return pipe from the bottom of the gear-case leads the oil back to the main oil tank, whence the oil pump on the turbine delivers it through an oil cooler back to the supply pipes.

This set was put on commercial load in January of this year, after exhaustive tests in the shops of the B.T.H. Co. had proved that the guarantees were fully met, and the completely satisfactory manner in which the set has behaved since its installation has given all concerned perfect confidence in the future of this combination.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electric Heating Resistors.

In the *Electrical World* an abstract of a German article is given in which the author describes heating resistors produced by the Schoop "spray process." The metal which is to be sprayed passes in the form of a ribbon through a pistol in which it is melted and shot out in spray form on to the surface which is to receive the deposit. One method of application is to cover a plate of clay, porcelain, slate, &c., with a thin film of metal by the spray process and then saw cross lines out of the metal film, as shown in fig. 1. These lines start alternately from one side and from the other side, but do not pass all the way over to the other side. In this way a continuous zigzag ribbon is obtained, as shown in the illustration. The connections are made at the points + and −. Another method of application is to produce this resistor ribbon not on plates but on hollow cylinders, as shown in fig. 2, where *a* is the ribbon and *b* represents the underlying clay tube. This resistor is particularly applicable for heating rooms. Through holes in the bottom, cold air enters into the interior of the cylinder; it is heated inside the cylinder and rises upward so that fresh cold air flows in at the bottom. A third method of application is to produce metallic resistor ribbons in artistic forms directly on the tiles of bathrooms, kitchens and other rooms. If at any point such a ribbon resistor is not thick or broad enough, the deficiency can be easily remedied by the spray process.

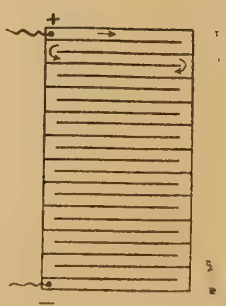

Fig. 1.—Plate Resistor.

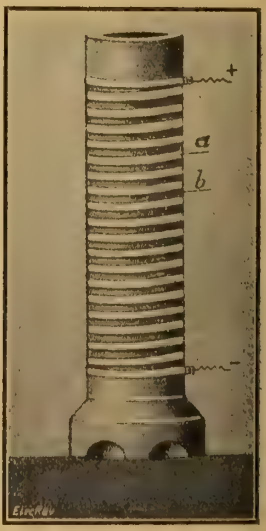

Fig. 2.—Spiral Resistor.

New G.E.C. Mining Telephone.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., has recently put on the market a flame-proof and watertight telephone known as the G.E.C. magneto mining telephone K 8098 (1915 type). The case is of cast-iron, the joint between the case and the lid being made by machined flanges 1 in. wide. When the lid is bolted to the case, the joint is both watertight and flame-proof—*i.e.*, any escaping hot gases are so thoroughly cooled in passing between the flanges that they cannot possibly ignite an explosive mixture outside the case, even in the unlikely event of an internal explosion. The entire equipment is of high standard, and is manufactured by the Peel-Conner Telephone Works, Ltd., of Salford. The internal unoccupied space is kept down to a minimum so as to limit the amount of explosive gas which might accumulate.

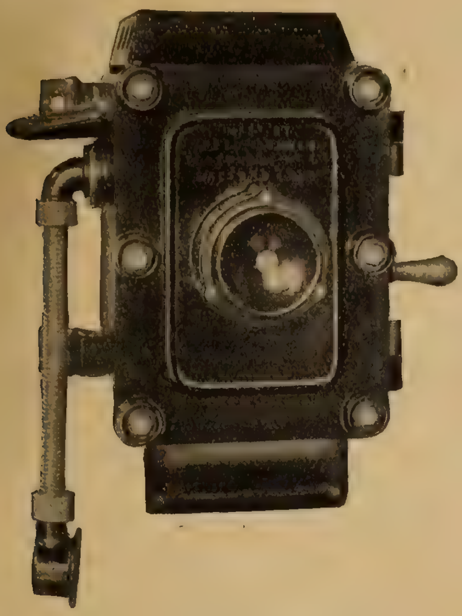

Fig. 3.—New G.E.C. Magneto Mining Telephone K 8098 (1915).

The telephone equipment comprises:—A four magnet tropical type generator, with the armature wound to a resistance of 300 ohms, and fitted with a very strong handle working through a flame-proof and watertight gland; a polarised bell movement fitted with two 3-in. bell gongs, protected by an iron cover; a long-distance speaking, solid-back, transmitter fitted in an iron chamber on the front of the lid, the diaphragm of which is protected by brass gauze; an induction coil; a double-pole "Bell" receiver fitted inside the instrument, the diaphragm end being fitted with a cam arranged so as to revolve when the listening tube (which is placed on the left-hand side of the instrument) is lifted to the ear; the cam is fixed on to the receiver and revolves with it, thereby pressing together a bank of springs which control the primary and secondary circuits; the gland through which the tube passes is flame-proof and watertight; also two G.E.C. dry cells fitted on the inside of the lid.

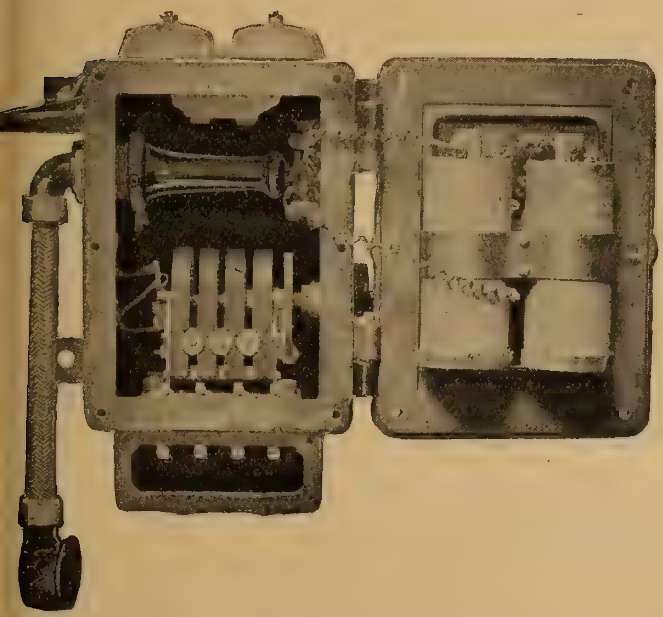

Fig. 4.—G.E.C. Mining Telephone, showing Internal Arrangements.

Attached to the bottom of the cast-iron case is a chamber which contains line terminals, and lugs are provided for fixing.

All mining requirements are met in the best possible manner and all Home Office regulations are complied with.

"Ediswan" Circuit-Breakers.

The Edison & Swan United Electric Light Co., Ltd., of Ponder's End, Middlesex, have for some time past specialised in circuit-breakers, and a recent pamphlet (No. A 3112) gives particulars of types "W" and "E." The former, illustrated in fig. 5, is built for currents of 150 to 6,000 amperes, the mechanism consisting of a substantial toggle movement, with loose handle so that the breaker is free to operate electrically even though the handle is held. The breaker is designed to clear all ordinary arcs without assistance from the magnetic blow-out; a wide, quick break is arranged and the magnetic flux for the blow-out is excited by the flow of current to the auxiliary contacts, no winding of any sort being used.

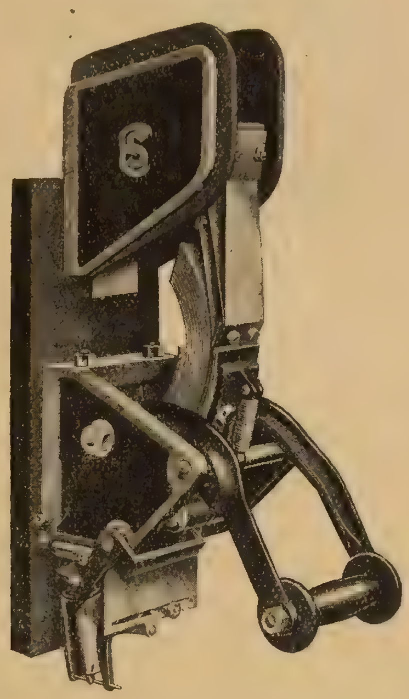

Fig. 5.—"W" Type "Ediswan" Circuit-Breaker.

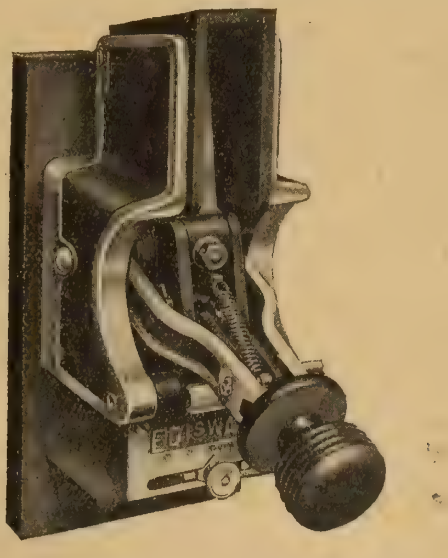

Fig. 6.—"E" Type "Ediswan" Circuit-Breaker.

The contacts have a wiping action, and the catch is external, and can be adjusted at any time.

The breakers are fitted with time limit, reverse, overload and no-voltage releases as required, and built in single and double-pole patterns.

The "E" type circuit-breaker, figs. 6 and 7, is made for currents up to 350 amperes at 600 volts and in both open and enclosed patterns, an explosion-proof case being provided for colliery work. Constructionally it follows generally the previous type, but when enclosed an external handle is fitted.

Time limit, reverse, overload and no-voltage releases can be fitted as desired; the principle of the reverse release used in both the "W" and "E" types of breaker is based on a purely polarity effect, which gets over the difficulties often associated with the differential winding system in the event of quick and heavy current reversals.

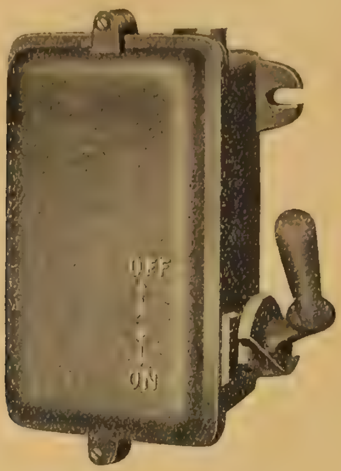

Fig. 7.—Enclosed "E" Type "Ediswan" Circuit-Breaker.

LEGAL.

Hamilton *v.* Marconi's Wireless Telegraph Co., Ltd.

(*Concluded from page* 138.)

Mr. Pollock, in summing up the defendants' case, said that the dismissal took place on January 13th, 1913, and the contract of May, 1910, between the plaintiff and the defendant company, ran for the definite period of three years, and so would have continued until May, 1913. The agreement was, according to the verdict of the jury, improperly broken by the defendants in January, 1913, and they were asked by the Judge to give damages in respect of the pecuniary profit Mr. W. Hamilton would have received if he had not been improperly dismissed, and they gave him, in respect of the first period, a sum of £640. There was evidence before the jury, and it was admitted that in respect of that period there was certainly a sum of £140 payable to him, but by reason of an order that had been made, and an agreement between Sir Edward Carson and Mr. Duke, it was contemplated that there would have to be a further inquiry as to damages. Therefore, it was known to the jury and all persons at the trial that at the time £140 was put forward it might not be the full sum which would be payable in respect of the broken period. It was fair to say that no jury could have at that time believed or supposed that there was finality in the £140. They must have taken that £140 coupled with the position which they knew existed—viz., that an account had to be taken. Mr. Justice Avory at the trial directed the jury that the plaintiff was entitled to damages for loss sustained by breach of the agreement and for pecuniary benefits which he might have derived from the agreement; and, further, that he was entitled to such sums as they thought he might have earned up to May, 1913. The jury estimated that sum at an additional £300, and he submitted that that closed the matter in respect of the period from January to May. Plaintiff could not be given any further sum unless it could be shown that the business done during that period overtopped that amount. The inquiry had, on the contrary, shown that he was not really entitled to the £300. The award represented a concluded matter, and, in addition to that, he had got the sum of £1,700 in respect of the value of the chance that the agreement should have continued for another three years down to 1916. He asked the Court to find that over the two periods the plaintiff had been compensated, and that for the further three years he had also been compensated by the sum awarded by the jury, and if the plaintiff asked for commission on sales effected between the periods of January and May, 1913, he was asking to be paid his commission twice over. The agreement was determined by a period of three years, and the plaintiff was to be paid 5 per cent. on the gross value of the sales in return for services rendered and his giving exclusive attention to the business of the company, therefore the agreement could not be for the period of his natural life. He was only entitled to be paid for the period during which the agreement was running. The claim in relation to the high-power stations, or the Imperial wireless exchange, said counsel, rather startled him, because when he looked at the agreement itself, it appeared he was to be paid on the sales effected by the company, as and when such payments became due and payable, and when the amounts were received by the company. The fact was that no money had been received in respect of those stations. The plaintiff then said he was entitled to be paid, because if the contract had not been abandoned there would have been a prospect of his being paid. It was impossible for an agent to charge his principals with a breach of agreement if they found it necessary to withdraw in order to get better terms. As to the claim in relation to the sale of the Amalgamated Wireless Australasian Co., Ltd., he said that it was a claim prompted by an over-sanguine spirit, which did not really know what the true facts were. There was a rivalry existing between the Berlin Co. and the Marconi Co. and the German Co., worked in Australia through the Australian Wireless Co. The rivalry became acute, and it was determined to try to put an end to it. The agreement of March 6th, 1913, was accordingly entered into—an agreement which contemplated taking over the German Co. and the Australian Co. by a new company to be formed. The intention was to take over the business as from October, 1912, which was after the agreement of the plaintiff had lapsed. That sale to the Amalgamated Co. was not a sale which was contemplated by plaintiff's agreement. As to the shipping contracts with the British India and Shaw, Savill lines, he contended that the plaintiff had no claim which could be substantiated. The evidence showed that those companies were fully alive to the importance of having the Marconi wireless, and after the evidence it was impossible to say that the contracts with those companies were secured by the plaintiff.

Mr. Hewart, K.C., in summing up the case for the plaintiff, repudiated the suggestion that the plaintiff was seeking to recover damages to which he was not entitled. The plaintiff was wrongfully dismissed from his position as agent, and in respect of that dismissal he claimed damages, and in addition certain sums to which he believed himself entitled under his agreement as money earned. But, unfortunately, the books and documents were in the possession of his employers. He had no access to them, and when he came to close quarters he was bound to a certain extent to go upon such information as he had, which in many respects was necessarily imperfect. The position taken up by the defendant company was that they did not owe plaintiff a single penny, but when they delivered their defence, they admitted owing him £117. Then, towards the end of a long trial, the defendants admitted that they owed Mr. Hamilton a further sum of £140, bringing the total up to £257. Again, at a late stage of the proceedings, the defendants admitted that they owed another sum of £432 odd; so that up to that point—the last stage of the proceedings—it was admitted that the company owed Mr. Hamilton £689, and, in the course of the present inquiry, it appeared that they owed him a further sum of £30 in respect of a steamship. Under these circumstances, it did not come with a very good grace for the defendants to speak of plaintiff approaching the question of damages in too sanguine a mood, or that he was asking for damages which existed only in his imagination. As to the claim for commission on the three Australian destroyers under the agreement of May 19th, 1910, if the defendants were liable it was not denied that the amount of their liability would be £103 15s. But it was said on behalf of the defendants that they were not liable at all, inasmuch as the contract out of which the sale arose was antecedent to May 2nd, 1910, the date from which the plaintiff's agreement ran. He submitted that the position which the plaintiff had taken up was a right one as the terms of his agreement was "on sales effected," and he submitted that the true date of the sale was that at which the agreement was reduced to writing, which was subsequent to the date of the plaintiff's agreement with the company. As to the sale of the four field sets to the Australian Government: What now appeared was that plaintiff had never received any commission on those four field sets, and that the order was given for them on January 25th, 1913. It was also common ground that if the defendants were liable in that case they were liable to pay the sum of £120, and the contention he had to meet was the contention as to the broken period between the time he was dismissed and the time his agreement for three years was to come to an end. There had been an order made in the action in March, 1914, reserving all questions of account, and it was after, and subject to, that order that the trial before the judge and jury took place. What happened was that towards the end of that inquiry a document which they now knew was prepared by Mr. Cappalare was to some extent made use of and was handed to the judge, and it appeared that for the period from January 13th to May 2nd the defendants admitted that payments had become due to the plaintiff to the amount of £140. They knew now from Mr. Cappalare that if the document had been explained by some one who understood upon what basis it had been drawn up, it would have been impossible to state as a fact that the sum of £140 and no more was what was due to the plaintiff in respect of the broken period. That figure being before the jury, it was no doubt taken into account by them. The question of what was really the total due to the plaintiff was never before the jury. On the question of royalties, counsel said, the facts were not in dispute. What happened was that certain battleships of the Australian Navy were constructed under the supervision of the British Admiralty with Marconi's wireless telegraph installed by the Admiralty. He submitted that it was actually a sale of the right to use the apparatus, if not a sale of the apparatus itself. Those ships were installed before January 9th, 1913, and he submitted that the royalties were part of the price. They were really deferred instalments of the purchase price. The plaintiff undoubtedly did much work in connection with the Australian business, and that high power stations were part of the work was not disputed. The evidence was that in 1910 he went to South Africa and Australia, and put the question of the wireless chain before the authorities, and had otherwise taken an important part in connection with it. When the contract was made between the Marconi Co. and the British Government, Pretoria and Singapore were included. Those stations were to cost £60,000 each, and were expected to yield royalties of from £4,000 to £30,000 a year. Th plaintiff's submission was that he, acting as agent on behalf of his principals, had done his part fully in the matter, and had succeeded. The contract was made, and in February, 1913 it was repudiated by the defendants themselves of their own choice, and the point was that when the plaintiff had performed his part, and the contract went off because of repudiation by his principals, the claim against the principals was a good one. He submitted that under those circumstances the plaintiff was entitled to the commission which he would have received had the contract been carried out.

The Referee: Had he gone so far that they were certain to get the money? They had a contract which was subject to the approval of the House of Commons, and the contract was not completed until it had been approved?

Mr. Hewart said it would be no part of the plaintiff's duty to secure the approval of the House of Commons. The defendants had wrongfully repudiated the contract, and therefore the plaintiff was in the same position as if they had received the money. Referring to the claim relating to the British India, Burma and Malay States stations, counsel said the contract was that in consideration of plaintiff devoting his whole services to the company, he would receive commission on all sales effected within the territory mentioned. The "all," he contended, covered any limitation as to time.

The Referee: The agreement says that he shall give the whole of his services exclusively, and that points to the fact that it was intended to limit it to such time as he remained giving his services, and that was for a period of three or six years.

Mr. Hewart said that what was contemplated at the time the agreement was made was that the Marconi Co. was to absorb the Pacific Radio Telegraph Co., Ltd., when the plaintiff would be offered the post of managing director. What was intended was that Mr. Hamilton should be their permanent representative, and that he should always receive his commission. In arriving at a decision, the Referee would have to consider the agreement as a whole.

Mr. Verey on Saturday, July 31st, delivered judgment. He said that by the order of Mr. Justice Avory, in the King's Bench Division, he had been called upon to take an account in the case of Mr. Hamilton's claim against the Marconi's Wireless Telegraph Co. The plaintiff claimed that in breach of an agreement of May, 1910, the defendants had not paid him 5 per cent. commission on sales within his territory, and that they had not paid him, as agreed, £10 per ship in cases where contracts for the installation of wireless had been obtained through his instrumentality. He also claimed 5 per cent. on all sales in South Africa. The defendants had paid into Court with an admission of liability £482 and £600, but they denied liability in respect of all claims except those admitted. The commission claimed in respect of the three Australian destroyers involved the construction of the agreement of May, 1910, between the company and the plaintiff, which said that the plaintiff should receive a commission of 5 per cent. on all sales within his territory, and the question was as to when the sales were effected. The order was given before May 11th, 1910, but the actual contract in writing was not signed until after that date. He had come to the conclusion that the sale must be regarded as having taken place at the date of the contract in writing, and he found that the sales in question were effected during the term of the plaintiff's employment, and that he was, therefore, entitled to recover commission upon them to the amount of £103 15s. As to the sale of the four field sets for the Australian Government, the order was given during what had been termed the broken period prior to May, 1913, and for the defence it had been contended that the jury had dealt with that claim in the sum of £640. After careful consideration of the arguments and the observations of the judge, he came to the conclusion that the jury had not dealt with that matter, and that he would have to take account of what was due to the plaintiff in relation to it. As the sale of the field sets was effected between January and May, 1913, the plaintiff was entitled to his commission on it. The defendants said as to the Australian battleships that that matter came within the agreement with the Admiralty, and that no royalties were paid, but he came to the conclusion that the payments to the defendants did not come within the agreement of 1903 with the Admiralty, and he found that the plaintiff was entitled to his commission to the amount of £157 10s. The claim in relation to the high-power stations was made under the agreement of July 19th, 1912, which provided for commission on all sales effected, and the plaintiff said that commission was due to him on a large sum which, he said, the defendants would have received in respect of stations at Pretoria and Singapore had they been erected. As a matter of fact, no stations had been erected, but the plaintiff contended that the defendants wrongfully repudiated the agreement and so prevented the receipt of the money upon which the plaintiff would have been entitled to commission had not the agreement been repudiated. The contract of January 16th, 1913, required to be ratified by the House of Commons, and until that was done the plaintiff was not entitled to receive the money. There was here a contract which enabled the defendants to receive the money even if there had been no default on their part. He found it had not been proved that if the defendants had not repudiated the contract the ratification by the House of Commons would have been obtained. It had not been proved that the repudiation was the cause of the ratification not being obtained, and upon the whole of the evidence he found that the plaintiff had failed to prove that he was entitled to the commission as claimed. As to the claim for damages for breach of contract, he had to consider what were the chances of the defendants obtaining the ratification and receiving any money, and what commission the plaintiff had lost. He found on consideration that the plaintiff had not suffered any damage. As to the sale to the Amalgamated Wireless Australian Co., the plaintiff's agreement provided that if the defendants should create a company to take over the business, the plaintiff should be offered the post of managing director. The arrangement, in his (the Referee's) opinion, was that there should be an amalgamation of the Australian businesses so as to avoid competition; that there should be a taking over of the old business by a new company. The actual transfer was dated November 12th, 1913, and it was provided that the profits under the new arrangement should date from October, 1912. The plaintiff contended that the date was immaterial, because it was intended that his commission on the sales should be for life; as to the claim for life, the agreement provided that the plaintiff was to be sole agent, and that his appointment should be for three years subject to determination in May, 1911, and that should business be satisfactory there might be a continuation for another three years; it was further provided that in consideration of the services he was to render to the company and in consideration of the fact that he was to devote his whole time to the benefit of the company, he should receive his commission. In his opinion, when the consideration, which was to give his services, ceased, the agreement to pay the commission ceased. On the construction of the agreement he found the plaintiff was not entitled to commission on sales effected after May 2nd, 1916, for which period the jury had given him damages. On the whole of the evidence he found, whether the date of the transfer were taken at 1912 or 1913, that the transaction was not such a sale as was contemplated by the agreement, and plaintiff was not entitled to any part of the commission which he claimed. Next, there was the question of the shipping contracts, and he decided that no commission was payable in respect of the Union Steamship Co., of New Zealand. As to the British-India and the Shaw, Savill Companies, the question was, did plaintiff secure the contract, and was he accordingly entitled to his commission on the transaction? After carefully studying the evidence in relation to that matter, he came to the conclusion that plaintiff had not proved that he secured those contracts, and he was, therefore, not entitled to commission upon them. As to the New Zealand warships, it had not been proved that the defendants received any money in respect of them, and the plaintiff was, therefore, not entitled to commission. The same observation applied to the Malay States and the Australian Navies. The claim in relation to the British India, Burma and Malay States stations depended upon whether plaintiff was entitled to commission for life, and as he was not entitled for life he was not entitled to commission in that case. On the whole, he found that the plaintiff was entitled to £482 8s. 11d. and £411 5s., which was more than covered by the amount paid into Court. The judgment of the King's Bench Court provided that the plaintiff should recover the costs of the action, and it was, therefore, not for him to deal with the question.

The Referee intimated that he would report his finding to the judge, and that in his written report he did not propose to say anything about costs.

Compensation Case.

A settlement was intimated in Dunfermline Sheriff Court, on Monday, July 26th, of a compensation action at the instance of the widow and relatives of a labourer against Messrs. C. E. Taylor and Co., electrical engineers, Crombie Ordnance Works. The labourer was killed in December last by an overhead crane falling upon him. Pursuers sued for £195, and have accepted tender of £100.

An Australian Customs Claim.

The *Melbourne Age* reports a reserved judgment, delivered on June 12th, in the High Court, respecting a claim by the Collector of Customs for Victoria. Our contemporary states the details as follows:—

Plaintiff in the original action was Ralph Sadlier Falkiner, trading as the Falkiner Electric Co., in Melbourne and elsewhere, and defendant was Percy Whitton, the collector of Customs for the State of Victoria. About November, 1913, plaintiff imported into Victoria a motor-car, with two benzine motors, each 100 to 120-h.p. capacity, and one double-dynamo chassis and ten electric motor-wagons chassis, with certain accessories. These were all manufactured in the United Kingdom. A dispute arose between plaintiff and defendant as to the rate of duty payable in respect of the goods. Defendant contended that the motor-car chassis was dutiable as a locomotive traction or portable engine, and that the wagons chassis were dutiable as vehicles n.e.i. Plaintiff asserted that the motor-car chassis and the wagon chassis were only dutiable as the chassis of motor-car lorries or wagons, and that the accessories were dutiable as vehicle parts n.e.i. Defendant demanded the sum of £871 as duty in respect to the motor-car chassis and accessories, and £3,720 as the duty in respect of wagons chassis. Plaintiff, on July 10th, 1914, paid the duty under protest. It was alleged by plaintiff that the duty legally payable in respect of the chassis amounted to the sum of £634 only, and in respect of the chassis £39, and proceeded against the collector of Customs for the recovery of £3,917, as part of the sum paid under protest. The action came on before Mr. Justice Hood, who, on December 16th, 1914, gave judgment for plaintiff for £3,917. Against this decision the collector of Customs appealed, on the ground that it was wrong in law.

Mr. Justice Isaacs said that the burden rested with the plaintiff to prove "the contrary" to what the collector of Customs asserted, that was, that the sum claimed was not legally claimable. The only question at issue was: Had more money been paid into the public revenue in respect of the goods than the law required? Plaintiff's case was that the articles were within the item which read: Chassis of motor car, lorries and wagons, *ad val.*, 5 per cent." If they were, plaintiff succeeded; if not, he failed. According to the strict construction of plaintiff's pleading, the Court would have to regard each of the vehicles as a whole, that was without considering the frame as a separate article from the body. Plaintiff's argument besides claiming the vehicles themselves as a car and wagons had also treated each frame as being separate, as if the particular body with which it came were detached legally as well as mechanically. The parts were in fact and reality separately imported, and the possibility of future combination was not a matter which the Customs could insist on. But, on the other hand, if in truth a complete machine were imported by the same person, at the same time, though its parts were disconnected for convenience or otherwise, his Honour was disposed to the view that the Crown could properly regard the importation in its integrity, as that of the one machine, and claim duty on that machine. His Honour was of opinion that the appeal should be allowed.

Mr. Justice Higgins, Mr. Justice Duffy and Mr. Justice Rich concurred.

The Chief Justice delivered a dissenting judgment, in which he thought the appeal should be dismissed.

The appeal was allowed by a majority decision, with costs.

WAR ITEMS.

Berlin Traffic Conditions in War Time.—The influence of the war has had an appreciable effect upon the passenger traffic in the German capital. During the first half of the present year the decline in the receipts of the Grand Berlin Tramways Co. and its associated undertakings amounted to 6·9 per cent. as contrasted with the corresponding half in 1914, and the decrease in the case of the Grand Berlin Tramways Co. alone was 6·4 per cent. On the other hand, the Underground and Elevated Electric Railway Co. experienced a diminution of 25 per cent., whilst the receipts of the Berlin Omnibus Co. receded by 49·7 per cent. as compared with the first six months in 1914. It is assumed from these figures that traffic has been diverted from the railway and the omnibus services to the tramways, and that the shrinkage in the receipts of the omnibus company is mainly due to the withdrawal of most of the highly remunerative motor-'bus lines and the greater use made of horsed vehicles in their place. The tramways company, however, is the only undertaking which has come forward with a proposal for the revision of its fares, which is now before the responsible authorities for sanction or rejection. What is desired is to bring into operation now the right which the company will be able to exercise in 1920 by virtue of an existing agreement with the municipal authorities. It is pointed out by the directors that great caution has had to be maintained hitherto in regard to the use of the 10 pfennigs (1¼d.) fare, which has enabled passengers to travel for a distance of over 9 miles, in order to provide a return on the capital invested in the undertaking. So long as the receipts constantly increased, which was at the rate of about 3½ per cent. per annum until 1912, there was an advance in the surplus on working, but the latter declined in 1913 by £41,000 and by £128,000 in 1914. The principal reason for the diminution is attributed to the growth in competition, particularly on the part of the underground electric railway and the motor omnibuses, whilst the higher wages granted in 1911-12 have placed an additional charge upon the company of £50,000 per annum, apart from an augmentation in the interest service on the loans. In addition the cost of materials has risen since the war began, and further expenses have been incurred in grants made to employés and to dependents of employés called up for service, these being estimated at £75,000 per annum. It can already be foreseen that the extra expenses will render the working results for 1915 less satisfactory than in 1914, when a dividend at the rate of 6 per cent. was paid. But two years hence fresh competition will be encountered on the opening for traffic of the A.E.G. high-speed railway and the municipal railway connecting the north and the south of the city, and the extension lines of the Berlin Elevated and Underground Railway. Under these circumstances the company has asked permission to revise the tariff, so that the fares shall be henceforth 10 pfennigs (1¼d.) for distances up to 3·10 miles, 15 pfennigs (1·75d.) up to 4·65 miles, and 20 pfennigs (2·35d.) for further distances. It is submitted that the suggested increases would only affect about 15 per cent. of the passengers, that the additional receipts thereby expected would merely serve to defray the higher wages paid during the war, and intended to be continued also in the future period of peace, and that any surplus remaining would have to be divided among the local authorities forming the public purposes union, so that there would be very little left for the tramway company, which would be unable to pay a higher dividend therefrom.

Lighting Supply in the War Area.—The report of the Upper Rhenish Power Works Co., of Mulhausen (Alsace), whose share capital of £1,000,000 is held chiefly by the Municipal Council of Mulhausen, the Zurich Bank for Electrical Undertakings, and the Electric Light and Power Investment Co., of Berlin, states that the supply of energy constantly increased down to the outbreak of the war, when, however, sales were detrimentally affected through the area being comprised within the field of war operations. At the end of the financial year (March 31st, 1915) the number of towns and localities supplied was 216, as compared with 190 on the same date in the preceding year. During the first four months the turnover reached 19,422,000 KW.-hours, as contrasted with 12,389,000 KW.-hours in the equivalent period of 1913, but in the succeeding eight months of war the sales were 20,373,000 KW.-hours, as against 32,888,000 KW.-hours, being a total reduction of 5,482,000 KW.-hours for the year. It was impossible to realise economies in working expenses to set against the decline in the turnover, as the supply is based mainly upon the utilisation of water power in connection with which the cost of production changes but little even when the output is considerably decreased, whilst at the same time the other working expenses were increased through the difficulties of transport and the higher cost of materials. The gross profits declined from £73,000 in 1913-14 to £40,000 in 1914-15, and the net profits from £58,000 to £23,000 in the two years respectively. Most of the latter sum has been placed to the renewal fund, this result comparing with a dividend of 6 per cent. in each of the two previous years. The total damage sustained by the plant is unascertainable, as a considerable portion of it is within the fighting area and is not accessible, but the material damage caused in the districts which are accessible is estimated at £25,000.

Russian Platinum.—According to a report received in Basle, Switzerland, from Petrograd, the Russian Minister of Finance has prohibited the export of platinum to neutral countries. The existing stocks of the metal are to be taken over by the Government for use in connection with the construction of Sikorsky aeroplanes.

Tramway Workers and the War Loan.—The Manchester Tramways Committee has been asked by the employés of the department to grant facilities whereby the workers may be enabled to contribute to the War Loan by means of small weekly payments, and the matter has been left with the chairman, the deputy-chairman, and the general manager, with power to deal with it.

Trade Openings Abroad.—Canada.—An engineer in Montreal wishes to secure the representation of United Kingdom manufacturers of power plant apparatus and equipment. Application should be made to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C., for the name and address of the inquirer.

Australia.—A firm in Melbourne is desirous of securing the sole agency for Victoria and Tasmania of a United Kingdom firm manufacturing direct-current and three-phase motors, lamps and electrical goods generally. Communications in this connection should be addressed to the office of the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Branch Offices.

In your last issue, Mr. "Erimus" is kind enough to suggest that manufacturers' branch offices are being used as "umbrellas" for shirkers. No doubt Mr. "Erimus" has taken all sides of the question into consideration before rushing into print; if so, I shall be glad to hear his solution of the problem—which is *the* problem of many branch office men—how is it possible to support one's wife and meet obligations out of a separation allowance which would not even meet the rent and rates account? Does Mr. "Erimus" propose that such duties should be neglected, or is he prepared to guarantee sufficient income? If the latter, as soon as the guarantees are satisfactorily fixed up, I can answer for one more recruit.

R. M. M.

August 1st, 1915.

Electrometallurgical Alloys.—The report for 1914 of the Swiss Société Electro-métallurgique Paul Girod, of Neuchâtel, whose investments and works are chiefly situated in France, and whose production is closely associated with the armament industry, shows that the war has exercised an unfavourable influence on the financial results. Not only so, but the convention hitherto existing between the different makers of alloys has been prejudicially affected by the war, resulting in a decrease in orders and causing difficulties in the working of patents. The French Compagnie des Forges et Aciéries Electriques (Paul Girod), whose share capital of £160,000 is held almost entirely by the Swiss company, realised net profits of £22,000 in 1914, as compared with £29,000 in the previous year, but the parent company had had to increase the credit granted to the French undertaking. Since the close of 1914, however, a favourable change had taken place, the credit had been considerably reduced and the prospects of the French company were good. The accounts of the Swiss company indicate net profits of £7,200 on an ordinary share capital of £480,000, and this sum, together with the balance brought forward, and the extraordinary reserve fund of £103,000, has been applied to depreciation, making a total of £131,000 set aside for this purpose for 1914.

REVIEWS.

The Dynamics of Surfaces, by Prof. Dr. Méd. LEONOR MICHAELIS. Translated by W. H. PERKINS, M.Sc. London: E. & F. N. Spon, Ltd. 1914. Price, 4s. net.

This small volume is the product of the new school of German scientists. It is characterised by its highly specialised nature. Like most recent Continental productions, it describes exhaustively one very small sub-division of scientific development. The work is intended for biologists, but the matter is treated entirely from the mathematical standpoint, and deals with surface phenomena. There is no doubt that this useful little work will prove of great interest to the more advanced scientists, but it is difficult to believe that present-day biologists will have the necessary mathematical knowledge to take advantage of the information contained therein.

The author states in his preface that the book is intended to summarise the essential points in the theoretical treatment of surface phenomena, always keeping in view the object of applying the knowledge obtained for biological purposes. Although not a biological work, it is intended for biologists, and is written from their point of view. The object of the book is rather to give an account of the principles of surface reactions, so as to enable biologists to deal with such problems more fundamentally than they have done hitherto.

The first chapter introduces the general conception of a surface, and defines the meaning of a phase according to Willard Gibbs. Chapter II deals with the phenomenon of surface tension from the mathematical standpoint, and introduces the idea of surface energy, surface contraction, adsorption, and other physical conditions well known to biologists. Chapter III discusses the electrical forces of surfaces. It introduces the new well-known principles of electromotive force, the conception of the ion, adsorption potentials, and other electrical phenomena characteristic of surfaces.

The book closes with a short appendix devoted to the kinetics of surface reaction. There is both an author's and a subject index. The matter is treated clearly and concisely, and is suggestive of new fields of scientific investigation. The mathematics is of necessity somewhat complicated and difficult to follow, but is not more than is essential. The book as a whole will appeal to students of the later school of physical chemistry, who have some biological knowledge. It will be useful chiefly to those who desire newer branches of research, the treatment being suggestive rather than explanatory.

Elementary Principles of Illumination and Artificial Lighting, by A. BLOK. London: Scott, Greenwood & Son. Price, 3s. 6d. net.

As an elementary book on the subject of its title, this is one of the most successful we have seen, and we believe that the author has completely filled his object as set forth in the preface. Almost without exception the theorems and examples are simply and clearly worked out, so that those whose mathematical knowledge is not very wide, can read and understand all that is put before them.

The work commences with a good synopsis of the contents, and it is worthy of note that Mr. Blok introduces at the outset an index to the tables, symbols, and equations contained in the body of the book. In the first chapter the nature of light is stated in a manner which we would recommend to many of those who endeavour to instil into others an understanding of the subject, for the simple language employed leaves no room for doubt. In this chapter is included an account of radiation, and we do not remember having seen the question of colour treated so well as here, save in a voluminous American work. In a natural sequence units and standards are next considered. We think that the author's comparison between a watering hose and illumination is most unhappy; though well-meaning, it by no means conveys the correct impression. The mathematical dissertation, however, is good until we come to the definition of the lumen, which is slightly involved. The relations between the various units of illumination are well set out in a separate table, and the cosine law is very concisely explained, several examples being carefully worked out in order that there may be no misunderstanding. Intrinsic brilliancy is next treated upon, after which mean spherical and mean hemispherical intensities are dealt with; here the author presents two polar examples, and, unless one is careful, there is apt to be confusion owing to the elevation of one unit being shown alongside the plan of another totally different; but for this the matter is very clear. A description of light standards completes the chapter, and it is disappointing to note that the Fleming Ediswan, and other electric standards are omitted.

The methods and apparatus used in illumination measurements are the subject next dealt with, and we must congratulate the author upon the complete manner in which he has dealt with this portion, the general remarks being especially interesting. The following chapter is devoted to illumination calculations and is worthy of close study, since the subject is treated in a thoroughly practical manner and is not overburdened with the fine mathematical dissertations which one often finds in books of like nature, and which uusally count for little owing to the variation of conditions which occur in practice. The examples enable one to appreciate the generalities treated. Point by point and flux methods are clearly dealt with, but we think that the author has been unfortunate in putting forward the carbon filament glow lamp as an example for finding the M.S.C.P., since a student is apt to forget that such a source does not give a symmetrical distribution. We are pleased to find a section devoted to the explanation of the fact that the polar curve is not a flux diagram, a point always difficult for a layman to understand, and often a stumbling block for the beginner. Distinction is also made between total flux and effective flux, but the example on page 80 is somewhat crude and the final statement on that page is open to argument. It is interesting to note that the author displays an example of flux polar paper, which will enable the uninitiated to follow matters more closely. Blok's method of determining flux is also detailed at length. We do not care for the reasoning set forth with regard to the disposition of lighting points as given on the last page of this chapter, especially since it is contrary to proved ideas, and we think that this section could be revised and extended with advantage.

The next section treats upon the derivation of polar curves and contains many novel features. With regard to the radial device described, we would say that we have used a similar contrivance ourselves and found it most effective, provided the supports and framework are well designed, otherwise errors are likely to occur owing to the stresses occasioned by the mirrors; this applies more particularly to a large photometer. We do not understand why the author should find it necessary to determine the reflection constant for the mirrors; it is surely a simple matter to insert a standard lamp in place of the unknown and calibrate the substandard accordingly. This need only be done when checking the substandard and it saves unnecessary labour and avoids sources of error. The chapter on shades and reflectors follows and contains much new and useful information. A visual inspection of many of the polar curves will enable one to appreciate the inefficiency of some of the so-called "globes," especially those relative to gas lighting.

The sections relating to indoor and outdoor illumination are well worth study, but they would not suffer if they were considerably amplified. The properties of illuminants are well treated, and the information relating to gas lighting should be of great service to electrical engineers in view of the frank statements of the author, who evidently quotes from experience. The work concludes with some useful tables and a good index. It is the best book of its kind that we have yet seen and is deserving of a wide circulation.

Wireless Telegraphy, by A. B. ROLFE-MARTIN, B.Sc. London: A. & C. Black. Price, 5s.

This is a work intended for the average student of electrical engineering who is obviously assumed to have a good general knowledge of electrical principles. It consists of some 248 well-printed pages and 143 clearly-finished illustrations. The opening chapter deals with the simpler theoretical principles of electro-magnetic waves and electrical oscillations. The general theory of electric waves is very briefly treated and confined to a few brief statements without any attempt to formulate a concept of the mode of transmission of ether waves through space. Explanations of apparatus and methods of working are aimed at throughout, rather than general principles.

The matter dealt with is, on the whole, judiciously selected, and the theoretical portion is certainly commendably terse and lucid. In particular, the question of arranging and dimensioning the low frequency circuit in transmitters operated from alternating-current power is well explained, though many text books conveniently ignore or gloss over this matter. In the more practical part there would sometimes appear to be a tendency to over-state the effectiveness of devices or methods. For instance, it is not clear on what grounds the Marconi continuous-wave method is said to cover "the only generator which has given satisfactory results in long-distance work." Neither is it considered that the statements made regarding alteration of damping by the opening and closing of gaps in rotary dischargers will bear close investigation.

On the whole, the book can be recommended as a useful and fairly up-to-date one for students.

Reports of Experiments on Tungsten Filament Glow Lamps carried out by the National Physical Laboratory; Part I and II. 1913. London: Crosby Lockwood & Son. Price, 21s. net.

The results arrived at through the many researches carried out by the National Physical Laboratory are usually of considerable service and of great interest, but we are inclined to think that the report now before us is all too brief, so that it is impossible for one to draw a definite conclusion as to the merits or demerits of the lamps under consideration, save in one particular.

We had looked for an exhaustive treatise that would have aided large buyers. As given, only four makes of lamps can be said to have been tested, since the quantities taken in the other cases are not representative, or, if so, give negative results. Of one of the four, the batches were taken from lamps delivered to War Office specification, and therefore in only three cases are the tests any criterion of the manufacturers' product. For obvious reasons the makes of lamps are not specified, and from the figures given we are inclined to think that the makers should be grateful. In his report, Mr. Paterson points out that it is inadvisable to draw general conclusions, and, with this admission before us, we do not comprehend why it should have been deemed advisable to make the publication.

The second volume of the report is entirely devoted to the admirable curves and target diagrams which represent the whole of the published results, and they betoken much tedious and careful work, of interest to but a narrow circle.

The first volume contains the text, and the objects of the tests are set out as (*a*) To obtain data as to the degree of uniformity existing at the present time in the individual lamps composing batches of metallic filament lamps of given nominal ratings; (*b*) to obtain data as to the behaviour of metallic filament lamps on life tests, mainly with a view to ascertaining the value of watts per candle on life test which corresponds to a given candle-power drop after 1,000 hours.

With regard to (*a*), the striking point is the unreliability of the makers' ratings, and we are inclined to think that if these tests were repeated now, considerable changes would have taken place owing to the constantly improving methods of manufacture.

Object (*b*) seems to have been more nearly attained, and Mr. Paterson's conclusions are indeed interesting. It would appear that the lamp-makers are very modest when they inform us that the life of the lamps is 1,000 to 1,500 hours, though there are fluctuations in individual performances. The arguments set forth for a proposed life-test specification are very clear, and generally we agree with the reasoning. There is but little doubt that the report has been of aid to the manufacturers, and many of the improvements in quality are due to the work carried out by our National laboratory. We trust that time and money may be found to repeat the experiments and a similar report issued, so that the public and others may gauge the progress made, and draw definite conclusions as to the modern tungsten filament lamp. If this may be done, we would like to suggest that it would be desirable to adhere to the same denoting letters that are used in this report, and, also, we think that all the lamps should be purchased in the open market, where no specification such as that issued by the War Office is in use.

Electricity in Gases, by Prof. J. S. Townsend. Oxford: University Press. 14s. net.

It is noteworthy that text-books on this and allied subjects are tending to become more stable; in other words, there is a greater absence of experimental data haphazardly put together, and a better attempt at synthesis; so that the student is gradually becoming able to obtain a connected or bird's eye view of the many intricate processes involved, and to base his study on fundamental conceptions that render such study intelligible. Another sign of the times is that the Electronic Theory, by reason of the basic ideas involved in it, is being increasingly used by writers; so much so that many text-books until recently regarded as standard, and usually full of irritating problems of no practical use, are already obsolescent.

The present work is the author's contribution to a treatise in six volumes dealing with the electrical properties of gases and the subject of radiation in general; the series being proposed some three years ago by Prof. Marx and conjointly worked out by several well-known physicists.

In this volume the author limits his work to a description of the conductivity obtained in gases at ordinary temperatures and at pressures ranging from atmospheric to those of the order of one millimetre, in which the discharges may be explained by the theory of ionisation by collision; but he includes a brief description of the principal experiments on cathode rays and positive rays obtained in high vacua. It is a large book—some 500 pages—and very little has been omitted in the way of experimental detail relative to its subject. Moreover, the author possesses the faculty of putting the gist of the matter under consideration into just the correct number of words—a very valuable faculty where students are concerned—with the consequence that, though he describes great numbers of experiments, he never commits the fault of wandering into side paths and diverting the reader's attention from the main argument. The subject of electricity in gases is one that requires lucid treatment. So complex is it that experiments very carefully conducted often give most divergent results by reason of the number of variable factors involved. In working out the currents which are generated by Röntgen rays, for instance, it is necessary to take into consideration the secondary rays which are given out when the primary rays fall upon metal surfaces, or when they pass through any kind of matter. The secondary rays are themselves very complicated and consist of groups of rays differing widely in penetrating power. Hence the difficulty of experimental research and of obtaining precise data—a difficulty which is a universal feature of this portion of electrical science.

The author, in his opening chapters, deals with the production and motion of ions in gases, the velocity of ions in an electric field, the diffusion of ions, and re-combination. Thereafter he discusses the determination of the atomic charge. Especially interesting is his account of the various metho for the formation of clouds in gases, and of Wilson's meth of making visible the paths of ionising particles in a gas (t latter being accompanied by photographs).

In Chapter VII is found much interesting matter on rece determinations of the charge e, Stokes's formula, Millikan experiments on positive and negative charges, Rutherford a Geiger's determination of the charge on an α particle by radio-active substance, Perrin's determination of the numb of molecules per cubic centimetre of a gas, number of granul in an emulsion, observation of Brownian movement and i theory, and so on. A fully-developed chapter is that deali with discharges between conductors of various shapes. So of the subjects considered are brush discharges, discharg between spheres with an account of Baille's experiments, di charge from a point to a plane with Töpler's investigatio of point discharges, determinations of sparking potentials wi results by Kelvin, De la Rue, and Müller, Baille and Pasche and Carr, the effects of different gases at various pressur on sparking potential, discharges between co-axial cylinde with an account of Gaugain's experiments, Whitehead experiments with alternating forces, and so on. The lat chapters have to do with discharge tubes, cathode rays, a positive rays.—W.J.C.

OVER-SPECIALISATION.

By JOHN MARKS.

That a man or a firm wishing to succeed to-day mus specialise is a freely accepted axiom; but, in the opinion o the writer, it is possible to carry this idea to such length that in place of giving a constant expansion to the trade o a firm, it may act as a decided restriction on their earnin capacity.

This war has shown up many points in which our firm are wanting, and amongst these points, is that of carryin specialisation to an extreme length. Over and over agai requests for articles which have usually been made abroa have been met with the reply: "Oh, that is out of ou usual line," even when quite a small amount of accommodation would have enabled the goods to be manufactured i commercial quantities.

The writer has naturally noticed this attitude in the cas of his own calling of an engineer; but the opinions o friends in other lines support the contention that our intens national conservatism is holding back our enterprise in good many directions. Specialisation is absolutely necessar if one is to sell one's products in the open market; that i not contested, but is it necessary at the same time to refus other lines of business, especially lines akin to our own Must we always remain men of one idea only, instead o applying our organising talents to the collection under ou business premises of two or more lines, each of which i carried out and prepared for the markets by specialists, and then put on their particular markets by men understanding those particular markets' demands?

That this is by no means incompatible with sound business is capable of proof by reference to more than one great engineering firm in this country which handle in a highly successful manner, propositions as wide apart as textile machinery, hydraulic work, and the manufacture of electrical and chemical works plant.

On the other hand, we had the spectacle of one celebrated specialist motor-car firm having to hang up its production for about three months last March, owing to the fact that the season's demands had been more than met at that date. Now, although the partial shut-down did not last the full three months, it was necessary to dispense with several thousand workmen, and it cannot be denied that during the partial cessation of output the firm were not making, but, on the contrary, must have been spending, money.

Another example of this kind which the writer witnessed occurred to a firm with which he was in close personal touch. The firm started as a general engineering works, and got together a really nice trade in general work, and in two or three small lines which were constant and fairly profitable. After a time they entered another field of the engineering trade, largely at the request of an influential agent. This trade was nursed by the agent, and the whole of the clever brains of the establishment were brought to bear on the problem of turning out a first-class product in the new line of business.

Naturally these combined efforts resulted in a large expansion of trade; the works were enlarged considerably, new plant was laid down to cope with the special line, and all went as well as could be desired. Space being required for the new line, the older and smaller lines were gradually obliged to give way, and two of them were disposed of to another firm.

This state of things continued for quite three years, and then for a period of about five months the special line was very badly hung up owing to a war putting a damper on that particular trade. The trade in the new line had been largely foreign, and in consequence the Home Market had been neglected, and no advertising done; consequently the firm were hardly in a position to claim that they were an accepted firm in that particular line, for they were practically unknown in the Home Market.

Naturally the extensions which had been made to cope with the great increase in the special line left the firm with a heavy standing or oncost charge, whether few or many machines were turned out, and in the period of slackness this was found to be a very heavy charge on the firm's financial resources.

Happily, about this time the proprietor of the old lines, which had been passed on to another firm, signified that he was very anxious for the firm to take up their manufacture again, and offered attractive terms to induce them to do so; this was an extremely fortunate turn of events, and the firm took the chance gladly.

It is to the procedure in this matter, however, that the writer wishes to call particular attention. The mistake was not again made of considering this work as of little value. A draughtsman was put at the head of the work, and given the old staff of men to work with. He was instructed that he was to act as works manager for that particular portion of the firm's products, and that he was to carry out the work as a specialist; that his time was to be devoted to devising the quickest and best methods of getting the work through; that any special tools or jigs he required would be made or procured for him; and that as soon as the foreman and himself had got the matter into a regular swing, he was to see what improvements he could introduce, and to ask for other draughtsmen or clerical assistance as soon as he required such.

This, of course, was simply specialising in that particular ine, and merely necessitated a little organisation to put the work into effect.

The results were what had been looked for; better manufacturing than occurred in the previous days, and hence a more rapid output and quicker turnover, as well as an enhanced profit on each machine sold. In discussing the matter with the general manager of the factory some two years afterwards, the writer was assured that never again would the mistake be made of allowing work to go away rom the firm. "If others can specialise in it, so can we," declared the manager. "It only requires a little thought and a little intelligent organisation."

He also stated that though the special line had, after its period of slack trade, picked up again as wonderfully as ever, yet they took care to keep the old lines in their own pecial way quite up to date; adding: "if ever we are lack again in our engine shops this work will always earn a little more than bread and butter, to keep us together until times mend again."

This policy was then supported by advertising in the recognised trade papers, in order to develop the home trade.

Another feature which followed in the track of this policy was that the firm invented special tools for carrying out certain of their engine-building operations more expeditiously.

When these tools had been thoroughly well tried, by use in their own shops on a commercial scale, they laid out pecial shops and machines, and put the tools on the market, both to their own profit and the benefit of the trade in general. This new department was, however, run by specialists on that particular work.

The proof of the success or otherwise of the policy is found in its results. When the first slump in their foreign trade occurred the firm in question were employing 200 men; within two years of the adoption of the newer policy the number had doubled, and after five years more when the tool department was manufacturing for the general market the employés were over 1,000.

Specialisation we must have, but specialisation which means the stagnation of all talents except one particular set is not the correct policy.

The directing heads of a firm should use their energies and experience in so organising matters, that every department is managed and run by specialists.

THE SUSPENSION OF A CONTRACT.

[FROM OUR LEGAL CONTRIBUTOR.]

There are probably many manufacturers up and down the country who are concerned at the present moment with problems raised by the suspension of contracts. However desirable a multiplicity of remunerative contracts may be in the piping times of peace, there are many reasons why it may be desirable not only to refuse new, but to suspend old, agreements, for a certain or uncertain time. Scarcity of labour, the rise in price of materials, the difficulty of obtaining from abroad goods which are indispensable for the proper completion of the work—all these are factors which may render suspension desirable from the purely business point of view. But other forces, not less cogent, are also at work. Your patriotic employer who desires to devote part of his works to the manufacture of munitions of war may find himself hampered by the necessity for fulfilling his obligations. In the event, however, of a way out being found by amicable arrangement, the energies of his staff may be devoted to the pressing needs of the nation.

The question is: How can a contract be suspended? It may be taken that, generally speaking, it is not competent to either party to declare the contract suspended because of the war. Unless (which is very unlikely) there was a special clause prescribing rights and liabilities on postponement owing to war, the parties must come to an arrangement between themselves. Mutual consent is of the essence of such an arrangement.

To narrow the scope of our discussion, let us consider how best a contract drawn up in accordance with a well-known form can best be varied or modified—noting some of the points which must receive consideration.

Take, for instance, the form of model general conditions for electricity works contracts approved by the Institution of Electrical Engineers. That form provides, by Clause 37, that the purchasers must pay to the contractor "all reasonable expenses arising from suspension of works by order in writing of the purchasers or the engineer, unless such suspension be due to some default on the part of the contractor." The "suspension" referred to in this clause is not the suspension with which we desire to deal, inasmuch as it would be ordered by the engineer and could not, apparently, be decreed by anyone else.

Let us consider some of the more important clauses to see what must be provided for.

By Clause 38 it is provided that "the works shall be completed on the site and ready for beneficial use or for testing by the date named under each section, or by such other date (if any) as may be incorporated in the contract." It is obvious that the suspension of the contract will make it necessary to vary the date of completion. If the completion is originally fixed as by the above clause, it will be necessary to recite, in the suspensory agreement, that the work was to have been completed within so many weeks or months from the commencement of the works and to provide, in the body of the agreement, that "the works shall be completed within —— months of the date of commencement but, in estimating this period, no account shall be taken of the time elapsing between the date of the suspensory agreement and the date by which the engineer shall have given at least one month's notice in writing for the work to be completed." To foresee the date of the conclusion of the war were impossible, and it will therefore be best to leave the date of completion entirely open—subject to the discretion of the engineer.

Provision must also be made for the covering up and protection of unfinished work, and for the settlement of the question who shall pay for such protection, and who shall be liable for the maintenance of such work during the suspensory period. Further, inasmuch as unfinished work might not fall to be paid for under certificate pursuant to Clause 34, the contractor will probably desire to secure the insertion of a clause whereby unfinished work shall be measured and paid for forthwith.

With regard to materials brought on to the site for the purposes of the works, Clause 27 provides that they: "Shall from the time of their being so brought, vest in and be the property of the purchasers (in other words, the employers) until the completion of the contract." It is conceived that if a suspensory contract is entered into it would be fair to provide that the contractor shall be paid for all materials delivered. Such materials as are not likely to deteriorate can be stored on the site or elsewhere, and provision can be made as to who shall bear the cost of carting, storing and re-carting when work is resumed.

As to perishable materials, *e.g.*, cement, &c., an arrangement must be made under which the contractor shall be at liberty to take them back for use elsewhere, and if he is under contract with merchants to deliver such materials on the site, he must be enabled to cancel those contracts—the necessary compensation being paid either by him or the purchasers in accordance with the terms of the suspensory agreement.

Inasmuch as the contractor will inevitably sustain other losses which cannot be very accurately estimated in money, it may also be necessary to provide for the payment to him of some definite sum to provide compensation for loss of profits.

Another matter to which the attention of those who draft a suspensory agreement must be directed is the change which is nearly sure to take place in the cost of labour and materials. After the lapse of a year or more—especially in war time—the cost of labour and material may be altered to the prejudice of a contractor who is tied down to the original schedule of prices and bills of quantities upon which his tender was based. It should, therefore, be provided that upon resumption of work the prices shall be reconsidered in the rate of current cost of material and labour, and the amount to be paid to the contractor varied accordingly. A final clause would provide that, subject to the terms and conditions of the suspensory agreement the original contract shall remain in full force and effect.

BUSINESS NOTES.

Bankruptcy Proceedings.—JOHN BOULT, electrician, 3, Grosvenor Street, Chester.—At the Chester Bankruptcy Court on July 27th, before Mr. Registrar Farmer, the public examination took place of John Boult, 48, Upper Hope Place, Liverpool, and John Hugh Bolt, 6, Pepper Street, Chester, carrying on business together in co partnership under the style or firm of John Boult, at 3, Grosvenor Street, Chester, electricians. The gross liabilities were returned at £620, and were expected to rank for dividend at £605. The assets were estimated to produce £580, leaving a deficiency of £25. The cause of failure, as alleged by debtors, was insufficient capital, the war affecting cash sales at shop, and cost of actions against the firm. The separate estate of Mr. John Boult showed gross liabilities £1,519, estimated to rank for dividend at £1,487. The assets were estimated to produce £801, leaving a deficiency of £686. The cause of failure alleged by debtor was the strike of three months' duration in the summer of 1914, and the war following, with a loss on the Chester business, in which he invested £100. The separate estate of Hugh Bolt showed his liabilities were expected to rank at £50. There was a deficiency of £43. The examination was closed, subject to the usual formalities.

HENRY GEO. WRIGHT, 69, Blackboy Lane, Wood Green, N.—An application for an order of discharge was made on Tuesday last week to Mr. Registrar Linklater on behalf of Henry Geo. Wright. Mr. Egerton S. Grey, Official Receiver, reported that the debtor petitioned the London Bankruptcy Court in March, 1912, to avoid a committal order. The provable debts amounted to £392 13s. 3d., and there were no assets in the estate. His Honour granted an order of discharge, subject to judgment for £15, to be paid within seven days.

WILLIAM WALKER (trading as David Smith & Co.).—An order of discharge was made on July 1st, varying the order made on December 15th, 1914, the bankrupt being required to consent to judgment against him for the sum of £1, and costs £1 10s. before his discharge takes effect.

Liquidations.—SPANISH NATIONAL SUBMARINE TELEGRAPH CO., LTD.—A meeting will be held at 106, Cannon Street, E.C., on September 16th, at 12.15 p.m., to receive an account of the winding up from the liquidator.

ADNIL ELECTRIC CO., LTD.—A petition for the winding up of this company, presented by Messrs. A. E. & A. C. Wheeler (Acme Electrical Manufacturing Co., Tottenham), is to be heard on October 19th.

CONSOLIDATED DIESEL ENGINE MANUFACTURERS, LTD.—A first and final dividend of 20s. in the £ is payable on August 17th, at General Buildings, Aldwych, London.

BALDUR ENGINEERING AND SUPPLY CO, LTD.—A meeting of creditors is to be held on Thursday, August 12th, at 11 o'clock, at the offices of Messrs. Strong & Bolden, 70, Gracechurch Street, E.C.

Catalogues and Lists.—THE ELECTRIC AND GENERAL WORKS, LTD., 15, Victoria Street, S.W.—Price list of electrical apparatus, covering switches, circuit-breakers, ironclad switchgear, oil switches, horn-type line switches and lightning arresters, and fuses, in great variety. We are informed that these apparatus are made by a Swiss firm, into the constitution of which no German interest enters, the capital being wholly French and Swiss.

HOTPOINT ELECTRIC HEATING CO., 38, Poland Street, Oxford Street, W.—Folder relating to the new hotpoint grill stove, "El Grilstovo," and the hotpoint irons, which have been reduced in price; also folder describing the "El Rangeo" electric cooker.

WESTMINSTER TOOL AND ELECTRIC CO., LTD., Suffolk House, Laurence Pountney Hill, London, E.C.—Illustrated folder, giving a "Business Chat," relating to the "Westool" electric drill, and a note of prices.

The German Cable Makers' Syndicate.—The syndicate of German cable makers, which on the outbreak of the war was provisionally prolonged to the spring of 1915 and then to the autumn, has again been extended to the end of this year. The chairmanship is continued by Herr Berliner, general director of the Bergmann Electricity Works Co.

Book Notices.—Halifax: A Commercial and Industrial Centre, 1915. London: Sells, Ltd. Price 2s. 6d.

"Wireless Time Signals: Radio-Telegraphic Time and Weather Signals, transmitted from the Eiffel Tower, and their reception." London: E. & F. Spon. Price 3s. 6s. net.

Trade Announcement.—The business of MR. JOHN BOULT, electrical engineer, 3, Grosvenor Street, Chester, is being offered for sale as a going concern.

LIGHTING and POWER NOTES.

Aberdeen.—In June the units generated at the Corporation generating station showed an increase of 108,510 over the corresponding month of last year.

Argentina.—The municipal authorities of Lincoln (Province of Buenos Ayres) and the representatives of the Gasmotoren Fabrik Deutsche Co. have signed a contract, whereby the latter assumes the lease for a term of five years, of the electric light and power stations and the waterworks belonging to the municipality. The leasing company has taken formal possession of these installations. The contract is *ad referendum*, subject to confirmation by the Municipal Council.—*Review of the River Plate.*

Atherton.—MILL DRIVING.—The new No. 2 Mill of the Laburnum Spinning Co. is almost fully equipped, and the shareholders had an opportunity of going through the place after the half-yearly meeting last week. The mill is electrically driven, the current being taken from the South Lancashire Tramways Co.'s generating station, through the local U.D.C. The B.T.H. Co. supplied the electric motors, and Messrs. John Collier & Co. the cables.

Australia.—The Castlemaine (V.) B.C. has provisionally accepted a tender for public electric lighting for 10 years.

The Shire Council of Korumburra (V.) is extending its electric-lighting plant.

The South Australian Railways Commissioner is applying to local undertakings for a supply of electricity for lighting the Wallaroo shunting yards.—*Aust. Mining Standard.*

Bradford.—YEAR'S FINANCIAL RESULT.—The annual statement of the city treasurer, as regards the electricity works shows:—Income, £147,583; working expenses, £71,587; gross profit, £75,996; interest on loans, &c., £24,460; provision for repayment of debt, £32,581; and surplus for the year, £18,955. The expenditure out of loans on the electricity works was £43,888, making the total expenditure on the undertaking £934,284, of which £428,591 represents loans repaid and sinking fund in hand, leaving a net debt on the undertaking of £505,690.

Brighton.—Year's Working.—The report of Mr. John Christie, the borough electrical engineer, on the working of the electricity department for the year ended March last, shows a decreased output sold of some half million units as compared with the previous year, this being due mainly to restricted lighting. The units sold were 10,214,436. The revenue, £93,869, was a decrease of £4,244; working expenses absorbed £50,903, leaving a gross profit of £42,966, and, after providing for capital charges, there was a net deficit of £1,354, as against a surplus of £2,342 in the previous year. The works costs per unit sold were ·75d., against ·74d.; coal cost more, but more efficient operation reduced the weight per unit to 3·97 lb., as against 4·06 lb. The output for private power, heating and cooking increased by 121,041 units, and bulk supply to Aldrington by 5,000 units, but this supply will probably be transferred to the Hove undertaking shortly. The maximum load was 4,960 kw., and the load factor 23·5; the generating plant capacity was 8,500 kw.

The Corporation Lighting Committee has decided that the following special clause shall be inserted on all official orders for goods issued from the electricity department:—"The condition of this order is that the goods supplied have not been manufactured in Germany or Austria."

Carlisle.—Year's Working.—The result of the last year's working of the electrical undertaking was a small profit of £76, as against £209 loss in the previous year. The war affected the business of the undertaking considerably, although 3,470,492 units were sold, as against 3,140,457 units in the previous year, the maximum load and load factor being 2,018 kw. and 19·6 per cent. respectively, as against 1.944 kw. and 18·45 per cent. The total revenue was £21,404; while the working costs were £13,063 (£1,000 less than in 1913-14), and the gross profit £8,341, compared with £7,161. The benefit of the new turbine plant, recently described in our pages, was not fully experienced during the year, and this will be more than counterbalanced by additional costs this year.

Chelmsford.—Street Lighting.—The T.C. has agreed to a rebate at the rate of £350 per annum from the Electric Supply Corporation's accounts for the period during which the diminished street lighting remains in force. Consideration of the account for the year ended June 30th has been adjourned until a report has been received upon negotiations with the Electric Supply Corporation regarding the payment, if any, for the period for which the whole of the street lamps remained extinguished.

Chester.—Year's Working.—The annual report of the electricity undertaking for the year ended March 25th last shows that the gross profit was £12,483, and the net profit, after meeting financial charges, was £3,194; £6,933 had been contributed out of revenue to the capital expenditure; £1,118 to the lamp rate; and a balance of £1 358 carried forward. The auditor's report states that after debiting interest and sinking fund charges on loans, and the revenue contributions to capital expenditure, and allowing ·632d. per unit for the sale of electricity generated at the hydro works, the surplus for the year was £2,974.

The T.C. has decided to purchase three electric 2-ton wagons for the removal of refuse, the cost being met by four annual payments of £800. It was stated that this mode of traction would result in a saving of £124 a year over the system now in use.—*Liverpool Daily Post.*

Dublin.—The small electrical contractors are complaining that the recent order of the Electric Lighting Committee as to rates of charge will have the effect of destroying their business, stocks of electrical goods being left on their hands. It is proposed that some arrangement should be entered into with the Committee.

Ealing.—Price Increase.—The T.C. has agreed to a 10 per cent. increase in the price of current after the September quarter. The engineer estimates that the coal costs during the winter will probably be increased by about £3,000.

Edinburgh.—New Power Station.—The Corporation, on the recommendation of the Electric Lighting Committee, has decided to accept the estimate of £5,727 for the foundations for the new generating station at Portobello; it was stated that in the opinion of the superintendent of works it would take six months to complete the foundations, and in view of their responsibilities it was urgent that they should adopt the recommendation, which came in for considerable criticism.

Erith.—Plant Extension.—The U.D.C. has adopted the proposals of the engineer for the extensions at the electricity works, mentioned in a recent issue of the Electrical Review, and has decided to apply to the L.G.B. for a loan.

Gillingham (Kent).—As there is only a credit of about £200 on the mains and services loan account, the T.C. has decided that no mains extensions be taken in hand, and to reserve the whole of the £200 for services.

Gloucester. — Annual Accounts.—The last year's working of the electricity department shows revenue amounting to £15 562, as compared with £15,125 in the previous year. The working expenses were £7,540, and the gross profit £8,022, compared with £7,616 in the year 1913-14. The net profit was £904, as against £595 in the previous year. The additions to consumers and to the connected load were only about half of the usual average. Of the net surplus £353 has been appropriated to capital expenditure, and £550 has been carried forward, increasing the balance brought forward to £1,305. The output of the works increased by 85,000 units, the sales for power purposes exceeding for the first time those for private lighting and domestic supplies. Having regard to the increase in the price of coal and the payment of a war bonus to the employés, an addition of £1,600 or £1,800 to the working cost is contemplated in the current year, but the question of raising the tariff to consumers has been postponed.

Harrogate.—Extension of Supply Area.—As a result of the recent granting of a provisional order to the T.C., an additional supply area of about 25 square miles of rural district has been obtained, although the order does not come into force until after the war. The compulsory areas are small districts in Pannal, where mains have already been laid under the general Act of 1909, and some 30 or 40 consumers are now being supplied.

Ilford.—The U.D.C. has received the sanction of the B. of T. to the provision of electricity generating plant in association with the refuse destructor.

Irlam.—E.L. Scheme.—Although the prov. order for the supply of electric light has been obtained, it is not expected that the U.D.C. will take any steps to give effect to it until after the war.

Kingston-on-Thames.—Year's Working. — Further increases in the charges for current have been made by the Corporation in view of the heavy deficit on the past year's working of the undertaking. According to the report of the borough electrical engineer, the deficit, after repayment of capital, amounts to £1,295 compared with £720 in the previous 12 months. The net total loss on the whole period of working amounts to £18,119; in the years 1904, 1905 and 1906 only was there a surplus after payment of capital charges. The engineer states that the year's working was obviously prejudicially affected by the war, principally by the compulsory shutting down of all outside lighting. At the meeting of the Corporation last week, Alderman Lyne said the decrease in revenue had been almost entirely in shop lighting. One solution of the difficulties was that they should sell the concern; they could, undoubtedly, get offers in normal times, but under existing circumstances no company could be started to take it over. The additional increased charges were estimated to bring in another £2,088, leaving a deficit this year of £200. During the course of his speech Alderman Lyne said that if all the plant at the works had been driven by oil, they could have reduced the cost of fuel by £1,759, the cost of oil fuel being under ½d. per unit and of coal over 1¾d.

Leyton.—Street Lighting.—The Electric Lighting Committee has decided to allow a rebate of £55 on the public lighting accounts for the December quarter, and a rebate of £65 in each subsequent quarter during the continuance of the present curtailment of lighting.

Llandudno.—Price Increase.—In view of the increased cost of coal, the U.D.C. has increased the price of current by ½d. per unit.

London. — Infirmary Lighting.—The Westminster B. of G. has had under consideration the question of electricity supply at the Union Infirmary, and has directed the clerk to inquire upon what terms the Chelsea Electricity Supply Co. will supply current to the institution, in order to ascertain whether this would not be cheaper than generating electricity at the infirmary. In the meantime, the Committee recommends that the radiant heat plant, now installed, be supplied with current from the Supply Co., as this will mean a considerable saving to the Guardians.

Woolwich.—The B C. has decided to appoint Mr. J. H. Paul to make an investigation of the corrosion that is taking place in the new economiser installed at the Globe Lane Works. The charge for steam generated from refuse for electricity purposes for the year ended March 31st last has been fixed at £540.

Islington.—Proposed Loan.—The B.C. has decided to at once proceed with the laying of additional mains, in order to cope with the increased demand for energy to factories engaged upon Government work. The cost of the extension is estimated at £9,076, and application will be made to the L.C.C. for sanction to the borrowing of this sum; also to the borrowing of £200 for another cable extension.

Maidenhead.—Price Increase.—The T.C. has, owing to the increased cost of production, &c., increased the price of current for lighting by ½d. per unit, and for power by 10 per cent., from October 1st.

Mexborough.—Year's Working.—The annual statement of the electricity department of the Mexborough and Swinton U.D.C. shows that during the year ended March 31st last, there was a revenue of £6,305 (an increase of £539 on the previous year). The expenditure totalled £3,725, and after the deduction of interest and for sinking fund charges, there was a net profit of £329, as against £1,043 during the preceding year. The units generated were 760,388, as against 635,782 during 1914, and units sold 678,336 against 565,254. The maximum supply demanded was 350 kw. The increased revenue was solely due to a heavy accession in power business, which outweighed the decline in lighting.

Salford.—New Plant, &c.—Application is to be made to the L G.B. for the further sanction to the borrowing of sums of £867 and £850. The Electricity Committee has recommended the T.C. to waive the condition as to completion of contract in connection with the acceptance of the offer of the British Westinghouse Co. for the supply of a 5,000-kw. turbo-alternator, in consideration of the company agreeing to the incorporation in the contract of Clause 31 of the Model General Conditions of the I.E.E., and further agreeing to treat the contract as a war contract,

South Africa.—Cape Town.—The Electricity Committee of the Corporation estimates the probable loan requirements of the electricity department for the next two years at £75,000, and recommends the Finance Committee to obtain the authority of the ratepayers to the raising of a loan. The heavy increase in the demand for electrical energy for all purposes makes the obtaining of fresh capital for extensions an immediate necessity; notwithstanding the discontinuance of free wiring, 300 new consumers were obtained from January 1st to April 30th last, and during the 12 months ended April 30th, 1,582 new consumers were connected. The electrical engineer, commenting on the growth of the load, points out that there are several propositions maturing, including the electrification of the Salt River works, which will materially add to the consumption of electricity.

Mossel Bay (C.P.)—At a meeting of voters held recently, the municipality was authorised to raise a loan for the purpose of a district lighting scheme.

Southampton.—Electric Vehicle.—The Electricity Committee is to fit up the chassis of the fourth electric vehicle primarily for main-laying work, and the borough electrical engineer has been directed to obtain tenders for various classes of batteries in connection therewith. The L.G.B. is unable to sanction the proposed additional loan for the purchase of a 750-kw. rotary-converter in lieu of the 500-kw. converter, in respect of which a loan was sanctioned in June, 1914.

Southborough. — E.L. Scheme. — The U.D.C. has agreed to the offer of Mr. W. C. C. Hawtayne to accept an inclusive fee of 30 guineas for his services in preparing an electricity scheme for the town, now closed by the inclusion of the district in the Tunbridge Wells Corporation's Order.

Sutton Coldfield.—Proposed Loan.—The Electricity Committee reported that the L.G.B. had refused its consent to the proposal to borrow £2,500 for the purposes of the electricity undertaking; a special report as to the necessity for the loan has been forwarded to the L.G.B.—*Birmingham Daily Post.*

Sowerby (Yorks.).—Street Lighting.—The P.C. has asked the Electric Lighting Co. for a rebate on the public lighting contract owing to restricted lighting.

U.S.A.—Discussing the rejection of tenders for street lighting by gas in Manhattan, Commissioner Williams recently stated that electric lamps are being widely substituted for gas lamps, and in place of 10,000 gas lamps at the beginning of 1915, it is estimated that by the end of the year there will be fewer that 3,000.—*Electrical World.*

Wanstead (Essex).—Prov. Orders.—The U.D.C. has received notification that prov. orders for E.L. are to be applied for by the County of London Electric Supply Co. and the Periander Syndicate. Both matters have been referred to the General Purposes Committee for consideration.

Watford.—New Plant.—The electrical engineer has been directed to obtain prices for switchgear for the library substation; also to purchase three 100-kw. and three 50-kw. transformers, under the existing contract.

The U.D.C. has applied to the L.G.B. for a loan of £1,560 for mains, &c., needed in connection with Government work.

Wirksworth.—E.L. Proposal.—With reference to the application of Messrs. Pullen & Best, of Bradford, inviting the co-operation of the U.D.C. in the formation of an electrical supply company for the district, the Council has referred to the Lighting Committee for consideration the agreements between the firm named and the Masham Council and East Westmorland R.D.C.

TRAMWAY and RAILWAY NOTES.

Australia.—The latest report from the Victorian Railways Commissioners on the working of the St. Kilda to Brighton electric tramway shows that for the quarter ended March 31st the gross revenue was £6,597, as compared with £6,272 in the same period of 1914. The working expenses for these periods were £4,190 and £5,702 respectively. For 1915 the net revenue was £1,687, and for 1914 £570.—*Australian Mining Standard.*

Barrow.—Female Labour.—Last week women conductors were introduced on the local tramway service, with, so far, satisfactory results.

Blackpool.—Electric Water-Cart.—The Corporation has now obtained delivery of its new electrically-driven street watering-cart, which has been supplied by the General Vehicle Co., at a cost of about £1,000. The vehicle battery will be recharged at the destructor works; the tank has a holding capacity of 750 gallons; the machine loaded weighs about 8½ tons; and the throw of the water spray extends to about 7 yd. The streets can be watered by means of the cart at the rate of about 10 miles per hour.

Brierley Hill.—The Brierley Hill, Quarry Bank and Rowley Regis Light Railway Committee has decided to allow the Light Railway Order to lapse, the district now being served by motor-'buses. The cost of securing the order in 1903 was £1,405

Gloucester.—Year's Working.—The accounts of the light railways undertaking for the past year show a total revenue to March 31st last of £17,806, as compared with £18 017 in the preceding year, the average receipts per car-mile being 6·84d., as compared with 6·77d. The total operating expenses were £13,704, and the gross profit was £4,102, compared with £4 136; 4,358,510 passengers were carried.

Halifax.—Figures relating to the working of the Corporation Tramways during the quarter ended June 30th, show that the revenue amounted to £30,242 and the expenditure to £23,911, leaving a profit of £6,331.

Huddersfield.—Female Labour.—The tramways department has started employing women as tramway conductors on the Honley and Sheepbridge section.

Irlam.—It is reported that the question of linking up Irlam and Cadishead with Eccles and Patricroft by electric car is again coming to the fore, and that the Salford Corporation Tramways Committee is understood to be prepared to reconsider the proposal.

A motor-'bus scheme was mooted some time ago, and the U.D.C. granted licences for six motor omnibuses to ply, but apparently the scheme has fallen through.

Leyton.—Having regard to the difficulty of obtaining supplies of tram-rails, fish-plates, steel-tires, axles, gear wheels, and pinions, and the rising prices, the tramways manager has been authorised to purchase a sufficient quantity to bring the stock up to the estimated requirements for the ensuing 12 months.

Manchester. — War Bonus. — The decision of the Committee on the application of employés of the Corporation Tramways for a war bonus makes the following awards:—1s. per week war bonus to employés between 18 years of age and 21 years; 2s. per week to employés aged 21 years and upwards who are in receipt of 38s. per week or less; employés receiving over 38s. and under 40s. are to receive a sum as bonus, which will bring their wages to 40s. The award makes the payment of the bonus run from the date on which the decision of the Corporation to pay a bonus became operative.

Sheffield.—Year's Working.—During the year ended March 25th, the Corporation tramways ran 8,810,252 miles, some 70,000 less, and carried 107,023,195 passengers, or about 3 800,000 more, than in the previous year. The total earned income was £394,531, and the gross profit (after deducting working expenses and £5,706, war allowances) amounted to £147,701. The balance on the year's working, after meeting all usual charges, was £69,939, as against £77,607 the year before, and was appropriated as to £7,882 to street improvements; £30 018 to renewals fund; £2,000 to the special purposes fund; £7,163 to the accumulated surplus fund; and £22,876 in aid of the rates. The tramway power station was transferred to the electric supply department on September 29th, 1914. Under the new arrangement 11,352,349 units were purchased from the electric supply department, and 6,977,426 units generated, the cost being stated as ·646d. per unit, as against ·446d. in the previous year (when the figures related to tramway generating and distributing costs only). The balance of the accumulated surplus fund amounts to £28,134; of the renewals fund, £3,186; of the insurance fund, £2,202; and of the special purposes fund, £928. The accounts include data as to the department's motor-'buses, which ran 369,404 miles, at an average working cost of 7d. per mile, leaving a gross profit of 3·4d., of which financial charges absorbed ·61d., the balance being placed to reserve and renewals. Petrol cost 1·68d. per 'bus mile. The omnibus reserve and renewals funds amount to some £6,900.

Southampton.—Year's Working.—For the year ended March 31st last, the Corporation tramways carried 13,265,715 passengers, running some 1,700,000 car-miles, both figures being in excess of those of 1913-14. The gross receipts were £71,038 and the gross profit £20,732, this comparing with £24 077 in the previous year. After providing for interest and sinking fund charges and allocating £5,000 to renewals, a sum of £5,134 was contributed in rate relief. The depreciation and renewals fund now stands at £14,251.

South Shields.—Year's Financial Result.—The Tramways Committee in its annual report states that the revenue for the year ended March 31st, totalled £39,815, and that after meeting all expenses there remained a gross balance of £14,335; of this sum £8,741 was absorbed by interest and sinking fund charges, leaving a net profit of £5,594, of which £2,400 was allocated to rate relief, and £3,194 to the reserve fund, which stands at £28,337.

West Ham.—The Corporation has been recommended to agree to the transfer of the control of the maintenance of the tramway tracks, from the Highways to the Tramways Committee, and has also been recommended to alter the title "tramways manager" to that of "general manager," and to fix the next two increments to the tramways manager's salary at the rate of £100 per annum instead of £50, as previously agreed.

Wigan.—Tramway Strike.—On Monday, the motormen, conductors, and depôt employés of the Corporation tramways came out on strike, stopping the whole of the tramway service which serves the Wigan coalfield area. The men have already been granted a war bonus of from 1s. to 1s. 6d. a week, but demand an advance of ½d. per hour on the present wages for motormen and conductors, and 1d. for electricians.

TELEGRAPH and TELEPHONE NOTES.

Colombian Neutrality.—Lord R. Cecil, in answer to a question in the House of Commons with regard to the neutrality of the Colombian Government and the question of the wireless telegraph station at Cartagena, said His Majesty's Government were convinced that the measures taken by the Colombian Government to control the use of wireless telegraphy in Colombia would, if effectively and adequately carried out, be sufficient to prevent the abuse of this means of communication in the interest of our enemies. The Government at Bogota had, moreover, caused a preliminary inspection by a neutral wireless telegraph operator of the station of Cartagena, in order to ensure the efficient local execution of their instructions; and they had further stated that a competent neutral would be invited to inspect this station and report upon the adequacy of the measures taken, so that no doubt might remain that their instructions had been effectively carried out by the local authorities.—*Times.*

Secret Wireless.—A wireless station has been discovered in Lisbon, with branches in the neighbourhood. Five wireless operators connected with the establishment were arrested.

Telegraph Censorship.—In connection with the censorship of telegrams to places abroad, the Postmaster-General announces that arrangements have been made for the reimbursement of any unexpended balance of the charges remaining in the hands of the Post Office and of the cable companies which have been paid for telegrams stopped by the censors while in the course of transmission. The concession is subject to the following conditions:—

1. Reimbursement will not be made in respect of any telegram on which the unexpended balance is less than 4s.
2. Every application for reimbursement must be accompanied by a written statement from the addressee that the relative telegram has not been delivered.
3. No information can be given as to the method in which the amount reimbursed is arrived at, and no inquiry on this point can be entertained.
4. The arrangement will not apply to telegrams sent prior to June 15th, 1915.

Telephone Service Economies.—In compliance with a Treasury ruling, and in order to carry out a policy of economy, the G.P.O. is spending as little as possible on telephone extensions. Provision has to be made for services required for naval and military purposes, including what is required for the Munitions Department, and a number of circuits must be provided for other than Government special services; for instance, the War Loan involved new offices and telephone installations. The aim of the Post Office had been to restrict new installations for the public generally to such as appear to be necessary and circuits that do not involve large expenditure and do not make great demands on the much-depleted engineering staff. No hard-and-fast rule has been made that new installations are not to be undertaken, but an application must have a very good case to support it.—*Times.*

Telephones in Warfare.—Mr. Charles R. Darling, in the course of an address on "Field Telephones" at the Society of Arts last week, said that in the fighting zone at the present time flag signalling, being too conspicuous, had been abolished, and all communications from the trenches to the base and between the different units in a battery were carried out with the aid of telephones. With regard to the training of telephonists, he said that naturally, with the large armies that were being gathered together, the number of field telephonists who could be obtained was not as many as might be desired. He suggested therefore that science teachers should combine together and offer their services for the training of field telephonists.—*Morning Post.*

Wireless Control.—The United States Government is said to be negotiating for the purchase of a device for the wireless control of torpedoes, invented by Mr. John Hays Hammond, jun.

Wireless Libel.—An action was brought in the Chancery Division by Prof. Arthur Schuster, one of secretaries of the Royal Society, against the publishers and printer of *Pearson's Weekly*, in respect of an article suggesting that Prof. Schuster's private wireless apparatus was discovered and "seized." Defendants offered an ample apology, paid the costs, and gave 50 guineas to the Red Cross funds. The judge described the libel as a cruel one, Prof. Schuster's loyalty and good faith being beyond question.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Adelaide.—August 25th. Dry cells, earth clips, recording counters, and various other instruments and apparatus, for the P.M.G. See "Official Notices" July 9th.

September 1st. Condensers, testing sets, rheostats, Morse sounders, and Wheatstone transmitters for the P.M.G. See "Official Notices" July 23rd.

Perth.—August 25th. P.M.G. One ton of crushed salammoniac, and 1½ tons of steel galvanised wire. See "Official Notices" July 23rd.

August 25th. Common-battery telephones, for the P.M.G. See "Official Notices" July 30th.

September 29th. Telephone switchboard parts, for the P.M.G. See "Official Notices" July 30th.

Sydney.—September 13th. Council. A.C. and D.C. electric motors. Specification (10s. 6d.) from E.L. Department, Town Hall.*

September 6th. Metropolitan Board of Water Supply and Sewerage. Centrifugal pumps and electric motors at Richmond pumping station.* Acting Secretary, 341, Pitt Street, Sydney.

Melbourne.—August 24th. Telephone instruments, for the P.M.G.*

August 31st. Switchboard parts, for the P.M.G.*

Blackpool.—August 13th. T.C. Wiring and fitting for electric lighting of the new Military Convalescent Camp, Squire's Gate, Blackpool. Particulars, &c. (one guinea, returnable), from the Borough Electrical Engineer.

Bristol.—August 23rd. Corporation. One 6,000-KW. three-phase steam turbo-alternator with condensing plant. See "Official Notices" July 23rd.

Earby.—August 16th. Dynamo, wiring, &c, for electric light at the sewage disposal works, for the U.D.C. Mr. J. E. Aldersley, Engineer and Surveyor (returnable deposit of £1 1s.).

Glasgow.—August 12th. Corporation. Electric lighting installation at the Govanhill and district public baths and washhouses. Specifications from the Office of Public Works, 64, Cochrane Street.

London.—H.M. Office of Works.—August 13th. Twelve months' supply of incandescent electric lamps. See "Official Notices" to-day.

Middleton.—August 10th. Corporation. Coal for the electricity works. Particulars from Mr. S. Pauls, Electrical Engineer.

Pontardawe.—August 12th. Electric wiring and fittings for the new Police Court, for Glamorgan C.C. Mr. T. M. Franklen, Clerk, Cathays Park, Cardiff.

Salford.—August 9th. Supply of coal for the Electricity Department. Particulars from the Borough Electrical Engineer, electricity works, Frederick Road.

South Africa.—Johannesburg.—August 25th. 8,600 drawn-wire spiral filament traction lamps, spare parts for tramcars, for the Municipal Council.*

September 25th. For the T.C. Two turbo-alternator sets, condensing plant, switchgear, &c. Specification, &c., on deposit of £2 2s., from Mr. J. H. Dobson, General Manager.*

Wigan.—August 13th. Fifty tons of street tramway rails, B S.S. No. 3; 150 cranked tie-bars; and 20 pairs of fishplates, B.S.S. No. 3. Particulars from Mr. A. T. Gooseman, Borough Engineer, King Street West.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The Sydney Municipal Council has accepted the following tenders:—

Supply of low-tension D.C. feeder panels.—Australian General Electric Co., £248.

Switchgear for A.C. sub-stations:

- Extensions to existing Westinghouse switchgear.—Standard Waygood Hercules, Ltd.. £1,062.
- Extensions to existing Ferranti switchgear.—Noyes Bros., £1,036.
- Extensions to existing B.T.H. switchgear.—Australian General Electric Co., £1,144.
- 18 5,000-volt feeder panels, £2,520; 80 5,000-volt transformer panels, £3,438.—Messrs N. Guthridge, Ltd.
- 22 415-volt transformer panels, £1,020; 28 415-volt distributor panels, £1,274; eight 415-volt summation panels, £575.—British General Electric Co.

Ferranti meters, 5, 10 and 25-amp.—Noyes Bros.

—*Australian Mining Standard.*

Brentford.—The tender of Messrs. Harrison & Gubbins has been accepted by the Guardians, at £48, to wire the Dundee, Grosvenor and Percy Houses.

Bundoran (Co. Donegal).—The Urban Council has accepted the tender of Messrs. Myles & Co., at £78, for lighting the town by electricity.

Chester.—The Refuse Disposal Committee has recommended the purchase by the Council of three Edison electric wagons (two-ton capacity) from Messrs. Drake & Gorham, Manchester.

Erith.—Subject to the L.G.B. sanctioning a loan, the U.D.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for a water-tube boiler and accessories for the electricity works, at £5,054.

Holmfirth.—The Electricity Committee has accepted the tender of Messrs. Swire & Co., Manchester, for a cooling tower and cast-iron tank.

Kingston-on-Thames.—The Lighting Committee has accepted the tender of Messrs. W. Cory & Son for 1,600 tons of Insdale rough small coal, at 22s. a ton.

Manchester.—The Electricity Committee has accepted the following tenders for the supply of stores required during the ensuing 12 months :—

Asbestos goods.—L. Andrew & Co.
Paper-insulated service cables.—B.I. & Helsby Cables, Ltd.
Dynamo brushes.—Wm. Patterson.
Carbon brushes.—Le Carbone, and Morgan Crucible Co., Ltd.
Earthenware bridges.—Doulton & Co., Ltd.
Earthenware pipes.—Isherwood Bros., Ltd.
Lampholders, tumbler switches, &c.—British Thomson-Houston Co., Ltd.
Single-pole damper fuses.—Samuel Gratrix, jun., & Bro , Ltd.
Firebricks and fireclay.—Glenboig Union Fireclay Co., Ltd.
Arc lamp resistances, copper strip, fuses, switches, &c.—Gaskell & Grocott.
Arc lamp resistances, copper strip, &c.—Bullers, Ltd.
H.T. corrugated racks.—Doulton & Co., Ltd.
Cable protectors.—Doulton & Co., Ltd.
Balata belting.—Charles Macintosh & Co., Ltd.
Armature tape, &c.—L. Andrew & Co.
Bitumen and other tape.—W. T. Henley's Telegraph Works Co., Ltd.
Steam and gas fittings —James Russell & Sons and John Russell & Co., Ltd.
General wiring.—Liverpool Electric Cable Co., Ltd.
Fuse wire.—B.I. & Helsby Cables, Ltd.
Workshop flexible, &c.—Chas. Macintosh & Co., Ltd.
Flexible.—L. Andrew & Co.
Tubing and accessories.—Brotherton Tubes & Conduits, Ltd.
Tubing.—Eureka Conduits & Fittings Co.
Recorder paper.—Eckstein, Heap & Co., Ltd.
Hellesen dry cells.—A. H. Hunt.
Soldering paste.—W. P. Burnley & Co., Ltd.
Varnish.—Pinchin, Johnson & Co., Ltd.
Evertite packing.—R. L. Ross & Co., Ltd.
Crucible.—Morgan Crucible Co., Ltd.
Anti-sulphuric enamels.—Griffiths Bros. & Co.
Nickel chrome wire and strip.—Wiggins & Co.
Tinned-steel and armature wire.—W. N. Brunton & Son.
D.C.C., silk-covered and Eureka wire.—London Electric Wire Co. and Smiths, Ltd.
Enamelled wire.—Connolly Bros., Ltd.
Box compound.—Callender's Cable & Construction Co.
Adhesive tape.—Connolly Bros , Ltd.
Metal polish.—Matchless Metal Polish Co., Ltd.
Pipe compound.—W. H. Mitchell & Co., Manchester.
Boiler tubes, land type.—Babcock & Wilcox, Ltd., London.
Boiler tubes, marine type.—British Mannesmann Tube Co.
Compo. and plastic magnesia.—Newalls Insulation Co., Ltd.
Adamant.—S. & C. Bishop.
Thermometers.—T. Armstrong & Bro.
Packing.—Bell's United Asbestos Northern Agency.
Lion jointing and packing.—James Walker & Co., Ltd.

The Sanitary Committee has reaffirmed the resolution accepting the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for lamps. The tender was mentioned at the last meeting of the City Council, when the Town Clerk undertook to secure definite information from Somerset House as to the composition of the firm named. The tender of Messrs. L. E. Wilson & Co. for providing and fixing telephones at Monsall Hospital has been accepted.

The Electricity Committee has accepted the tender of Messrs. Johnson & Phillips, Ltd., for cable.

Menston.—The Wharedale Union Joint Hospital Committee has accepted the tender of the Leeds Private Telephone Co., at £135, for installing telephonic intercommunication between the different wards of the hospital.

Rotherham.—The Corporation Electricity and Tramways Committee has accepted the following tenders for coal for the Electricity Department :—

Earl Fitzwilliam's Collieries.—6,000 tons of slack, at 14s. per ton.
Sheepbridge Coal & Iron Co., Ltd.—4,000 tons of Glapwell smudge, at 11s. 8d. per ton.

Salford.—The Electricity Committee has accepted the following tenders :—

Bertram Thomas.—Switchgear for rotary converter, £292.
F. Mitchell & Sons.—Alterations and additions to buildings and the construction of foundations at the Frederick Road station, £1,070.
Aiton & Co., Ltd.—Piping, &c., for additional 5,000-KW. turbo-alternator, £279.

Material and stores for the period ending March 31st, 1916 :—

W. T. Glover & Co., Ltd.—Unarmoured cable.
Dussek Bitumen Co.—Joint-box compound.
G. Hattersley & Sons, Ltd.—White tape.
Henley's Telegraph Works Co., Ltd.—Rubber strip.
General Electric Co., Ltd.—Copper fuse wire.
Doulton & Co., Ltd.—Stoneware conduits, £100.
B.I. & Helsby Cables, Ltd.—Maximum-demand indicators, £95.
Le Carbone.—Motor carbon brushes.
David Walton & Co.—Meter boards and blocks.
Vacuum Oil Co., Ltd.—Cylinder oil.

Southampton.—The T.C. has received nine tenders for the supply of coal to the electricity works for periods of three, six, or twelve months, and has decided to purchase from Messrs. Cory Bros. & Co., Ltd., 6,000 tons, at 21s. 3d., and 2,000 tons from Messrs. A. Usher & Co., at 21s. 9d. per ton.

Watford.—The U.D.C. has accepted the tender of Messrs. Bowaters for 1,560 tons of Baddesley bean coal for the electricity works, at £1 1s. 6d. per ton.

Willesden.—The tender of Messrs. Venables has been accepted by the D C. for the provision of telephonic communication between various departments of the municipal offices and the temporary offices recently erected.

Woodford.—The U.D.C. has accepted the tender of the Walter's Electrical Manufacturing Co., for the installation of fire alarms, at a payment of £88 on completion of the work and £88 annually for four years.

Woolwich.—The following tenders have been accepted on the recommendation of the Electricity Committee :—

Babcock & Wilcox, Ltd.—Coal and ash-handling plant, coal chutes and rack valves, £1,175.
Willans & Robinson, Ltd.—Set of re-action and impulse blading for turbines, £94 10s.

FORTHCOMING EVENTS.

North of England Institute of Mining and Mechanical Engineers.—Saturday, August 7th. At 2 p.m. At Newcastle-on-Tyne. Annual meeting.

NOTES.

Educational Notes.—MUNICIPAL SCHOOL OF TECHNOLOGY, MANCHESTER.—The prospectus of University courses provided by the School of Technology for the session 1915-16, has just been issued; it contains an account of the splendidly equipped laboratories—in the department of Electrical Engineering there are four 100-KW. generating sets and a 50-KW. turbo-generator, as well as over 100 motors, aggregating 1,250 H.P. A novel feature of the prospectus is a series of summaries of approved courses, which students proceeding to the degree of B.Sc.Tech. or the Certificate in Technology are recommended to follow.

UNIVERSITY OF BRISTOL.—The session in the Faculty of Engineering will commence on September 14th; in Science, &c., on October 1st. Particulars are given in our advertisement pages to-day.

The Manufacture of Insulators in Australia.—In the *Melbourne Age* for June 8th a lengthy and interesting article appears relating to efforts that are being made at Box Hill, within 10 miles of Melbourne, in connection with the manufacture of insulators. Some time ago in the district named a remarkable deposit of clay was discovered, having many of the properties essential to the manufacture of art pottery and a special suitability for the non-conductive properties desired in insulators used for telegraphic and electrical purposes. Vast quantities of insulators are used annually throughout Australia. The Postal Department alone has an annual consumption of about 800,000, while electrical supply undertakings are also large users. The Commonwealth Art Pottery and Insulator Co. acquired this valuable bed of clay, and has since worked it, mostly in the production of insulators. The company had to start from the beginning and train men to fashion the goods for which there was the best market. Gradually it succeeded. Insulators were made for the Postal Department and for various private consumers; the works were considerably extended, new plant laid down, and additional kilns erected, until in time the establishment became an important factory, employing from 70 to 80 hands. Prior to the war insulators were imported from Germany and Austria; a few came from Japan. The Box Hill works might compete with European manufacturers, but had no chance against labour that considered itself handsomely remunerated at 7s. per week. Recently the Postal Department called for tenders for insulators involving a considerable supply. Imagine the consternation among the shareholders and employés of the Commonwealth Art Pottery Co. when the rumour got about that the Postmaster-General intended to accept a Japanese tender. Happily, however, the Commonwealth Art Pottery Co. obtained an order for 200,000 insulators. The works are now in full swing.

The writer proceeds to give a brief account of the manufacturing and sorting operations and processes. There are six filter presses producing about 10 tons of plastic clay per day; the two pug mills treat a similar quantity; three stamping machines have each a capacity of 3,000 insulators per day; the 13 lathes have an average capacity of 500 per day; the 4 kilns have an average capacity of 9,000, and the average stock in process of manufacture is 45,000. Insulators only are produced, the clay being especially suitable for the manufacture of high-tension ware. It is practically the only deposit of clay in the State which has so far turned out any considerable quantity of insulators suitable for electrical installations. In addition to being used by the Commonwealth Government, the company's insulators find customers in the Melbourne Electric Supply Co., the Councils of Northcote, Brunswick and Port Melbourne, the North Melbourne and Essendon Electric Tramway Co., and numerous local and inter-State firms. The bulk of the output, however, has been absorbed by the Postal department, private orders being necessarily of an intermittent character. Although numerous attempts have been made in a small way to supply high-tension insulators, only the Commonwealth Art Pottery Co. has succeeded on any extensive scale. "Being a combination of primary and secondary production, the industry should become one of the settled activities of the Commonwealth. The manufacturing cost is made up of about 92 per cent. labour and 8 per cent. material. The industry is subjected to a Wages Board, and the rate of pay is considerably higher than the rate of wages in foreign countries. Germany and Austria, hitherto the chief suppliers, pay wages of one-third to one-half those fixed by the Wages Board, and, despite the sneers of the free trade organ about undue preference to local industry, it is to be hoped no Government contract will ever be allowed to run in that direction. With the perfecting of the plant and appliances, and the increased skill of operatives a steady reduction in the cost of manufacture may be anticipated."

Fire.—The *Daily News* states that the electric power station at the Ebbw Vale works, near Newport, was completely destroyed by fire on Sunday. It was well equipped with the latest machinery, and it is estimated the damage will amount to thousands of pounds. "Thousands of men are rendered idle. The fire is believed to have been caused by the fusing of live wires. Practically all the local industries have been brought to a standstill, and as electricity was supplied to the town the streets of Ebbw Vale are in darkness."

Fatality.—On Wednesday, last week, an accident took place at the works of the Shipley Fan Co., electrical and ventilating engineers, Valley Works, a young man—James Rogers, mechanic—whilst standing on a ladder attending to some belting having his right arm caught and being whirled round the shafting. The arm was taken right off, and the injured man was removed to Saltaire Hospital.

An inquiry was held at Gateshead-on-Tyne, on the 2nd inst., into the death of Andrew Turnbull Crook, a chargeman, at Redheugh Colliery. A stoneman at the colliery, named Walter Harbottle, said that early on the morning of July 30th Crook said to him that as it was getting near food time and the place was drained he would stop the electric pump. Crook went away, but did not return, and as he (Harbottle) wanted a shot fired he sent a man named Mucklow to seek Crook. Mucklow returned and said he could not rouse Crook, who was lying on his side and appeared to be dead. Witness went to the pump and found Crook lying near the switch. The current was switched off. There was a burnt mark on Crook's right wrist, and his nose had been bleeding. Artificial respiration was tried but without success. Edward Watson, an electrician at the colliery, said there were three switches connected with the pump. Crook would pass in front of the pump to the switch on the main cable. He would shut that off, then he would shut off the starting switch, and, finally, the brush switch. After the accident witness went to the pump and found all the switches correctly turned off. He found deceased lying on the ground alongside the switch to the main cable. Witness examined the main cable and found about 6 in. of the cable with the insulating material torn off. The cable was insulated with rubber, then tape, and again with cotton braiding. The portion of cable to which he referred was quite bare. He found a piece of the cable tape lying between the switches. He examined the cable and switches on July 26th, and then they were all right. The jury returned a verdict that deceased had been "electrocuted," but there was no evidence to show how he had come into contact with the current.

Trading with the Enemy.—The Public Trustee, as custodian for England and Wales of enemy property, has issued a special notice to the Press drawing the attention of bankers, traders and others to important provisions of the new Act as follows:—

1. Dividends and interest payable in respect of all classes of securities held for enemies are now payable to the custodian. Under the provisions of the new Act interest on securities issued by, or on behalf of, British, Colonial or Foreign Governments, or Corporations or municipal or other authorities, and moneys representing the payment off of the capital of any securities are payable to the custodian. The duty of making such payments to the custodian, and of furnishing him with the necessary particulars, rests with the person, firm or company through whom the payments in the United Kingdom are made.

Accountable parties should apply to the Public Trustee for Receivable Order "A," upon which the return should be made. No money should accompany the receivable order, but a warrant directing payment will be issued in due course.

N.B.—Where coupons or drawn bonds to bearer are held for the accounts of enemy persons the holder should apply to the office of the Parliamentary Counsel, Whitehall, S.W., for a licence authorising the presentation for payment of such instruments, and should apply to the Public Trustee for copies of Receivable Order "A," which should be completed and handed to the paying authority, upon whom the duty will then fall to account to the custodian.

2. The obligation to register property with the Public Trustee under Sec. 3 (1) of the earlier Act is now extended to (*a*) bank balances and deposits; (*b*) debts to the amount of £50 and upwards.

All persons, firms or companies with whom enemies have bank balances or deposits or who owe £50 or more to enemies (apart from those dividends, &c., payable to the custodian) should apply to the Public Trustee for Registration Order "F."

N.B.—The Act provides that the liability to disclose property of any nature held for enemies shall apply to companies as well as to persons and firms.

Companies who have not already disclosed property under Sec. 3 (1) of the old Act should therefore apply to the Public Trustee for Registration Order "B."

The term "enemy" means any person or body of persons of whatever nationality resident or carrying on business in the enemy country, but does not include persons of enemy nationality who are neither resident nor carrying on business in the enemy country.

Attention is called to the penalties fixed by the Trading with the Enemy Amendment Act, 1914, for non-compliance with the requirements thereof, and to the fact that such penalties will also apply for non-compliance with the requirements of the present Act.

L.C.C. Tramway Wages.—The ballot of the L.C.C. tramway employés shows a big majority in favour of accepting the Conciliation Board award as against Board of Trade arbitration. The award offered the men a war bonus of 3s. per week, or 6d. a day to men earning 40s. per week or under. The claims of the men for a permanent increase of wages of 1s. per day, overtime at the rate of time and a half, an extra allowance of 2s. 6d. per day to motormen on trailer cars, and a reduction in the hours of labour to eight daily were refused by the Conciliation Board.

Indian Trade.—A Reuter dispatch from Simla states that in view of the success which has attended the sample exhibition of goods heretofore imported from Germany and Austria-Hungary recently held in Calcutta and other centres, the Government has decided to establish a permanent commercial museum in Calcutta in order to bring manufacturers and traders together and develop the natural resources of the country.

Volunteer Notes.—The Birmingham Electrical Engineers (Volunteers) have been in camp at Luddington, a village on the banks of the Avon, from Friday to Wednesday last. They have had about 400 names on their books, but as over 50 men have joined the Regular Forces, and a large number of the remainder are on Corporation and Government work, it was not expected that more than 100 men would be able to go into camp. The force was under Sub-Commandant D. Shanks.

Engineering Institutions' Volunteer Training Corps.—Headquarters—Marconi House, Strand, London, W.C.

Drill Centre.—By kind permission of Lieut.-Colonel A. E. Le Rossignol, head-quarters of London Electrical Engineers, 46, Regency Street, London, S.W.

Company Orders.—By Lieut.-Colonel C. B. Clay, V.D., Commandant, for week ending August 14th, 1915.

Monday, Wednesday and Friday.—Drills, 6.30 and 7.30 p.m.

All applications for enrolment should be sent to the Commandant, Marconi House, Strand, from whom all particulars can be obtained.

E. G. Fleming,
Company Commander and Acting Adjutant.

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, August 5th, 1915:—

Captain of the week, Capt. Eastwood; Orderly Officer, Mr. R. P. Groom Johnson.

Week-end Parades.—Saturday, August 7th.—The Battalion will parade at 2.30 p.m., at Baker Street Station, and entrain for Wembley. Officers will bring with them notebooks and sketching material.

Sunday, 7 a.m., reveille; 10 a.m., Church Parade; 10.20 a.m., Parade under Company Commander; 2.15 p.m., Battalion Parade.

Resignations.—The following members, having obtained temporary commissions in His Majesty's Forces, are placed on the honorary list of the corps:—Mr. Last Smith, London Welsh; Mr. O. Onion, Royal Engineers; Mr. B. Strachan, 3/24th County of London Regiment (Queen's); Mr. Frank K. Chater, The Welsh Regiment; Mr. Wilfred H. Carey, Army Service Corps.

The following extracts from C.A.V.T.C. letter, dated July 20th, 1915, are published for information:—"'Previous military training, if any' (Paragraph 4 of Corps Register Form XII), shall be taken to include previous military service in a Volunteer Training Corps. It will be necessary, therefore, for all recruits to answer this question accordingly. No man shall be accepted as a member of any Unit of the Volunteer Training Corps, who less than three months previously has been a member of any other Unit, except with the consent of his original Commanding Officer.

"*Drill.*—The completion of 40 drills does not do away with the obligation for Volunteers to continue to attend drills. A member of a Volunteer Corps who does not attend a minimum of four drills per month shall be liable to be struck off the roll of the Corps, unless absent on leave given by the Commanding Officer of his Unit."

Establishment.—The Establishment for a Company is as follows:—One Acting Company Sergt-Major; one Company Q.-M. Sergeant; four Platoon Sergeants; eight Corporals; eight Lance-Corporals. This Establishment is on no account to be exceeded. Any Company above these numbers must absorb men already appointed before further appointments can be made.

Musketry.—Saturday, August 7th, Acton Range, 2.30 p.m.; "C" Company, as previously arranged. Members of "C" Company wishing to shoot should send in their names to their Company Commander without delay.

On Saturday, August 7th, there will be a 500 yards' target at Bisley, for members who have not previously shot, and who send in their names to the Musketry Officer not later than Friday morning, 6th inst. Members will report themselves to Sergt. Cotter, at No. 9 Barrier, Waterloo Station, 12 45 p.m.

Acton Range.—There will be shooting as usual on Tuesday and Thursday, at 2 30 p.m.

A. G. Joiner, *Captain and Adjutant.*

Board of Trade Inquiries.—The Board of Trade Commercial Intelligence Branch has issued its list, No. 32, for the week ended July 31st, giving particulars of further inquiries received for names of makers of specified articles. Under "Electrical Apparatus and Accessories," inquiries were received for electric cables, and felt tape for insulated wire covering.

X-Ray Gift to France.—The most up-to-date travelling X ray motor ambulance that has ever been constructed is about to be sent from London to the Front. It cost over £1,000, subscribed by the public to the fund organised by the London Committee of the Scottish Women's Hospitals (N.U.W.S.S.), and will be attached to the field hospital at Royaumont.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—An error occurred in the paragraph which appeared in our last issue respecting Mr. L. Marshall Jockel. Mr. Jockel has resigned his appointment as engineer-in-charge of the York Corporation electricity and tramways department to take up the position of assistant engineer to the Government of Malta electric lighting department at Valetta. During his period of service with the York Corporation he also held the post of Lecturer on Electrical Engineering at the N.E. Railway Institute Evening Classes, which classes are arranged for students from the city as well as from the railway company.

Mr. Archibald J. Howard, borough electrical engineer of Taunton, was married on July 28th at the Albemarle Baptist Chapel, Taunton, to Miss Florence U. Taylor. On the previous day the staff and employés of the electricity department presented Mr. Howard with a clock, Mr. R. J. Yendall, works' foreman, acting as spokesman on their behalf.

Mr. F. A. Nicholls, of the Islington electricity department, has been appointed chief assistant engineer in the electricity department of the Leek Urban District Council.

Mr. Tom Hudson, eldest son of Mr. C. W. Hudson, of Bradford, has been granted a commission as Sub-Lieut. in the Royal Navy. Lieut. Hudson has been employed at the Lancaster electricity works, and also at Devonport on Government work.

Mr. H. A. Ratcliffe, head of the testing department of the Manchester electricity works, has been co-opted a member of the Manchester Air Pollution Advisory Board, which was formed some time ago by the Manchester City Council.

Mr. R. H. Fox has been appointed chief electrical engineer at Musselburgh (Scotland), at a salary of £215 per year.

The marriage took place at All Saints' Church, Frindsbury, Rochester, on July 22nd, of Mr. J. A. Smith, of the Kent Electric Power Co., and Miss Winifred Edith Whyte, eldest daughter of Mr. Andrew Whyte, of Frindsbury.

By 9 votes to 4 the Redditch U.D.C. has adopted a report of the Electricity Supply Committee recommending that the application of Mr. R. Mayne for an increase of £100 per annum in his salary be refused.

On July 17th Mr. W. Coles, charge engineer at the Luton Corporation electricity works, was married to Miss R. Bowles, of Cambridge. Mr. Coles's colleagues at the works presented him with a dinner service.

Tramway Officials.—The Manchester Tramways Committee has acceded, on certain conditions, to an application of Mr. Mattinson, chief civil engineer, for permission to be allowed to apply for a commission in the Royal Engineers.

Mr. A. J. Bousfield, assistant manager of the Isle of Thanet Tramway Co., has secured a similar appointment with the Chatham and District Light Railway Co.

General.—A distinguished conduct medal has been awarded to Private A. Hotz, of the 1st East Surrey Regiment, for conspicuous gallantry on "Hill 60," when he placed himself in front of a communication trench occupied by the enemy, and, on the enemy advancing, attacked them with hand grenades and dispersed them. Before the war Mr. Hotz was employed in the construction department of the British Thomson-Houston Co., Ltd., and the members of the B.T.H. staff are naturally very much pleased with the winning of this reward for gallantry by one of their number.

On the eve of departure for Australia, Mr. W. A. Holmans, a member of the staff of the Edison & Swan United Electric Light Co., Ltd., Ponder's End, Middlesex, for over 16 years, was presented by the staff with a diamond ring, a cabin trunk and a pocket-book. Mr. Holmans is to be stationed in the Ediswan showroom, at Melbourne.

The vacancy caused by the death of Mr. James Walmsley, who had charge of the electric plant at the Blackpool Tower, Grand and Palace, has been filled by the appointment, out of 240 applicants, of Mr. Wm. Quayle, assistant superintendent engineer to the British-American Tobacco Co., Liverpool.

We have received a copy of the first number of the *Staff War Bulletin*, issued by the County of London Electric Supply Co., Ltd. It has been published for private circulation, and while it is of great interest as showing what members of the staff are now doing in connection with the war, it will also be of permanent value as a record of the part played by the employés of the County and Associated Companies in the great national struggle. A full Roll of Honour is followed with notes regarding, and photographs of, those of the number who have been killed in action; also a list of wounded; and extracts from letters from men at the Front. Among a number of general notes, we read that Mr. J. B. Braithwaite, the chairman of the company, has two sons on active service in the Dardanelles; Captain A. E. Sanderson, son of one of the directors (Mr. A. H Sanderson), is also at the Front. One son of Mr. C. P. Sparks, the engineer-in-chief, has been awarded the military cross, and has been twice mentioned in dispatches, and two other sons of the new I.E E. President, are also on service as lieutenants. 168 members of the County and Associated staffs are serving as special constables.

On July 28th, at Holy Trinity Church, Kingsway, W.C., a marriage took place between Mr Frederick E. Chilton, London manager for Messrs. Royce, Ltd., of Manchester, and Miss Winifred Elsie Eleanor Gordon, daughter of the Rev. S. C. Gordon, M.A., B.D., of Bromley, Kent.

Mr. A. D. Bergtheil, electrical engineer, a natural-born British subject, has, by a deed poll, renounced the surname of Bergtheil and assumed the name of Berkeley in place thereof.

Roll of Honour.—Private Henry Herbert Davenport, who was with the British Thomson-Houston Co, Ltd., of Rugby, has been killed in action in France. He was shot through the head by a sniper.

Private Ll. L. Jones, of the Plymouth Battalion Royal Naval Division, who has been killed in action in the Dardanelles, was on the staff at the tramway depôt at Johnstown. He joined the Royal Marines last October.

Private Alexander Hanley, of Manchester, who is officially reported "missing" since June 28th, was serving with the 1/4 Royal Scots at the Dardanelles, and prior to the war was an apprentice with the British Westinghouse Electric and Manufacturing Co., Ltd., at Trafford Park.

Obituary.—Mr. Robert Hammond.—We deeply regret to learn, as we go to press, that Mr. Robert Hammond passed away on Thursday morning, at the age of 65 years. Mr. Hammond had been unwell for several weeks past, and had been unable to attend at his office. We shall refer to the deceased gentleman's career next week.

The *Sydney Daily Telegraph* records the death, which occurred at Rylstone early in June, at the age of seventy-eight years, of Mr. Audley Coote, who is described as "the father of Australia's Pacific cable service." His last work in this connection was the laying of the cable between Queensland and New Caledonia. "For successfully carrying out this undertaking Mr. Coote was to have received the French Legion of Honour, but he died before the formalities preliminary to the acceptance of this honour by a non-Frenchman had been completed." He was a lifelong friend of, and co-worker with, the late Sir Henniker Heaton.

We regret to note from the *Times* "Deaths" column that Mr. John C. Gill, Assoc.M.Inst.C.E., chief engineer to the city of Peterborough, has passed away at the age of 63 years. In his capacity as city engineer he was also responsible for the electricity supply system.

The death occurred on July 27th of Mr. Jas. Smith, head of the firm of Jas. Smith & Sons, Ltd., electricians, &c., Carmichael Road, South Norwood. Deceased, who was in his 87th year, served on the Croydon Town Council for 17 years.

The death occurred suddenly on July 26th, from heart disease following neuritis, of Mr. Fredk. John Gale, who was for many years associated with Brooking & Co., electrical engineers, of Queen Street, Exeter.

Will.—According to the *Times*, the late Major Flood Page left £5,671.

NEW COMPANIES REGISTERED.

Ramsden Green, Ltd. (141,122).—This company was registered on July 27th, with a capital of £2,000 in £1 shares, to take over from F. J. Green the business of an electrical and mechanical engineer carried on by him at 10, Wagner Street, Old Kent Road, S.E., as the Crathorne and Green Manufacturing Co. The subscribers (with one share each) are: F. J. Green, 10, Wagner Street, Old Kent Road, S.E., engineer; B. E. Green, 154, Beulah Hill, Norwood, S.E., private secretary. Private company. The number of directors is not to be less than two or more than five; the first are F. J. Green (permanent) and B. E. Green. Remuneration of F. J. Green, £300 per annum. Registered office: 10, Wagner Street, Old Kent Road, S.E.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Accumulator Co., Ltd. (125,172).—Capital, £13,900 in 4,000 "A" and 8,000 "B" shares of £1 each, and 38,000 defd. of 1s. each. Return dated December 31st, 1914 (filed March 24th, 1915). 4,000 "A" and 38,000 defd shares taken up; 18s. per share called up on 4,000 "A"; £3,200 paid, leaving £400 in arrears; £1,900 considered as paid on 38,000 defd. shares. Mortgages and charges: Nil.

Greenwood and Batley, Ltd. (27,098).—Capital, £400,000 in 14,000 pref. and 26,000 ord. shares of £10 each. Return dated July 13th, 1915. 11,066 pref. and 18,052 ord. shares taken up (of which 13 ord shares have been forfeited); £10 per share called up on 6,934 pref. and 12,134 ord., £3 per share on 1,466 pref., and £5 per share on 1,252 ord.; £201,312 paid, leaving £26 in arrears; £73,320 considered as paid on 7,332 shares (2,666 pref. and 4,666 ord.). Mortgages and charges: £100,000.

Electric Supply Co. of Western Australia, Ltd. (56,551).—Capital, £100,000 in £1 shares. Return dated June 23rd, 1915. 75,007 shares taken up; £46,607 paid; £28,400 considered as paid. Mortgages and charges: Nil.

Guildford Electricity Supply Co., Ltd. (36,725).—Capital, £55,000 in 25,000 pref. shares of £1 each, and 6,000 ord. shares of £5 each. Return dated April 14th, 1915. 18,856 pref. and 3,059 ord. shares taken up; £34,153 paid, including £2 on two ord. shares forfeited. Mortgages and charges: £25,000 1st and £15,000 2nd mortgage debs.

Hastings and District Electric Tramways Co., Ltd. (82,521).—Capital, £372,942 10s. in 130,000 pref. shares of £1 each and 485,885 ord. shares of 10s. each. (Originally £500,000 in 50,000 pref. and 50,000 ord. shares of £5 each. Reduced, 1911.) Return dated March 23rd, 1915. 80,000 pref. and 268,235 ord. shares taken up; £80,000 paid on the pref.; £134,117 10s. considered as paid on the ord. Mortgages and charges: £250,000.

CITY NOTES.

County of Dorset Electric Supply Co., Ltd.

At the meeting held on July 14th, at Moorgate Court, E.C., the directors submitted their report for 1914. They showed that the capital expended and invested in the associated companies amounted to £30,044. The revenue receipts, exclusive of the Lyme Regis dividend, amounted to £1,062, against £46 for 1913. The gross profit (including the dividend for the Lyme Regis Co.) amounted to £340. Against this were placed interest on temporary loans £500, leaving a deficit on the year's operations of £160, against a deficit of £654 in 1913.

The subsidiary companies, viz., the Lyme Regis E.L. & P. Co., Ltd., the Blandford Forum and District E.S. Co., Ltd., and the Swanage E.S. Co., Ltd., have each shown satisfactory progress. The Lyme Regis Co. shows a substantial profit on the year's working, and a dividend of 10 per cent. has been declared. The Blandford Co.'s supply was commenced only three weeks prior to December 31st, 1913, and the Swanage Co. has only been operating for about eleven months, so that these companies are only in their first year of working. The number of consumers in Dorchester on December 31st was 89, in Blandford 39, in Lyme Regis 126, and in Swanage 70. The company's' progress from its inception to the present moment has been uniformly steady and satisfactory.

Electric Supply Corporation, Ltd.

The report of the directors for the year ended December 31st, 1914, shows that the gross earnings during the year amounted to £35,646, an increase of £956 upon the corresponding figures of the previous year. The sum taken into net revenue account amounted to £17,883, as against £15,655 for 1913. After paying interest upon debenture stock and the actual cost of the year's repairs and renewals, there remained with the balance brought forward from the previous year a surplus of £9,844, which the directors proposed to deal with as follows:—To place the sum of £273 to the renewals account, making this fund £10,000; to place £3,000 to a reserve fund; to distribute dividend to the shareholders at the rate of 2¼ per cent. per annum for the year 1914, less income tax, and to carry forward the balance of £1,847. The following table shows the progress made by the company:—

Year.	Equiv. 32-watt lamps connected.	Units sold.	Gross earnings.	Profit, including investments.
1912	186,207	3,730,780	32,387	13,449
1913	201,266	3,975,091	34,690	15,655
1914	214,715	4,258,981	35,646	17,883

The Hendon Electric Supply Co., Ltd., distributed a dividend of 13 per cent. for 1914, and the Dumbarton Burgh and County Tramways Co., Ltd., a dividend of 1½ per cent. upon its ordinary shares. The total amount received has been brought into these accounts.

	Lamps connected. (Equivalent in 32-watt lamps.) 1913.	Increase.
Chelmsford	37,242	2,166
		(Decrease.)
Jedburgh	3,880	211
Melrose	5,138	201
Dalkeith	8,255	758
Dollar	3,214	102
Totnes	6,175	551
Exmouth	17,995	1,632
St. Andrews	25,481	1,371
Hitchin	11,217	1,212
Dumbarton	65,360	7,804
Falmouth	17,309	1,773
Net increase during 1914, 13,449.		
Hendon	97,636	17,803
Dawlish	2,850	855
North Berwick	681	907

These figures take no account of the supply to the Dumbarton Burgh and County Tramways, which used 626,709 units in 1914.

Mr. J. G. B. Stone (chairman) presided at Salisbury House, on July 29th, over the thirteenth annual meeting of the company. The Chairman, in proposing the adoption of the report, expressed regret that the accounts were not in the shareholders' hands at an earlier date, owing to delay caused by the depletion of the head-office staff, many of whom had joined His Majesty's Forces. They would note the satisfactory growth in the number of lamp connections; in the case of Chelmsford they had to record a lower figure than last year, due to the withdrawal of a large customer whom they had supplied at an exceptionally low rate for a number of years, so the reduction in lamp connections was not accompanied by a corresponding loss in profits. The Hendon Co., in which they were largely interested, was progressing most favourably, as evidenced by the handsome dividend they received on their shareholding. The Dumbarton tramway paid the same small dividend, but they hoped would ultimately yield a better return. In connection with Dumbarton, last year he told them they had arranged for a bulk supply for the town, but as the war caused considerable delay in the delivery of the necessary plant, it was only during the current year that the supply had become of beneficial use to them. As regarded the sale of current, he did not think they had been adversely affected by the war, as they had had an increased demand for power supply, more particularly in Dumbarton, which was an active centre for shipbuilding. In other places, dependent on visitors for their prosperity, the ordinary business had been replaced to a large extent by increased trade brought by the billeting of troops. As to the other side of the account, namely, the production of electricity, the actual cost during the year under review had not been very materially affected, though they would have to face higher prices for labour and coal in future. A very large number of their staff were serving with the Forces, and they had at present only 54 per cent. of the men who were in their employment at the outbreak of the war. They recommended bringing the renewals account up to a sum of £10,000, and proposed to continue paying for repairs and renewals out of the yearly revenue, unless they had to meet some abnormal expenditure. There was a considerable increase in their bill for repairs, due to renewal of their batteries. Most of their works had now been in operation for about ten years, and a battery did well if it lasted for that period. It was particularly to meet battery repairs that this fund was built up, and it was gratifying to feel that they could carry out such work without trenching upon it. They now proposed to inaugurate a general reserve fund, setting aside £3,000 for that purpose. Apart from general depreciation charges, they had to bear in mind that item on the balance sheet representing the cost of issuing shares and debentures, and the shareholders would no doubt agree that it would be wise to make some provision of this nature. With regard to the dividend, the board did not think it politic to pay more than 2¼ per cent. The small additional payment under the present conditions was encouraging and marked the general improvement in face of the difficult conditions which had prevailed.

The report was adopted without discussion.

Bombay Electric Supply & Tramways Co., Ltd.

The tenth ordinary general meeting was held on Thursday last week at Electrical Federation Offices, Kingsway, under the presidency of Sir C. Ollivant, K.C.I.E.

In proposing the adoption of the report (see p. 52), the Chairman said it was gratifying to note that the net revenue had continued to expand, notwithstanding many adverse factors. The gross receipts amounted to £302,569, an increase of £26,100, and the net receipts to £157,582, an increase of £12,010, or of 8.25 per cent., as compared with the previous year. The adverse effect of the war upon the traffic had been mainly due to the heavy falling off in both the export and import trade of the port of Bombay, and to the measure of impoverishment resulting from the trade shrinkage. For the first seven months of the year, prior to the outbreak of the war, they carried 24,192,216 passengers, as compared with 23,092,082 during the corresponding months of 1913. But for the second five months they only carried 16,257,418 passengers, as compared with 17,599,940 the year before. Owing to the increase in receipts during the first half of the year, the aggregate gross earnings for the twelve months showed a falling-off of only £788. The decrease in net earnings of £4,961 was, consequently, mainly attributable to the fact that the traffic expenses for 1914 exceeded those of 1913 by £4,173. This was due to the increased expenditure necessitated by the increased running during the earlier months of the year, and to the fact that the decrease in the later months under this heading was offset by the rise in the cost of materials and heavier expenditure on the maintenance of rolling stock and track. They would be glad to note that there had been a recovery in the scale of the traffic receipts since the commencement of the current year, and this, so far, continued to progress. The progress of the electric supply branch of the undertaking had been very satisfactory, the net earnings showing the handsome advance of £17,700 as compared with those of the preceding year. They were fortunate in securing temporary supply for power purposes to two of the Bombay mills during the last six months of 1914; those mills were under contract to purchase electric energy from the Tata Hydro-Electric Co., so soon as that company was able to supply them, and it was in a position to do this early in February, when these two customers passed to the Hydro Co. As that company had now commenced supply at Bombay, it was perhaps desirable that he should remind them that under the terms of its licence it was restricted to supplying factories and railways whose annual consumption was not less than 500,000 units. The fields of operation of the two companies were, therefore, to that extent demarcated. In view of the loss of the temporary mill load, they could not look for the same increase in revenue from the supply branch this year as that recorded last year. But he was glad to be able to inform them that for the five months of the current year, for which returns had reached them, there had been a considerable increase in the number of units sold as compared with last year. All the extensions of the mains laid last year were yielding good results. With regard to the balance sheet, during the year the capital expenditure aggregated £46,461. Of this amount, £36,195 was expenditure in the supply branch, and £10,266 in the traction branch. The provision for depreciation was increased this year to £27,000, as compared with £23,500 last year. They had now at credit of that fund £113,400. The sinking fund for capital redemption had been increased from £41,686 to £57,198. They had found it advisable to postpone for the present some extensions of the tramway lines which they had in contemplation. The very heavy rise in the cost of materials and the adverse influences checking the normal growth of the traffic had dictated this postponement. But, on the other hand, they were steadily pursuing the policy of extending their supply mains into any districts of the city not yet served by their distributors, where it was demonstrated as the result of careful canvassing that the returns in sight justified the expenditure. The progressive realisation by all classes of the Bombay public of the conveniences and economy of electric lighting, and the hygienic benefits of electric fans, had resulted in a growth in the demand for both which rendered possible many extensions which could not have been justified a year or two ago.

Mr. F. C. Rimington seconded the motion, which was carried unanimously.

Yorkshire Electric Power Co.

The report of the directors for the half-year ending June 30th, 1915, states that there has been an increase in the revenue from the sale of electrical energy, but owing to additional costs occasioned by the war, the net profit after payment of mortgage and other interest shows a small decrease on that for the corresponding half-year of 1914. Both wages and materials have become more costly during the war, and the conditions of the coal market have been especially difficult. The net profits for the three half-yearly periods ending June 30th are:—

1915.	1914.	1913.
£9,873 8s. 9d.	£10,414 5s. 0d.	£6,971 18s. 9d.

Under the powers conferred upon them by the Yorkshire Electric Power Act, 1914, the directors have declared a dividend for the half-year on the amount paid up on the six per cent. cumulative preference shares, which will absorb £5,051 3s. 3d., and they are of the opinion that under the circumstances the consideration of a dividend on the ordinary shares should be deferred until the end of the year. The advantages which have repeatedly been claimed for a public supply of electricity have been emphasised by the present conditions. Old consumers have increased their demands upon the company, and many important new consumers are being supplied. Power users whose premises are connected to the company's mains find that with a minimum of expenditure and without delay they are able to meet the unprecedented requirements for war and other purposes. During the half-year applications for £10,995 of the six per cent. cumulative preference shares have been received, and the balance unissued has now been reduced to £2,845. Owing to over one-fifth of the company's employés having enlisted and to the growth of the business, more work has fallen upon a depleted staff. The directors have pleasure in drawing attention to the cheerful spirit with which these extra responsibilities have been undertaken.

Russian Electrical Companies.

The electrical concerns in Russia possessing a good organisation, both for buying raw materials and selling their products, as well as having abundant working capital, were never more prosperous than they have been of late. This can be seen from the following figures from the published reports for the working year 1914:—

	Profits in roubles.		
	1912.	1913.	1914.
General Electricity Co. ...	1,300,000	1,750,000	2,070,000
United Cables Co.	970,000	1,400,000	3,340,000
Siemens & Halske	640,000	500,000	810,000
Duflon Constanovitch & Co.	240,000	250,000	350,000
Siemens-Schuckert	—	1,300,000	1,150,000

Amongst these concerns the United Cables Co. is particularly distinguished by its net profit, namely, 55.6 per cent. on its nominal capital, or more than double that of 1913.

How, asks a Petrograd journal, has such an unprecedented increase taken place in such an abnormal year, when other branches of industry were in more or less difficulty? This question is answered by the report of the company itself, which shows that at the beginning of the war, the company had in stock reserves of metals and other necessary goods for production, which had been bought in the first half of the year at low prices, whilst the finished products were sold in the second half of the year, when prices steadily rose.

The satisfactory position of the company is explained, also, in part by its participation with three other concerns in the consumers' syndicate, called the "Abnehmer-Syndikat." This is a union of consumers of copper which, on its part, is bound by agreements with the Russian syndicate of copper smelters, called the "Myed." Under such conditions it can be understood how the company in the last three years made a net profit of 6,000,000 roubles, or the equal of its nominal capital. Further, the increase in the profits of this company, as well as of others closely associated with it—the General Electricity Co., and Siemens & Halske—is explained by the large orders given for war service. A considerable portion of the profits of all these companies has been put to the amortisation of the cost of buildings, etc., notwithstanding the fact that most of them, as shown below, have paid higher dividends than in 1913.

	Dividends per cent.		
	1912.	1913.	1914.
General Electricity Co.	9	9.4	10
United Cables Co.	8	10	15
Siemens & Halske	6	5	6
Siemens-Schuckert	—	6	5
Duflon Constantinovitch & Co.	12	12½	10

In the first four companies named, down to the period of the war German capital was chiefly interested; but the last-named is French. The house of Siemens-Schuckert is an exception: its dividend was less compared with that of 1913. The decline in the profit of this large concern which, two years ago, with the co-operation of important German electro-technical groups, was formed from the Russian Schuckert Co., is explained by the fact that it was largely dependent on its foreign contractors, both financially and industrially. Some idea of this dependence may be found in the report of the said company. It says that the result for 1914 is less satisfactory than that of the preceding year, because of the impossibility of executing certain portions of the contracts from the company's works, through the stoppage of the importation of special machines then being made abroad, and the impossibility of constructing machines in the factory of the company in time, in view of the complete stoppage of delivery of raw materials and half products.

The report of the General Electricity Co. also specifies the lack of raw material as well as of fuel at the factory, and the impossibility of obtaining equipment, previously obtained from abroad, which had an unfavourable influence on the operations of the company in 1914.

To-day, amongst electro-technical concerns, there is observed an effort to get rid of foreign control. Thus the board of Duflon Constantinovitch & Co., in its report points out the necessity of fresh extensions of the factory equipment due to the desire to experiment in some new branches of productive activity in the sphere of electro-mechanics to be installed in the workshops of the company, so as to take an active part in freeing Russia from that foreign control.

At present accounts of three other large electric companies have also been published for 1914, and these show that the demand for electric current in 1914 was good. In connection therewith the net profits increased as compared with 1913, as can be seen from the tables (in roubles) which follow:—

	1912.	1913.	1914.
Electric Lighting Co., 1886	5,350,000	6,040,000	6,840,000
Petrograd Electric Constructions Co.	1,400,000	1,520,000	1,740,000
Electric Power Co.	590,000	1,050,000	1,400,000

The dividends per cent. paid by these companies were as follow:—

	1912.	1913.	1914.
Electric Lighting Co., 1886	11	11	11
Petrograd Electric Constructions Co. ...	9	10.2	10.2
Electric Power Co.	—	9	9

British Columbia Electric Railway Co., Ltd.

Owing to the large decrease in the earnings of the company since the turn of the year, the directors are unable to recommend the payment of any further dividend on the preferred or deferred ordinary stocks in respect of the year to June 30th. In the last days of 1914, owing to the stagnation of business, brought about by the war, an extraordinary form of competition suddenly arose; a large number of motor cars, most of them privately owned, started plying for hire in opposition to the company's cars, at ordinary tram fares. In an endeavour to meet this competition the company has recently, as an experiment, reduced some of its fares. Sufficient time has not yet elapsed to enable a conclusive opinion to be formed as to the ultimate result of this step. The approximate net earnings of the company and its subsidiaries for the six months to December 31st last amounted to £190,585, a decrease of £61,252, or 24 per cent., as compared with the earnings for the corresponding period of the previous year. For the six months to June 30th, 1915 (the period of motor-car competition), the approximate net earnings show a still greater decline of £152,379, or 65½ per cent., as compared with the earnings of the corresponding period of the previous year, making an approximate decrease in the net earnings for the year of £213,631, equal to 44 per cent. The approximate net earnings for the twelve months to June 30th amount to £270,588. An extraordinary general meeting will be held on August 19th, for the purpose of passing resolutions confirming two agreements which have been entered into between the company and two of its subsidiary companies, for the operation by the company of branch lines owned by the subsidiary companies, and for matters incidental thereto.—*Financial News.*

Kensington and Knightsbridge Electric Lighting Co., Ltd.—Interim dividend of 3 per cent. on the ordinary shares, for the half-year ended June 30th, 1915.

Vickers, Ltd.—The following interim dividends for the half-year to June 30th will be paid:—2½ per cent. (less income-tax) on the preferred 5 per cent. stock and 5 per cent. preference shares, and 1s. per share (free of income-tax) on the ordinary shares.

Westminster Electric Supply Corporation, Ltd.—Interim dividend at the rate of 6 per cent. per annum, less income-tax, for the half-year to June 30th, payable on September 1st.

Metropolitan Electric Supply Co., Ltd.—Dividend on the ordinary shares for the half-year to June 30th at the rate of 2 per cent. per annum.

London and Suburban Traction Co., Ltd.—The directors announce that no interim dividend will be paid on the ordinary shares at this time.

City of London Electric Lighting Co., Ltd.—The directors announce an interim dividend at the rate of 6 per cent. per annum, less income-tax, on the ordinary shares for the half-year.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share (being at the rate of 5 per cent. per annum), less income-tax, for the three months ended June 30th.

Blackpool and Fleetwood Tramroad Co.—The directors have decided to pay the usual dividend, at the rate of 4 per cent. for the half-year ended at June.

Official Notices re Companies.—The following companies will be struck off the register at the expiration of three months, unless cause is shown to the contrary:—

Auto-Electric Vacuum Drying Syndicate.
Automatic Centrifugal Pump.
Boudjah Electric Lighting Co.
Chapman Motor Starter Syndicate.
East Kent Electric Supply Co.
Filaments.
Radiographic Processes.
Ridge Speed Indicator Syndicate.
Silico Bitumen Co.
Simplex Life Guard and Step Co.
Small Power Dynamo and Motor Co.
Society for the Protection of the Motor Trade.
Treibel Smoke Combustion Co.

Para Electric Railways and Lighting Co., Ltd.—No interim dividend will be paid on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

Principal interest in the Stock Exchange continues to centre in the 4½ per cent. War Loan. Upon the establishment of an active market in the scrip, there was a sharp fall in the price, the partly-paid dropping at one time to 2½ discount. This, however, was halved at the beginning of the present week, and with the recovery in the stock, other investment markets sympathised. The newcomer monopolises most of the business that is going on. There is probably fifteen to twenty times as much doing in the War Loan as in any other single security outside the Consol market. This state of affairs is likely to continue for a week or two, after which business will quietly slide into the normal, although, of course, there are still many issues, in investment markets especially, which will have to come down in price, in order to conform to the lowered standard of levels—or, to put it in another way, the higher rate of yield—set up by the War Loan.

This is a condition which will apply to various stocks and shares in our own price lists. Those people who ask why quotations are not lowered straight away, to meet the altered circumstances, may be reminded that since the issue of the War Loan, at the end of June, business in most markets has been of meagre character, and that, so far, only in certain cases have the markets been sufficiently tested to enable the quotation of approximately accurate prices. It might be difficult to sell various of the stocks set out in our lists at the given prices, although we would venture to say that in the majority of those enumerated the market has sufficiently accustomed itself to the War Loan atmosphere to permit of accurate prices being obtained.

The Electrical Supply list is featureless and devoid of alteration. Dividend declarations so far have emphasised the cautious note sounded here at various times as to the effect of the war upon the profits of the electricity-producing companies. The Westminster has reduced its interim dividend from 10 per cent. to 6 per cent., and this reduction of 4 per cent. is the principal cut announced up to the present. The St. James' and Pall Mall, it will be remembered, lowered its interim dividend to 7 per cent., which is 3 per cent. less than that of the corresponding period last year. The Metropolitan 2 per cent. goes against 4 per cent., and the Charing Cross declares 4 per cent. against a point higher. The City of London and County of London, with 6 per cent. and 5 per cent. respectively, make no difference in their distributions As may be supposed, the market is somewhat dull, but, as we have just said, there are no quotable changes.

The Adelaide Electric Supply Co. has convened a meeting of its 5 per cent. debenture stockholders for next Monday week (August 16th), to consider and, if approved, to pass certain extraordinary resolutions, the adjective being literally as well as formally correct. The debenture proprietors are asked to consent to a variation of the trust deed, on the ground that the deed, as at present drawn, contains a clerical error in the matter of the amount of money to be set aside towards redemption of the stock by 1936. The new clause to be proposed provides for an accumulative sinking fund, the effect of which would be to redeem the stock—certainly not in the twenty-one years from now, as at present provided, but in a considerably longer period. To talk about a clerical error in a trust deed when that error touches so vital a spot as redemption of the debenture stock seems to us most surprising. This debenture has been recommended here from time to time as a first-class security, well covered; and one of its attractions lay in its being redeemable at 105 in 1936. To move the date on, even by ten or twenty years, on the excuse that the trust deed contained a clerical error, is surely an attempt to infringe debenture rights which should be stoutly resisted; and those who have followed the suggestion that they should invest money in the security may be further advised to oppose the present proposals in every way possible.

The Brazilian Traction Co. has declared a dividend of ½ per cent. on its common shares in respect of the past quarter; and if it repeats the distribution three months hence, the dividend for the year will be brought up to 4 per cent. What will happen after this, however, is a theme for much speculation. Will the company declare quarterly dividends of 1 per cent.? or is the present ½ per cent. to be continued? This is the point disturbing the market; and the price of the shares has fallen to 45½—comparing, it may be noticed, with 66 on the eve of the outbreak of war.

The Rio exchange has been moving within the past few days against holders of Brazilian securities, although of this factor too much need not be made, in view of the speculation which is going on in the Exchange just now. The Argentine group is quiet, and Mexican descriptions are not affected by the news, for what it may be worth, that the Carranzists have already started on a scheme of pacification, and that regular communication between Mexico and Vera Cruz is about to be restored. The British Columbia Electric Railway has passed the dividends on its preferred and deferred stocks. Prices, naturally, are dullish. Nominally, the two issues stand at 45 and 35 respectively. The preference is called 65 to 70.

Telegraphs, on the whole, are weak and depressed. Little or no support has been forthcoming to counteract the fall of the past month. Prices continue to crumble, and this partially from the considerations outlined in our opening paragraphs. The American group has derived no benefit from the wild speculation in all kinds of United States industrials that is taking place in New York. Some of the Canadian stocks and shares are better because of it, and American Marconis furnished one of the surprises of the week with a jump from 14s. to 20s. 6d. in a single day. Of this rise about a florin was subsequently lost. Canadian Marconis moved up in sympathy to 5s. 9d., and the parent shares benefited from the spurt in their progeny. Marconi ordinary rose temporarily to 2, and, being now ex-dividend, the net rise at 38s. 9d. amounts to 4s. 6d. per share; while the preference have hardened to 1 13/16, and even Spanish Marconis, from being scarcely saleable at 2s. 6d., soared to 6s. New York Telephones rose to 97, but subsequently lost the advance of a point which this represented. The Eastern and Western groups are both dull, the deceased accounts not having yet been fully absorbed.

Home Railway stocks are steady, a fall of a point in Metropolitans being counteracted by a similar improvement in Districts, while Underground Electric issues maintain their recently-acquired firmness.

The Miscellaneous group shows little change. Manufacturing shares are steady as a whole, but Telegraph Constructions fell a point to 31, and preferences are generally disposed to ease off. In the rubber market there is not much going on, with a consequent quietude in prices. The armament division is a little erratic. It may be mentioned, incidentally, that at one of the munitions-making companies which has a factory not a hundred miles from the City, a gang of Stock Exchange men find more strenuous employment than has been their lot for many years past in the House.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend, 1914.	Price Aug. 3, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	8	—	£6 5 0
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4	—	6 5 0
do. do. do. 4½ Pref.	4½	4	—	5 12 6
do. do. City Pref.	4½	3⅞	—	5 16 2
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4½	—	5 11 1
do. 4½ Deb.	4½	88	—	4 17 10
City of London	9	13	—	6 18 6
do. do. 6 per cent. Pref.	6	11	—	5 9 1
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10½	—	6 13 4
do. do. 6 per cent. Pref.	6	10½	—	5 14 3
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6½	—	6 18 6
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4¾	—	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	8½	8	—	5 16 8
do. 4½ per cent. Pref.	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	7	—	7 0 0
do. do. do. 7 per cent. Pref.	7	6½	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	3	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7	—	6 8 7
do. 4½ Pref.	4½	4⅝	—	4 17 4
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	97	—1	6 3 6
do. Def.	1½	21	— ½	7 2 10
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8¼	—	6 1 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11	— ½	*7 5 6
do. 4 Deb.	4	78 xd	—	5 2 7
Eastern Tel. Ord.	7	120	—1	*6 13 4
do. 3½ Pref.	3½	70	—	5 0 0
do. 4 Deb.	4	80	—	5 0 0
Globe Tel. and T. Ord.	6	9½	— ¼	*7 4 4
do. Pref.	6	10	—	6 0 0
Gt. Northern Tel.	22	33	—	6 13 4
Indo-European	65/-	50	—2	6 10 0
Marconi	10	1 15/16 xd	+4/6	5 3 1
New York Tel. 4½	4½	96	—	4 13 9
Oriental Telephone Ord.	10	1⅞	—	5 6 8
do. Pref.	6	1⅛	—	5 6 8
Tel. Egypt Deb.	4	80	−8	5 0 0
United R. Plate Tel.	8	5¾	—	*7 19 10
do. Pref.	5	4	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	11½	— ½	*6 19 0
do. 4 Deb.	4	81	—	4 16 5
Home Rails.				
Central London, Ord. Assented	4	74	+1	5 8 1
Metropolitan	1½	23½	— ½	5 6 5
do. District	Nil	14	+1	Nil
Underground Electric Ordinary	Nil	1½	+ ⅛	Nil
do. do. "A"	Nil	6/-	—	Nil
do. do. Income	6	75	—	*9 3 0
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref.	5½	4	—	6 17 6
do. 2nd Pref.	5½	8½	—	7 17 2
do. 4 Deb.	4	75	—	5 6 8
do. 4½ Deb.	4½	75	—	6 0 0
do. 5 Deb.	5	75	—	6 13 4
Brazil Tractions	4	45½	− 2½	8 17 10
Bombay Electric Pref.	6	10¼	—	5 16 10
do. 4½ Deb.	4½	90	—	5 0 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds	—	50	—	Nil
do. 6 per cent. Bonds	—	80	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	45	—	—
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	99	—	5 1 0
Manufacturing Companies.				
Babcock & Wilcox	14	2¼	—	6 4 5
British Aluminium Ord.	5	1⅛	—	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	11	—	6 13 4
do. Pref.	6	6	—	5 0 0
British Westinghouse Pref.	7½	83/6	—	8 19 2
do. 4 Deb.	4	70	—	5 14 4
do. 6 p. lien	6	100	—	6 0 0
Callenders	15	11	—	6 16 4
do. 5 Pref.	5	4¾	— ⅛	5 5 3
do. 4½ Deb.	4½	95	—	4 14 9
Castner-Kellner	15	8¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/6	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	60	—	6 13 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	11/6	—	10 8 8
do. do. Pref.	7	1	—	7 0 0
Gen. Elec. Pref.	6	9¾	—	6 3 1
Henley	20	14	—	*8 8 8
do. 4½ Pref.	4½	4¾	—	4 14 9
do. 4½ Deb.	4½	95	—	4 14 9
India-Rubber	5	8¾	—	5 14 3
Telegraph Con.	20	31	—1	7 15 0

* Allowance made for dividends being paid free of income-tax.

Charing Cross, West End and City Electricity Supply Co., Ltd.—Interim dividend on the ordinary shares of the West End undertakings for the half-year ended June 30th, 1915, at the rate of 4 per cent. per annum. Warrants will be posted on August 14th.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 4th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a „ Nitric	„	19/-	..
a „ Oxalic	per lb.	..	..
a „ Sulphuric	per cwt.	..	..
a Ammoniac Sal	„	£49	..
a Ammonia, Muriate (large crystal)	per ton	£40	..
a Bleaching powder	„	£9	..
a Bisulphide of Carbon	„	£21	..
a Borax	„	£22	..
a Copper Sulphate	„	£28	..
a Lead, Nitrate	„	£35	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
a Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	7½d.	..
a Potash, Caustic (88/90 %)	per ton	..	..
a „ Chlorate	per lb.	1/6	..
a „ Perchlorate	„	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	Nom.	..
a Shellac	per cwt	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers	„	£11 10	..
a „ Recovered	„	£8	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %)	„	£10 2 6	..
a „ Chlorate	per lb.	1/1	..
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	4d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	..	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	..	..
b „ Sheet, in ton lots	„	..	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/1¾ to 1/2¼	..
c „ Tubes (solid drawn)	„	1/2¼ to 1/2¾	..
c „ Wire, basis	„	1/2 to 1/2½	..
c Copper Tubes (solid drawn)	„	1/1¾ to 1/2¼	..
g „ Bars (best selected)	per ton	£102	£4 dec.
g „ Sheet	„	£102	£4 dec.
g „ Rod	„	£102	£4 dec.
d „ (Electrolytic) Bars	„	£88	£7 dec.
d „ „ Sheets	„	£106	£7 dec.
d „ „ Rods	„	£94	£7 dec.
d „ „ H.C. Wire	per lb.	11½d.	¾d. dec.
f Ebonite Rod	„	3/-	..
f „ Sheet	„	2/6	..
a German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/5	1½d. dec.
i Iron Pig (Cleveland warrants)	per ton	66/-	7d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£26	£3 inc.
g Lead, English Pig	„	£24 15	£1 dec.
g Mercury	per bot.	£18 5	..
e Mica (in original cases) small	per lb.	4d to 2/6	..
e „ „ „ medium	„	3/- to 5/-	..
e „ „ „ large	„	6/6 to 10/6 & up	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/2 to 1/3½	..
p „ „ rolled strip & sheet	„	1/3½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£80	..
g Tin, Block (English)	„	£158	£9 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/8	..
p White Anti-friction Metals	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a	G. Boor & Co.	*h*	Edward Till & Co.
b	The British Aluminium Co., Ltd.	*i*	Bolling & Lowe.
c	Thos. Bolton & Sons, Ltd.	*k*	Morris Ashby, Ltd.
d	Frederick Smith & Co.	*l*	Richard Johnson & Nephew, Ltd.
e	F. Wiggins & Sons.	*n*	P. Ormiston & Sons.
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	*o*	Johnson, Matthey & Co., Ltd.
g	James & Shakspeare.	*p*	
		r	W. F. Dennis & Co.

J. F. & G. Harris, Ltd.—The directors report that the total number of shares allotted is 12,554 3 per cent. cumulative preference shares of £1 each, and 21,404 ordinary shares of 2s. 6d. each. Seven of the ordinary shares have been allotted for cash and 17s. 6d. has been received in respect of such shares. 12,554 3 per cent. cumulative preference shares and 21,397 ordinary shares have been allotted as fully-paid shares in accordance with the agreement between J. F. & G. Harris and this company, dated June 22nd, 1915. The statutory meeting is to be held to-morrow.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be quoted in the Official List :—

Calcutta Electric Supply Corporation, Ltd.—2,178 ordinary shares of £5 each, fully paid, within Nos. 250,001 to 260,000 ; and 2,014 5 per cent. cumulative preference shares of £5 each, fully paid, within Nos. 200,001 to 210,000.

Winnipeg Electric Railway Co.—Further issue of £400,000 4½ per cent. perpetual consolidated debenture stock.

THE ELECTRICAL TRADE POSITION IN CHINA.

By GEO. R. ARCHDEACON, A.M.I.E.E.

At present China is in a state of muddle, out of which British, German or American influence will, in the near future, develop Law, Order and Commerce. The object of this article is to present to the British manufacturer a few hints that may assist him in capturing the extensive trade that remains to be developed in this great country of China.

First and foremost, one must try to realise the appalling indifference of the Chinese to new ideas, and the intense suspicion of all forms of change in thought or action. Yet if the deeply-rooted Conservatism of the country can be overcome, and the people's interest excited, there is to hand crude material out of which it is possible to make rapid progress in the most modern forms of civilization and culture.

In a recent paper on this subject, Prof. Middleton-Smith, of the Hong-Kong University, estimated that "for all practical purposes, China is entirely devoid of roads, and more than 99 per cent. of the inhabitants are living under conditions which are the same as those which existed in China 2,000 years ago. Ninety per cent. of the inhabitants have never heard of a steam engine or a heat engine of any kind."

It is into this primitive country that the engineer must bring his wares, and by all the powerful aids of legerdemain and the usual tricks known to modern commerce he must so contrive to engage the attention of the natives as to lull their suspicions and allay all their fears of devils, fiends, demons and dragons.

It is here where the British manufacturer's "slap-dash" methods and "take it or leave it" system are of no avail. If Spain is the land of "to-morrow," China is the land of "next week." Nothing less than a devil or a demon can make John Chinaman hasten out of his usual bland contemplation of life and all its complexities. The British manufacturer may send out smart, well-groomed voluble representatives by the battalion, but few of them will return laden with orders. Talk carries no conviction to the Chinese mind. Past-master in the art of "bluff" himself, he is "too old a bird" to be caught in such a simple trap.

It is first necessary to send out a man who has had previous experience in handling Chinese labour, one who is somewhat familiar with the Chinese and their peculiar temperament. He must possess an abundance of tact and patience, with a sympathetic leaning towards the Chinaman, his objects and ideals; he must be most polite and obliging; above all, he must be scrupulously honest and just in all his transactions, but firm in whatever attitude he finally adopts.

The Chinaman always asks three times the amount he hopes to ultimately secure; consequently he expects you to play the same game. After you have made your demands, both parties amicably settle down to an amusing and friendly argument, politely depreciating each other's criticisms, but slowly and surely reducing the price until you have finally arrived at your pre-determined figure. All this takes time, but unless you are prepared to engage in these friendly discussions and display no haste to take your departure, precious little custom can the British manufacturer hope to obtain from this land of dirt, dollars and doubt.

It frequently happens at home that, to assure the satisfactory working of a special piece of machinery, your representative must make a suitable impression upon the *man who works that machine* rather than the manager or director who simply buys it. The author could some tales unfold of the unsatisfactory working of machinery that persistently refused to become efficient until the operator's prejudice had been finally overcome. This item most especially applies to China, the great land of "squeeze." The Chinaman loves "squeeze." The author is of the opinion that a Chinaman would be perfectly happy if you were to reduce his wages, say, 2s. per week, but allowed him to make 1s. 9d. per week in squeeze.

Every Chinese makes "squeeze"—and that is why a representative who is strictly honest may be considered simple; yet he ultimately gains their respect and confidence, and when he has once accomplished that feat the road to success is wide open.

The Chinaman only accepts the evidence of his own eyesight, therefore I would suggest to British manufacturers that whenever there is a technical college or university opened in China, they should give it their strongest support. Let the samples of their work be in constant application in the various laboratories of those institutions, so that the rising generation of Chinese may be familiar with their products and convinced of the soundness of their adoption, to the exclusion of all other methods. Let all British manufacturers adopt the principle that "all things of interest to China are of interest to us."

Just to cite one small instance which, nevertheless, shows to what an extent the lack of interest and lack of information have hitherto permeated the British manufacturers in things concerning China.

The author (at Hong-Kong) has personally received from engineering firms at home, letters stamped with 2½d. stamps instead of 1d. stamps. He has also had the same experience brought to his notice by other engineers domiciled out here.*

The British Electrical and Allied Manufacturers' Association and the China Association are both steps in the right direction. I would suggest that manufacturers should see that all their agents in China are constantly supplied with leaflets advertising their wares *written in Chinese*.

The two principal dialects are so dissimilar as to necessitate different translations; therefore the leaflets should be printed in Pekinese for North China, and Cantonese for South China.

The Singer Sewing Machine Co. have long realised this necessity, and not only do their leaflets abound, but wherever one goes a dainty Chinese lady may be observed on large advertisement boards sewing away on the inevitable Singer machine, whilst the accompanying letterpress matter is all in Chinese.

Throughout the whole of China there are practically only three towns wherein the modern industries have been developed upon anything approaching a large scale. These towns are Hong-Kong, Shanghai, and Hankow. Hong-Kong is a British colony, and as such possesses all the marked features of British rule, namely, law, order, sanitation, and a general feeling of peace, and security of life and property. Hong-Kong possesses two great shipyards, run upon similar lines to those at home, equipped with all the latest machinery and appliances for shipbuilding and general engineering work. There is also a large Government shipyard equally well equipped. These three engineering works employ between them about 600 Europeans and 10,000 Chinese. In this colony we have two electrical companies and one tramway company.

The Hong-Kong Electric Co. operates on the island in the city of Victoria. Its station is a mixed one consisting of about 2,000 KW. in Diesel engine sets, and about 700 KW. in steam plant. The Tramway Co. possesses a generating station consisting of steam plant of 800 KW.

Across the water is situated Kowloon, on the mainland about three-quarters of a mile from Victoria. In Kowloon one of the above-mentioned dockyards has its works.

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* We are more familiar with the complaint that letters are insufficiently stamped.—Eds. E.R.

The China Light and Power Co., Ltd., operates the electric lighting scheme in Kowloon. Extensive developments are at present in hand, as this company is changing from the 2-phase to the 3-phase system of supply, and is replacing a 500-KW. suction gas plant by a 1,500-KW. turbine station.

Knitting and weaving factories abound in this district, also rope works, cement works, a sugar refinery, and numerous small engineering works requiring a power supply of from 5 to 50 H.P.

Some 90 miles from here is the famous city of Canton, the population of which is well over a million. The Canton Electric Supply Co. has a Diesel station of some 1,600 KW. In this part of South China there are also small electricity stations at Fatshan and on the island of Macco.

Striking out towards the North, we have Swatow, Amoy, and various small towns already equipped with pumping stations, mills, mines, and electricity supply stations.

In North China there is the cosmopolitan city of Shanghai, which is a model of the development that can be brought about in China if British firms will spend more money, more time, and more energy in their attempt to open this great market that only awaits a well-directed policy for development.

Can the British manufacturer realise that in Shanghai, thousands of miles away from the beaten track of his operations, there is a generating station of some 20,000 KW., fully equipped with all that is best in modern electrical practice? This district is also full of cotton mills, engineering works, mines, shipbuilding works, rope works, breweries, cement works, etc.

The interior of China is beginning to waken up. Already there is in Yunanfu a 25,000-volt scheme with a transmission line of over 25 miles. Small isolated plants are gradually becoming dotted all over the country—at Nanking, Heungshan, Cheung Chow, Kongmoon, Hoihow, Peking, and Changsha. The best hotels are all equipped with electric light and electric lifts; and in many cases are generating their own power. How many British firms have their products installed in these various places?

German and American goods have held sway and secured most of the trade. Germany is, for the moment, removed from active operations. Are we going to step in and win, or are we going to stand aside and merely timidly angle with a few cheap catalogues as our only bait, instead of boldly sending out good men with an ample supply of literature, plenty of samples, and having a fairly free hand with regard to credits, contracts, and a system of free trials with small machines? For a matter of about £700 a good man might be sent out to China on a twelve months' tour.

If the prospect before the eyes of the British manufacturer does not warrant the sporting risk of £1,000 to get a footing in the Chinese markets, let him by all means stick to his home trade, with his carefully planned system of personal and banker's references, and his usual timid attitude of carefully dipping his big toe into the water to feel if it is too cold.

Whilst he stands miserably shivering on the bank he will doubtless derive some pleasure (!) in watching the antics of his foreign and American competitors who have boldly plunged in, and from their loud acclamations of joy seem to be in no doubt of the success of their venture.

STROBOSCOPIC FREQUENCY MEASUREMENTS.*

The light emitted by an incandescent solid varies much more rapidly than its temperature, and makes it possible to measure the frequency of an alternating current by observing stroboscopically the frequency of the illumination peaks in a thin, gas-immersed filament incandesced by the current in question. Referring to fig. 1, if A represents the impressed E.M.F. wave, and if, for simplicity, the wire be taken to have zero temperature coefficient of resistance, the current wave will be undistorted and in phase with A, and the rate at which energy is dissipated will be represented by the sine-squared curve B.

In the case of a filament of infinitesimal thermal capacity (such as can be realised approximately by mounting a thin filament in a gas-filled bulb), the temperature of the wire at any moment is approximately represented by the curve B.

The (monochromatic) candle-power curve C is much more peaked than the energy wave, and it is found that a gas-cooled filament will give sharp stroboscopic effects even when operated on sinusoidal current. In the case of a thin filament operated in a vacuum, the considerably less peaked curve D of candle-power is secured. Gas immersion makes the heat capacity of a filament negligible, even though the latter is not excessively thin, and thus produces sharper stroboscopic effects than are obtainable from a vacuum lamp.

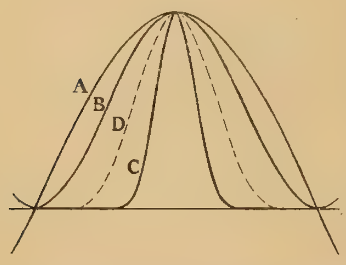

Fig. 1.—Time Variation of Light from a Rapidly-Cooled Filament.

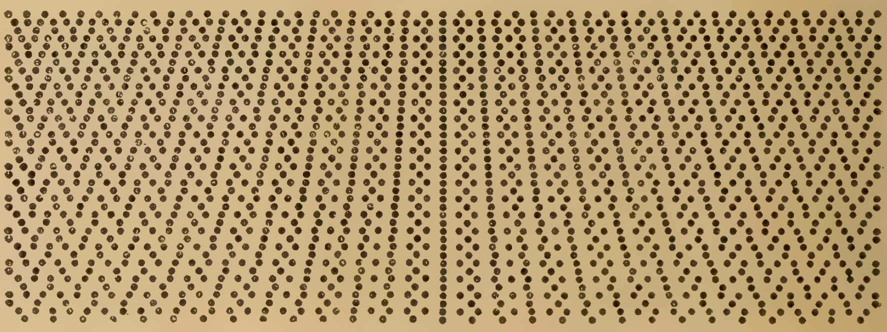

Fig. 2.—Stroboscopic Screen.

Stroboscopic frequency measurement requires a dotted or otherwise marked disk and an intermittent illumination: either the speed of rotation of the screen or the frequency of the intermittent illumination must be proportional to the frequency to be measured, and the other factor, whichever it be, must be constant. The best procedure is to drive the stroboscopic disk at absolutely constant speed—say by directly coupling it to a 10-pole attracted-iron synchronous motor operated by a vibrator making 10 contacts per second. Motor and vibrator windings and contacts may be connected in series across the A.C. supply, the frequency of which is to be determined. The motor runs in synchronism with the vibrator. To avoid hunting and facilitate synchronising, the moment of inertia of the system may be divided into two parts, one being that of a small fly-wheel rigidly mounted on the armature shaft, the other that of the drum on which the stroboscopic screen is mounted. The latter drum is best driven by rubber bands from the motor shaft or fly-wheel. This arrangement ensures absolute steadiness of rotation of the stroboscopic disk, and when the moment of inertia of the system is properly divided and the flexible connection properly adjusted, the motor drops into synchronism (one revolution per second) at once on being twirled by the fingers.

Fig. 2 shows an improved form of stroboscopic screen containing two series of alternating dots (as first used by Seashore). The screen is mounted on the circumference of a drum, and the row of dots which apparently stand still, when illuminated by intermittent light in synchronism with the current examined, is readily identified since the rows on either side of it appear simply as streaks and give a marked "framing" effect. The screen illustrated has 39 rows of dots; the number of dots in a row varies from 29 to 67, and the screen is thus suitable for indicating frequencies between 29/2 = 14·5 and 67 × 2 = 134 per second. A 30-cycle current gives 60 illuminations per second, hence the 60-dot row appears stationary; 60-cycle current produces 120 illumination peaks per second, hence the 60-dot row again appears stationary, but with the dots at half their actual distance apart. The rows are numbered on two fixed scales—one for each series; the overlapping of the dots at higher frequencies does not prevent the detection of exact synchronism. The frequency indications are independent of the wave-form of the alternating current employed, and a simple portable reed vibrator gives sufficiently constant frequency of current interruption in the motor circuit for all ordinary purposes.

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* *Elec. Review and Wn. Electrician.*

ON AN UNBROKEN ALTERNATING CURRENT FOR CABLE TELEGRAPHY.

By Lieut.-Colonel GEORGE O. SQUIER, Ph.D.

(*Abstract of Paper read before* The Physical Society of London, *June 25th*, 1915.)

(*Concluded from page* 158.)

The ideal alphabet to employ in cable signalling would be one in which, other things being equal, each letter had the same limit of legibility; because if this is not so, the speed of signalling is lowered to meet the legibility of certain letters only. In present cable practice, what may be called the "resolving power," or the definition, is not equal throughout the letters of the alphabet.

Letters like "a" or "n," for instance, may be considered as perfect letters, and whether sent by one complete cycle of E.M.F. of a dynamo, or by two square-topped waves of equal area and opposite sign separated by a time interval, produce on the siphon record approximate sine-waves. On the other hand, in the case of letters like "s" or "h," where three or four square-topped waves of the same sign are sent into the cable consecutively, the received record at high speed fails to resolve these separate impulses, and the siphon record becomes a more or less continuous hump of large amplitude, which the expert operator learns to read without being able to detect the individual impulses; in fact, some practical operators seem to prefer these letters to what are known as "cross-letters," such as "a" and "n."

Careful experiments have been conducted through long cables, which prove, however, that the so-called "cross-letters" have a superior legibility, which obviously should be the case from theoretical considerations only.

We may consider the siphon record of an uninterrupted alternating current as possessing 100 per cent. definition, independent of the frequency, the voltage employed, or the particular cable used, and regard it as the standard of definition for all signals. Indeed, such a record is, in fact, a message composed of a series of the letter "a" joined together without spaces between.

In present practice it is found necessary to insert a receiving condenser in series with the recorder coil, or an inductive shunt around the coil, for the purpose of improving the definition of certain letters of the alphabet, such as "s" and "h," as well as to eliminate from the record the effects of earth currents of very low frequency induced in the cable.

One of the chief attractions in the use of an unbroken alternating current for operating the cable is the fact that for the first time we are enabled to measure the constants of the different elements of the bridge and cable circuits employed under actual signalling conditions. Since one particular frequency is used and the current is never broken, it is necessary and sufficient to use the ordinary commercial hot-wire ammeters and voltmeters which are now available over suitable ranges.

A tachometer is attached to the dynamo armature shaft, so that the frequency is indicated continuously, and these readings, in connection with those of the ammeter and voltmeter, are all that are required to determine the impedance and phase angle of any part of the transmitter circuit, including those of the cable itself.

In the present forms of battery transmitter a square-topped wave is employed, and, in addition, it is found necessary to disconnect the battery and connect the cable to earth during a portion of each individual signal sent. The reason for this is that, in this form of wave, the cable receives a charge dependent upon the time during which the key remains closed for the signal, and when the circuit is opened it is necessary to give time for the cable to become discharged before the succeeding signal can be sent. This discharge is shown in the spark that is seen in the present form of transmitter when the circuit is broken. The percentage of time of each elementary signal during which the cable is connected to earth varies according to the cable, but in long cables it is usually about 25 per cent. of the whole time of the signal.

This means that of necessity the cable is entirely disconnected from the battery at both ends for a period aggregating six hours per day, due to the present method of sending the individual signals.

This discharge of the cable has, indeed, been turned to account for a useful purpose by the late Mr. Gott (British patents No. 10,534 and No. 22,364 of 1912), who quite recently developed a system of transmission in which the discharge of the cable is ingeniously utilised to co-operate the tongue of a relay, which causes the succeeding signal to enter the cable with the opposite sign.

This form of square-topped wave, when combined to make up letters and words, causes a broken and irregular form of current to enter the cable, which precludes the possibility of measuring the ordinary quantities, such as voltage, current, impedance and phase-angle of the different elements of the circuit. This is extremely unsatisfactory from an engineering standpoint, and retards progress.

The development of the modern artificial line for simulating the action of the cable has required a large amount of patient and careful work extending over a number of years. As soon as any form of break, with its consequent spark or arc, is removed from the transmitter circuit, and an alternating current of one frequency only is substituted, the artificial line can more faithfully represent the action of the current flowing in the real cable, and its construction may be simplified.

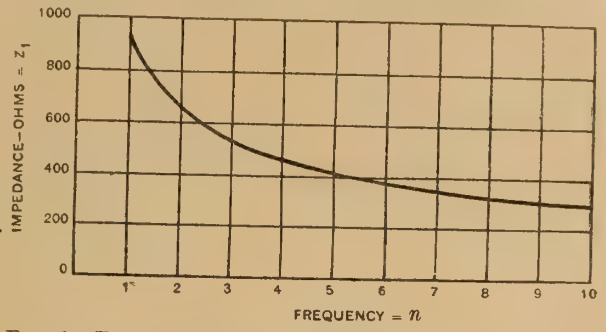


Fig. 6.—Transmitting Impedance of a trans-Atlantic Cable as the Speed of Signalling is Varied.

In the case of long submarine cables having resistance and distributed capacity, self-induction and leakance being neglected, we have the well-known sine-wave formulæ for an infinite cable—

$$e = \text{E}\,\epsilon^{-\sqrt{\frac{1}{2}\text{C R}\,\omega}\,x} \sin\left(\omega t - \sqrt{\tfrac{1}{2}\text{C R}\,\omega}\,x\right) \quad \ldots \quad \ldots \quad (1)$$

$$i = \text{E}\sqrt{\text{C}\omega/\text{R}}\;\epsilon^{-\sqrt{\frac{1}{2}\text{C}\,\omega}\,x} \sin\left(\omega t - \sqrt{\tfrac{1}{2}\text{C R}\,\omega}\,x + \pi/4\right) \quad (2)$$

e and i represent instantaneous values of the voltage and current at any point of the cable at a distance x from the origin and a time t; E is the maximum value of the E.M.F. applied to the cable, R and C are the resistance and capacity of the cable per unit length, ω is 2π times the frequency.

These formulæ are accurate for all practical purposes in the case of long cables, as will be shown presently.

At the transmitting end of the cable $x = 0$, and (2) becomes—

$$i = \text{E}\sqrt{\text{C}\,\omega/\text{R}}\,\sin(\omega t + 45^\circ) \quad \ldots \quad \ldots \quad (3)$$

$$i = \text{I}\,\sin(\omega t + \theta) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

where I is the maximum current and θ is the angle by which the current leads the E.M.F. This angle is constant and equal to 45°. The transmitting impedance of the cable is—

$$\text{Z}_1 = \text{E}/\text{I} = \sqrt{\text{R}/\text{C}\;\omega} = \sqrt{\text{R}/2\,\pi\,\text{C}}\,\sqrt{1/n} = c_1\sqrt{1/n} \quad \ldots \quad (5)$$

where c_1 is constant for any particular cable.

$$\text{I} = \text{E}/\text{Z}_1 = \text{E}\sqrt{n}/c_1 \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

Let us assume—

R = 4,895 ohms, C = 914 × 10^{-6} farads, length = 2,164 knots, which data represent one of the best trans-Atlantic cables.

Substituting in (5) and (6) we have—

$$\text{Z}_1 = 923{\cdot}2/\sqrt{n}, \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

$$\text{I} = \text{E}\sqrt{n}/923{\cdot}2. \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

The graph (fig. 6) represents the impedance-frequency curve at the transmitting end of this particular cable plotted from (7).

For $n = 5$, or at 150 letters per minute, the cable impedance is 412 ohms, or only 8·4 per cent. of the ohmic resistance of the cable. The impedance of this same cable, as measured by the ammeter-voltmeter method, for a frequency of $n = 5{\cdot}03$ is 397·5 ohms.

With 50 volts on this cable at the same speed of transmission the current flowing into the cable from (8) is I = 0·12 ampere.

The transmitting impedance is most sensitive to change of frequency at the lower frequencies, and by increasing the speed from $n = 4$, or 120 letters per minute, to $n = 9$, or 270 letters per minute, the cable impedance is decreased in the ratio of 3 to 2, and the current correspondingly increased. The same values of impedance and current deduced above apply to the equivalent artificial line, which is made to balance as far as possible the real cable.

By inserting a hot-wire ammeter in the cable itself beyond the bridge, and also connecting the transmitting end of the cable to earth, through a suitable voltmeter (preferably an electrostatic instrument, to prevent any disturbance of the bridge balance), we have the means at hand for determining the best transmitting conditions for any particular cable and frequency of signalling. Heretofore the values of the transmitting condensers in the duplex arms of the bridge have been more or less arbitrarily assigned by certain practical rules obtained by an expert study of the signals themselves. Here, however, we may approach the problem more scientifically by so adjusting the values of the condensers or inductances, or both, in the bridge branches as to produce a maximum reading of the hot-wire ammeter in the cable itself for any particular voltage assigned. The criterion for best transmitting conditions alone would be that the transmitting impedance should be a minimum, or the current flowing into the cable as measured by a hot-wire ammeter should be a maximum for any particular signalling frequency.

This practical method is, of course, entirely analagous to the present practice of inserting a hot-wire ammeter in the transmitting antenna of a wireless station, except in the latter case we can go much further and adjust for the maximum current possible at the maximum point of the resonance curve of the antenna. In the cable circuit we are dealing, not with resonance, but with forced waves maintained by the dynamo.

Submarine cables are at present operated by primary batteries giving an open-circuit voltage of from 50 to 80. The main reason for this is, of course, the constant fear of subjecting the cable itself to undue electrical strain, particularly in the deep-sea portion, where repair is difficult and expensive. This is not the only reason, however, although it is the principal one.

The present form of battery transmitter impresses upon the cable square-topped waves, which may be analysed by Fourier's method, and in the hands of Malcolm and a few others the wave-form can be worked out and predicted as the wave passes through the cable to the receiving end. Since we know that it is only the fundamental term of the Fourier analysis which produces an appreciable effect at the receiving end, all of the harmonic waves which are required to build up the square-top form of wave are impressed upon the cable at the transmitting end, and are absorbed in the cable itself, and never reach the receiving end. These, therefore, represent superfluous electrical charge impressed upon the cable, and this charge for each signal must be got rid of before the succeeding signal can be sent into the cable.

It is, therefore, probable that a practical limit would soon be reached in the present form of transmitter, where the magnitude of this extra charge sent into the cable would become so great that there would be little advantage in further increasing the E.M.F.

The direct influence which increase of voltage produces on the amplitude of the record received as the frequency changes is shown in the graph (fig. 7). These data were obtained over a submarine cable from New York City to Canso, Nova Scotia, of :—R = 13,700 ohms; C = 231·4 × 10^{-6} farads; length = 880·6 knots. The cable was used at the transmitting end simplex, without condensers, and at the receiving end the ordinary duplex arrangements were employed with 50 mf. condensers; the cable recorder was adjusted once for all, and remained unchanged throughout the experiments. The receiving arrangements were not particularly sensitive, and the recorder was not readjusted as the frequently was increased.

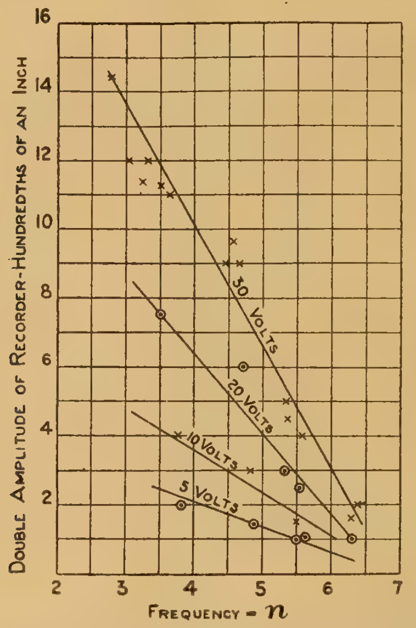


Fig. 7.—Variation of Double Amplitude of Siphon Record with Change in Frequency, Voltage Constant.

It will be observed that, within the limits of these experiments, the amplitude of the excursions of the siphon increased with the voltage for any particular frequency of the dynamo, and as the frequency was increased, the voltage remaining constant, the double amplitude of the siphon record gradually decreased. Theoretically, these lines are curved lines, but for observations up to 30 volts, with but one adjustment of the recorder, the right lines in this figure best represent the actual observations at each voltage.

It is seen that these lines converge towards a common vanishing point at somewhere about $n = 7$, which means that, with the limited sensibility of the particular recorder used (which may be considered as an ammeter if properly calibrated), we cannot expect by any increase of voltage to signal faster than about $n = 7$ with this particular cable.

This graph has been made from data of experiments made 17 years ago, and since that date, due to the great improvement in sensibility of cable relays and amplifiers, the vanishing point at the present day for this cable would be moved to the right along the axis of abscissæ, to some point corresponding to a considerably larger number than 7.

The above outline will be sufficient to show that in the case of an alternating current being impressed upon a cable, increase of voltage for signalling purposes should be considered from a new point of view, for we know that the power impressed in this case varies directly with the square of the voltage used in transmitting.

In (1) and (2) above, it is seen from the exponential factor that the maximum ordinates of the E.M.F. and current waves decay according to the logarithmic law, and that the rate of decay is dependent upon the capacity and the resistance of the cable per unit length, and also upon the frequency.

Assuming $n = 5$, or 150 letters per minute, the instantaneous value of e or i, and also the maximum volts per volt at sending end have been computed for the Atlantic cable of fig. 6, and are shown in the following table:—

Knots.	e or i,	Maximum volts per volt at sending end.
0	1	1
135	0·5135	0·5924
270	0·1755	0·3510
405	0	0·2079
540	—0·0616	0·1231
675	—0·0630	0·0729
810	—0·0432	0·0432
945	—0·0222	0·0256
1,080	—0·0076	0·0152
1,215	0	0·0090
1,350	0·0027	0·0053
1,485	0·0027	0·0031
1,620	0·0019	0·0019

These relations are shown graphically in fig. 8. It is seen from the table that the maximum voltage impressed upon the cable has decreased to 1/500 of its original value in one complete wave-length, and to 0·5924 of the original value in the first 135 knots from the transmitting end of the cable.

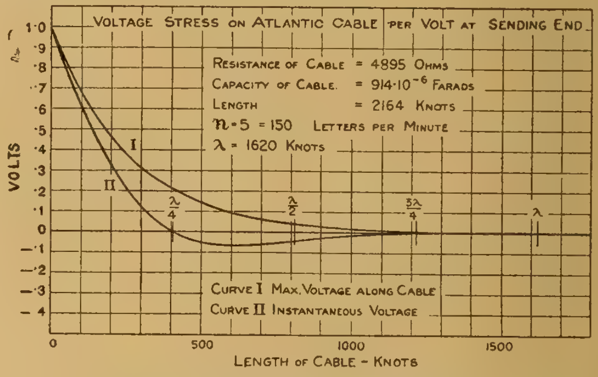


Fig. 8.—Voltage Stress on trans-Atlantic Cable for $n = 5$, or 150 Letters per Minute.

At this speed of signalling a complete wave is 1,620 knots in length; also we have: λ = 1,620 knots, $T = 1/n = 1/5$ second, total length of cable = 1·33 λ.

Rate of propagation of wave through the cable = λ/T = 8,100 knots per second, or the time required for the wave to travel the length of the cable = 0·27 of a second.

The frequency n has a marked influence upon the rate at which the amplitude of the wave decreases as we proceed along the cable from the transmitting end. The distance at which this amplitude will have $1/\epsilon$ of its original value is the reciprocal of the coefficient of x in the exponential term of (1), or $x' = \sqrt{2/CR\omega}$ = 258 knots, or x' varies inversely with the square root of the frequency. This means that if we increase the speed of signalling from $n = 4$ to $n = 9$ the higher frequency wave will experience the same decrease in voltage in two-thirds of the distance from the transmitting end. In other words, the higher the speed of signalling attained on any cable for a given transmitting voltage the safer the cable is from electrical strain. Increase in efficiency of the cable plant means increase in safety also.

With a battery, it is possible to subject every centimetre of the cable to the full voltage stress of the battery, as occurs whenever the usual insulation resistance test of the cable is made, or in case the transmitting condenser should be accidentally short-circuited.

With the alternating-current dynamo, however, it is impossible either by accident or by design to produce in the cable in the deep sea portion any voltage, even momentarily, of more than a small fraction of the voltage used at the transmitting end. This suggests, as has been done before, that, by designing submarine cables with heavier insulation over comparatively short distances at the ends, we can employ higher voltages in signalling with no possibility of subjecting the cable to undue electrical strain at any point of its length.

Submarine cables before laying are at present subjected to a stress of several hundred volts in the cable tanks for a considerable period, and if there is a material advantage in speed in increasing the signalling voltage there would seem to be no good reason for hesitating in the slightest degree to increase the voltage moderately in actual traffic.

In a long cable there is no reactive influence upon an ammeter or voltmeter placed in any circuit at the transmitting end due to any variation in the form of apparatus inserted at the receiving end of the cable. Opening and closing the cable circuit produces no perceptible indication. The energy of the waves may be considered as leaving the transmitting end of the cable along the conductor path never to return.

We are, therefore, at liberty to consider the electrical conditions for best receiving, separately and independently of the conditions for sending, and then inquire how far these two sets of conditions can be made to harmonise with each other.

Fig. 9 shows one of the standard arrangements for operating on long cables in which the values of the condensers and the resistance of the recorder coil as shown have become more or less fixed quantities in cable practice. The condenser *c* is limited to this comparatively small value, as its main function is to improve the definition of letters like "s" and "h," for there is no need to correct for letters like "a" and "n."

This lack of uniform resolving power for all letters at present limits the free use of any value of condenser in this arm which would be the most suitable from electrical considerations to increase the value of an alternating current in the recorder coil.

In fig. 9 the attenuated alternating current at the receiving end of the cable is divided at the point B of the duplex bridge, and again subdivided at A and C inversely as the vector-impedances of the paths.

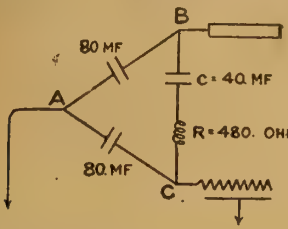


Fig. 9.—Form of Duplex Circuit used on Long Cables.

In the recorder arm B C the ideal electrical conditions would be so to assign values to the receiving condenser *c*, and the inductance and resistance of the recorder coil, as to cause this arm of the bridge to be in resonance, entirely independently of the cable itself, the artificial line, or of any other arm of the bridge. In other words, we should so arrange matters, if we could, that if the arm B C were short-circuited on itself its natural frequency would be equal to the frequency of the current it is required to receive. In the abstract, there would be an infinite number of solutions for this arm, depending upon the stiffness function L/C selected, each solution fulfilling the condition : $C L \omega^2 = 1$.

The alternator has been designed for the particular purpose of operating a cable, and possesses some novel features. Since we cannot reduce the number of poles to less than two, we must rely on a high magnetomotive force, and a minimum clearance for the armature to produce, at such low frequencies, the voltage required. In addition, it is especially desirable to generate an accurate sine wave of E.M.F. These objects have been satisfactorily obtained in the design of the machine used in these experiments.

The resistance of each of the field coils is nearly 1,000 ohms, and the inductance of the armature largely controls the current in the armature circuit, so that the machine can be short-circuited at full voltage without harm.

In starting and stopping the dynamo no form of switch is used, but, instead, the motor which operates the dynamo, starting from rest, gradually builds up the E.M.F. from zero, which gradually dies down to zero at stopping. In this manner there is never any possibility of a "break" in any metallic circuit connected with the transmitting apparatus.

Since the dynamo transmitter comprises the power plant for an ocean cable, it must, therefore, take its place on the instrument table, where the transmitter is directly geared to it. The armature is mounted on ball bearings, and runs with remarkable silence and smoothness under load.

The developments of wireless telegraphy have introduced alternating-current dynamos of considerable power of 100,000, and even 200,000, cycles per second ; but for the present purpose we require an alternator to operate at from 4 to 10 cycles per second, and to develop 100 volts or more. This type of dynamo possesses some interest to the engineer, because it may be said to represent the extreme infra-red end of the dynamo spectrum, just as the high-frequency machines mentioned above represent the ultra-violet end. It would be strange indeed if the needs of telegraphy should be ultimately responsible for the development of both ends of this spectrum.

It is seen that once we can employ a system of signalling in which we are dealing with one fundamental frequency only, and the circuit is never broken, the process of measuring the constants of the cable itself and the most suitable bridge arrangements for high efficiency is greatly simplified.

The removal of any form of arc or spark from the cable circuit has been shown very materially to increase the accuracy of balancing the duplex bridge, while the smooth type of waves employed in sending the signals has enabled this important object to be attained with an accuracy greater than has been possible before.

Using the low-resistance coil of a transformer or auto-transformer as the actual source of E.M.F. in the circuit comprising the cable itself, enables each end of the cable to be permanently connected to earth, thus providing a drainage path for earth currents of all kinds induced in the cable, and also adding to its safety.

The present forms of cable recorders, relays and amplifiers, when relieved from the necessity of recording consecutive impulses in the same direction, are liberated from some practical restrictions which have heretofore hampered them. In the example shown, the recorder coil of the gold-wire relay oscillates back and forth at a definite frequency, and the inertia of the moving parts is, therefore, less troublesome, and we are at liberty to increase the flux of the magnetic field, as well as to reduce the control of the coil so as to allow it to vibrate more freely at its natural frequency.

No mention has been made of the possible application of this method of transmission to landlines, but it may be remarked that in the present Wheatstone automatic system there is great trouble caused by the induction of one line upon another, and if we could remove from the Wheatstone system the necessity of making and breaking the battery circuit at comparatively high voltage we could at a single stroke, very largely reduce all such inductive effects.

It is known that certain characteristics are very desirable in any cable system, such as

(*a*) All signals should represent equal lengths of time ;

(*b*) No two consecutive signals should be of the same sign ;

(*c*) The resolving power or definition of each letter of the alphabet should be as nearly as possible the same ;

(*d*) The total quantity of electricity measured in coulombs impressed upon the cable should be as nearly as possible equal to zero for any two consecutive signals.

It will be seen that the ideal solution for power transmission automatically comprises each of these conditions, and, in addition, has other advantages in safety to the cable property from undue electrical strain throughout every centimetre of its length.

FOUR YEARS' OPERATING EXPERIENCE ON A HIGH-TENSION TRANSMISSION LINE.

The following abstract of a paper by A. Bang, read before the American Institute of Electrical Engineers in June, gives the operating record of a line which transmits energy at 70,000 volts from the Pennsylvania Water & Power Co.'s hydro-electric plant on the Susquehanna River at Holtwood, to the same company's terminal station at Baltimore, Md., where the current is stepped down for distribution purposes. Practically all the load consists of synchronous machinery, such as synchronous converters, frequency changers, etc.

The line is about 40 miles long and consists now of two rows of steel towers, each capable of carrying two independent three-wire circuits. The first of these tower lines (No. 12) was built in 1910, with both circuits installed; the second (No. 56) in the summer of 1914. On this latter at present only one circuit is installed (circuit No. 6).

There is a considerable number of differences in the design of the two lines. The following is mainly a description of the new line, though wherever there is an essential difference, it is pointed out.

Towers.—The towers are galvanised steel, designed for six power cables and two ground cables (on the old line only one ground cable); they are spaced about ten to a mile and the cables on the new line are anchored at every fifth tower at least. All the towers on the new line are set in concrete foundations, while on the older line, steel tripod foundation stubs were used for the suspension towers.

The height of the tower is 44 ft., from ground to the lower crossarm. The distance between the crossarms is 9 ft., against 7 ft. on the older tower line, and the ground wires are located 4½ ft. above the upper crossarm. Contrary to what was the case on Line No. 12, where the power cables for each circuit were located all three in a vertical line one above the other, the cables on the new line have been staggered. The conductors are 300,000-cir. mil, 19-strand aluminium cable. The ground wires consist of ⅜-in. galvanised seven-strand steel cable. The insulators are of the suspension disk type, 10 in. in diameter. The units selected for the newer line have the following electrical characteristics :—

Individual dry flash-over voltage = 95,000 volts.
Individual puncture voltage = 140,000 to 150,000 volts.
Units on older line have a dry
flash-over voltage = 90,000 volts.
and puncture voltage = 100,000 to 107,000 volts.

Eight units to the string are used on anchor towers and seven on suspension towers. Seven units correspond to a dry flash-over voltage of 378,000 volts.

On the old line originally, five and six units, respectively, were used for suspension and strain towers.

Electrical Data.—

Frequency	25 cycles.
Normal line voltage between phases	60,000 to 70,000 volts.
Ohmic resistance of one wire ... =	12.1 ohms (12 deg. Cent.)
Ohmic reactance at 25 cycles is =	13.1 ohms
Impedance at 25 cycles is ... ... =	17.9 ohms.
Losses in three lines at 200 amperes ... ... =	5,800 KW. or 10 per cent. when 58,000 KW. are transmitted.
Capacity current ... ... =	3.5 amperes per wire.

Operating Record.—Below is given a tabulation of all the disturbances to normal operation of the system originating in the transmission lines, together with the cause of the trouble and the year it occurred. These disturbances have further been divided into three groups, depending on their seriousness, *i.e.*, total interruptions (T.I.), where all the load was lost, though generally not more than for a few minutes; partial interruptions (P.I.), where a percentage of the load was momentarily lost; and, finally, mere voltage or frequency disturbances (V.D.), where no load whatever was lost. These disturbances have been recorded whenever the voltage changed suddenly five per cent. or more.

TABLE I.—OPERATING RECORD FOR HOLTWOOD-BALTIMORE TRANSMISSION LINE, JAN. 1ST, 1911, TO DEC. 31ST, 1914.

Cause.	1911.			1912.			1913.			1914.			Total for four years.		
	T.I.	P.I.	V.D.	T.I.	P.I.	V.D.	T.I.	P.I.	V D.	T.I.	P.I.	V.D.	T.I.	P.I.	V.D.
Lightning ..	23	—	10	3	19	4	3	17	11	1	6	7	30	42	32
Defective insulators ..	—	—	—	—	—	—	1	—	—	—	1	1	1	1	1
Sleet on cables	—	—	—	—	—	—	—	—	—	2	2	—	2	2	—
Birds on line ..	1	—	—	—	—	—	1	—	2	1	3	2	3	3	4
Wires blowing together ..	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1

It will be seen that the cause for all the disturbances can be covered under the five headings; of these the overwhelming cause of trouble is lightning.

It may be of interest to recount a few observations made on the effect lightning has on a transmission line in operation. Though the lines are protected at both ends with aluminium lightning arresters, which duly discharge during storms, lightning discharges or surges will nevertheless give rise to "flash-overs" on the line, which, once established, are maintained by the power from the generators. Such flash-overs practically always start at the towers where the clearance distances to ground (*i.e.*, towers) are the smallest (a double or triple ground to the same tower is naturally in effect the same as a two- and three-wire short-circuit). The path of the flash-over may vary. Thus, when circuits Nos. 1 and 2 originally went into service, the suspension towers were equipped with five units to the string and strain towers with six units. With this arrangement it was always found that the flash-over would occur upwards from the conductor, *alongside* the string of insulators.

Fig. 1 shows a typical string of insulators, damaged by such an arc. It can be seen how the three lower insulators are completely broken to pieces, probably mainly due to the heat generated by the arc; the bottom bolt shows a deep burn. It can also be seen from the marks on the string how the arc in this string, instead of travelling all the way from conductor to the tower in one unbroken arc, has broken into small individual arcs, each encircling one insulator. That happens frequently, though not always.

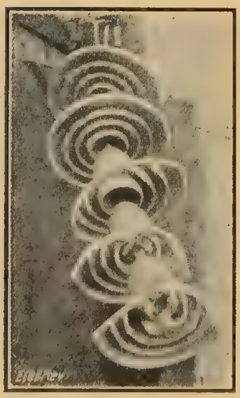


FIG. 1.

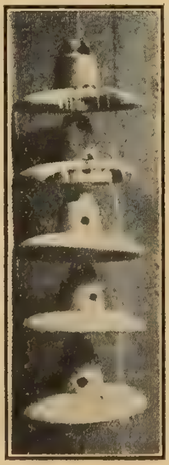


FIG. 2.

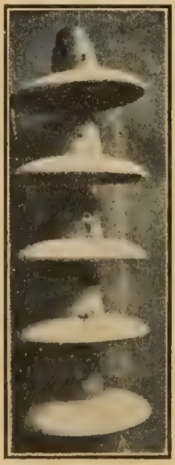


FIG. 3.

FIG. 1.—SUSPENSION TYPE INSULATOR, BOTTOM-PHASE, REMOVED AFTER PARTIAL INTERRUPTION.

FIG. 2.—INSULATOR STRING PUNCTURED ON LINE.

FIG. 3.—INSULATOR STRING PUNCTURED BY TEST.

Not only the insulators, but also the cable is liable to be damaged by lightning arcs. If the arc stayed at one place it would quickly burn the cable through. As a rule it is blown away from the power house, due to its own magnetic action.

The plan was tried in 1912 of increasing the number of disks of a suspension string to seven and of a dead-end tower to eight. Before the lightning season of 1913 one whole circuit was equipped in this way; the result was, as shown by the power-house ground chart record, that in 1913 the lightning flash-overs were distributed between the two circuits as follows:—

27 lightning strokes on circuit No. 1.
20 lightning strokes on circuit No. 2.
6 lightning strokes unknown on which circuit.

In other words, the circuit with the many insulators showed the larger number of lightning strokes. Inspection showed that whenever the flash-over took place on a suspension tower (which generally was the case in preference to a strain tower) the lightning arc on a circuit with the five insulators in the string, would as usual rise upwards along the insulator strings to the crossarm above, while on a circuit with the seven units in the string the arc would in every case go just the opposite way, *i.e.*, from the conductor to the crossarm below. This was naturally due to the fact that this clearance distance for the two upper conductors was materially decreased by adding two more units to the string. For the bottom conductor, the number of flash-overs was greatly reduced. This change in the location of the arc resulted in two distinct gains. In the first place, the arc did not have nearly the same chance for damaging the insulators by heat, as it did not pass alongside them but away from them. The other advantage was that it proved to be easier to extinguish the arcs; that it could be done with much less loss of the synchronous load connected to the system (on account of the preponderance of two-wire short circuits compared with three-wire short circuits).

Altogether the number of insulators removed from the line due to lightning damage is small, not more than about 100 per year, on the average, and the number is not on the increase.

Far more important from a maintenance point of view is the continuous *deterioration* of the porcelain in the insulators, such as it was discovered a few years ago could be determined on insulators of the suspension type by means of taking insulation readings between the pin and cap (megger tests).

The first complete test of circuits Nos. 1 and 2 was made after about three years of operation, and the same line was gone over again about half a year after the first test. All told, four years' operation produced 2,640 bad units, or 11.7 per cent., an average of 2.9 per cent. per year. Judging from the last test, it seems as though this deterioration goes on at a rapidly increasing rate year after year.

The two circuits had practically the same number of bad units, but the strain towers on both circuits show a very much larger percentage (17.1 per cent.) of damaged units than the suspension units (7.6 per cent.), indicating that the horizontal strain units are very much more exposed to this trouble than the vertical suspension units.

FIG. 4.—NICHOLSON ROTARY FUSE BANK; FUSE BLOWING.

After a number of these units were removed from the line, a series of tests was made in an attempt to determine the cause of this trouble. While these tests were going on, a puncture of each and every one of a string of five insulators occurred one day on the line, during actual operation. No lightning was reported, the weather was clear, and no switching was done at the time of the disturbance. Fig. 2 shows this string.

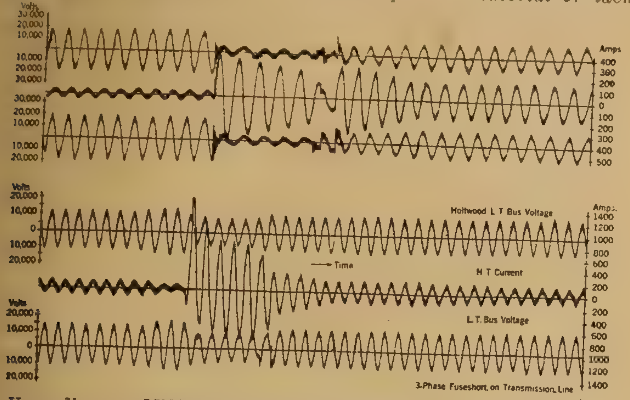
It was naturally thought that this was a case of deteriorated porcelain, which could have been caught in time to prevent failure, if only megger readings had been taken of these insulators sometime beforehand. To prove this, five units removed from the line because of low megger readings were mounted in a string and high voltage was built up on them from a 70,000-volt, 10,000-KW. transformer, with a 10,000-KW.

generator behind it. The current was limited to about 250 amperes by a resistance.

The result of this test is shown in fig. 3; when the voltage reached about 30,000 volts, the insulator punctured, burning porcelain and iron being, so to speak, shot out from the side of first one, then another insulator, leaving holes of just the same nature as found in the insulator string punctured on the line.

While the foregoing tests conclusively prove the serious nature of this insulator deterioration, they do not throw much light on the real nature and the cause of this trouble. The following tests were made with this object in view: On 24 insulators discarded, the pin, cap and cement were dissolved in a diluted solution of nitric and hydrochloric acid so as to give an unobstructed view of the surface of the porcelain, normally hidden by the pin and cap. Of these insulators seven showed clearly a tiny crack in the porcelain at the bottom of the head; three insulators showed similar cracks across the head; 13 insulators did not show any cracks; one insulator was destroyed during the test.

Trying with the megger on the cracked insulators, it could readily be shown that the low resistance was located right in the crack. On insulators where no cracks could be found, it is believed that the failure is due to *porous material or lack of vitrification in the burning*, which gradually has allowed moisture to be absorbed by the porcelain in the same way as moisture has penetrated through the cracks in the cracked insulator.



Upper diagram: Middle wave represents H.T. current at sub-station; outer ones, L.T. bus voltage at sub-station. Lower diagram: Middle wave represents H.T. current, others L.T. bus voltage at power house.

Fig. 5.—Three-phase Short Circuit on Transmission Line.

When it was first discovered that a large percentage of the low megger readings was due to cracks in the porcelain, it was naturally feared that these insulators had lost a great part of their mechanical strength. This proved, however, not to be the case.

Working on the theory that the depreciation was at least partly due to high internal stresses, set up by temperature changes, the insulators were subjected to a hot and cold water treatment.

After each temperature change the insulator was tested with a megger and discarded if it gave a reading less than "infinity." If an insulator endured the treatment without any change in resistance it received in all 10 temperature changes, and was finally subjected to high potential. With one type of insulator no failures were recorded.

Working, on the other hand, on the theory that, at least in part, this insulator trouble was due to absorption of moisture without accompanying cracks, the plan was tried of drying out some of the insulators removed from the line, under high vacuum and at temperatures varying from 50 to 90 deg. Cent.

After only a few hours' treatment, the insulation resistance decreases materially; after 24 hours' treatment a material increase is, however, always found, and this continues steadily until many insulators reach the infinity mark, even when hot. All of them, without exception, will record infinity, when tested cold after two days' treatment.

After drying out, the insulators were given a high-potential test with 25 cycles.

The result was that out of a total of 37 insulators tested, 12 withstood a heavy flash-over test for ½ min. The rest of them punctured at voltages varying from 30,000 to 90,000 volts.

On the whole, the experiments all tend to show that the deterioration of the type of insulator in question is not due to electrical but rather to mechanical and ceramic causes.

The most common cause of sleet trouble is that with the arrival of milder weather, the sleet will often fall off one full span or several spans at one time, but still remain on other spans. Such conditions result in unequal loading, and if the wires of different phases are in the same vertical plane, they are liable to come in touch with each other and produce short circuits. The few disturbances recorded as caused by sleet on the Baltimore transmission line have all been of this nature.

In building the new line it has been attempted to minimise this trouble by having the middle crossarm extend farther out than the top and bottom ones.

Another method of preventing sleet trouble is simply to keep the transmission lines so hot that no sleet whatever can be formed on them.

The birds troubling this line are turkey buzzards, and they often choose the towers as a resting place, and are liable to ground the line to the tower through their own bodies. There is especial danger if they sit on the crossarm right below the live wire. Often they will fall down without even causing a voltage disturbance, but frequently they will give rise to an arcing ground, which may even develop into a two-wire short circuit.

The one voltage disturbance recorded as being due to wires blowing together is of no special interest.

In order to maintain continuous operation, several different protective devices have been adopted.

Trouble from defective insulators, sleet, buzzards, and the wind swinging the wires together, generally results in grounds or short circuits that persist on the system until the voltage is taken off the faulty line. The method to safeguard operation is to cut the damaged line out.

The system in use consists simply of overload relays at the power house connected in series with the line current transformers and also one relay in the ground connection for the neutral of each transformer bank. At the sub-station, reverse current relays take the place of the overload relays at the power house. To prevent all three lines from going out by relay action, in case there should be a short circuit on all the lines at the same time, the trip circuits are interlocked.

The interlocking relay arrangement is not sufficient as lightning protection, as lightning flash-overs very often occur on both circuits Nos. 1 and 2 at the same time. (It still remains to be seen whether they will occur on all three circuits at the same time.) When both circuits are in trouble at the same time, the clearing of both means a total interruption. Experience showed that if only some means could be found to extinguish the power arcs, an interruption might be avoided.

The system in use is the arc extinguisher arrangement invented and designed by Mr. L. C. Nicholson, Buffalo, N.Y. The principle of this arrangement is to shunt any arc that arises on the line with a fuse wire, so that the current, as long as the fuse lasts, will prefer this path to the arc. The fuse is calibrated to blow in from 5 to 10 cycles (25-cycle system), and this short time, experience has proved, is enough to extinguish the arc on the line; therefore as soon as the fuse blows, the line will be clear again. The fuse wires are connected across the proper wires automatically by means of specially designed magnetic relays and switches. The whole arrangement is placed right outside the power house. The design of the equipment is such that seldom more than one cycle will pass from the time the lightning arc is established until the switch is closed. It is in this speed that the apparatus has its greatest advantage, since it allows the arc on the line so very little time to spread and do damage.

Fig. 5 shows two oscillograms which illustrate the action the short-circuiting of the lines with such fuses has on the system. This device is especially satisfactory on the Baltimore line when only a ground or two wire short circuit occurs; in such cases it saves all, or practically all, the synchronous load. On three-phase short circuits generally about 50 per cent. of the load can be saved.

In 1913 and 1914 it cleared the line 25 times out of 40 times when it was struck.

Another device in use, not to prevent lightning flash-overs, but to minimise their consequences by extinguishing the arcs, is a so-called field destroying and restoring device, invented by Mr. F. E. Ricketts, of Baltimore. The principle on which it operates is that when a short circuit occurs on the line, the field of all the generators is for a moment destroyed, so as to allow the arc on the line to die out on account of lack of voltage, and then immediately after be built up again, so as to force the synchronous load into step again before the synchronous converters, frequency changers, etc., have come to a stop.

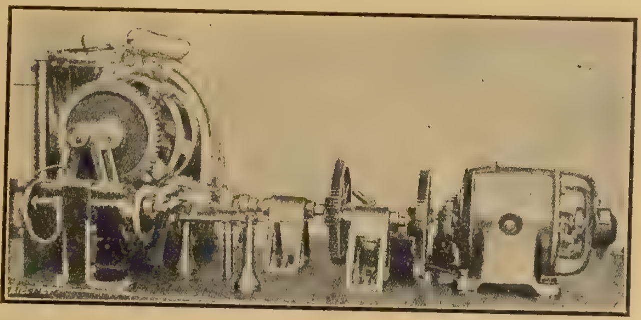


Fig. 6.—Relay Motor and Revolving Drum for Ricketts Field Destroying and Restoring Device.

The switching for this device is operated by relays, the action of which is delayed four seconds to give the Nicholson arc extinguisher and interlocking relay arrangement the first chance to clear the trouble.

To operate it a small continuously running motor is clutched to a contact drum, which, on starting, simultaneously opens all the ordinary field circuit breakers, at the same time short-circuiting the field windings across their respective discharge resistances, thus allowing the field gradually to die out and the line voltage to be reduced correspondingly. Meanwhile the drum continues to revolve and will, after a predetermined time (originally 5 sec., now 1¼ sec.), close other contacts which have the effect of slamming all the circuit breakers in again. Immediately the fields and line voltage start to build up again. After some surging between the generators themselves individually and the generator and synchronous load, the voltage will again be normal, generally after about one minute. The drum continues to rotate until it has made one complete revolution, after which time it is disengaged from the motor and the whole equipment is ready for another operation.

The record for this device shows for 1913 and 1914 a total number of 12 successful lightning operations and 4 failures.

The fuse arrangement has been given preference and first chance for acting, mainly on account of its quickness of action, which saves the line from too severe damage, and also on account of the excellent results it has produced in case of the lesser lightning disturbances like grounds and two-wire short circuits.

The field-destroying device treats all lightning disturbances as equally severe and produces the same disturbance on practically all of them, but seems, on the other hand, to have the great advantage of extinguishing the arcs with more certainty.

While lightning still gives rise to a number of disturbances, these have been very materially reduced by the use of special protective devices. As to sleet, special operating methods have been adopted during such storms, which, it is believed, will prevent trouble from this cause. The approaching danger from deterioration of the insulators has been discovered at an early stage, and rigid and repeated elimination tests of bad insulators with the megger, have been adopted as part of the routine maintenance, so that it is felt that *operation* will have but little to fear from this source.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

10,433. "Automatic electrical human target." J. Callaghan. July 19th.

10,453. "Electrical driving of spindles." Siemens Schuckertwerke G.m.b.H. July 19th. (Convention date, July 20th, 1914, Germany.) (Complete.)

10,454. "X-ray apparatus." British Thomson-Houston Co., Ltd. (General Electric Co., United States). July 19th.

10,485. "Electro-magnetic recording apparatus for telegraph circuits." R. W. James. July 19th. (Alexander Hill Annand.) (Complete.)

10,521. "Electrical element for heating machine tools." H. Tomlinson-Lee. July 20th.

10,535. "Electric arc lamps." Clarke, Chapman & Co., Ltd., and R. C. Harris. July 20th. (Complete.)

10,552. "Holder or gallery for securing gas and electric shades and the like." W. G. Scott. July 20th.

10,560. "Armouring of electric cables for motor-cars and similar purposes." F. J. Chaplin. July 21st.

10,598. "Rheostat switches and the like." J. Roothaan & Ferranti, Ltd. July 21st. (Complete.)

10,604. "Electrolytic cells." H. R. Nelson. July 21st. (Convention date, Aug. 17th, 1914, United States.) (Complete.)

10,605. "Method of electrolysis." H. R. Nelson. July 21st. (Convention date, August 17th, 1914, United States.) (Complete.)

10,639. "Portable telegraph and telephone apparatus, applicable for signalling purposes." C. Doherty & Underwood, Ltd. July 22nd.

10,667. "Electric alarm or calling devices used in receiving apparatus, and more particularly in wireless receiving apparatus." A. H. Morse & The Indo-European Telegraph Co., Ltd. July 22nd. (Complete.)

10,668. "Electric welding machines." Deutsche Schweissmaschinen-Bau-und-Vertriebs G.m.b.H. July 22nd. (Convention date, July 22nd, 1914, Germany.) (Complete.)

10,669. "Telephonic reproducers." C. Stille. (Addition to 9,644/13.) July 22nd. (Complete.)

10,672. "Wireless type-printing telegraph systems." L. C. Stewart and J. J. Little. July 22nd.

10,676. "Ampere-hour electricity meters." Landis & Gyr Akt. Ges. July 22nd. (Convention date, July 22nd, 1914, Germany.) (Complete.)

10,680. "Couplings for armoured or protected cables and electric conductors for use under water and elsewhere." V. C. Hastings & G. Fiorentino. July 22nd.

10,681. "Utilising electric energy." E. Bachelet. July 22nd.

10,706. "Electrically operated intermittent motion in cinematograph apparatus applicable to other purposes, such as ratchet or feed gearing or free-wheel mechanism." A. C. Moll & A. D. Moll. July 23rd.

10,709. "Automatic telephone transmitters." Eastern Telegraph Co., Ltd., & B. E. Phillips. July 23rd. (Complete.)

10,711. "Cooling or ventilating devices for dynamo-electric machines." A. Mond. July 23rd. (Maschinenfabrik Oerlikon, Switzerland.) (Complete.)

10,722. "Electrical heating and cooking apparatus." C. G. Nobbs, Sen., and W. W. Nobbs. July 23rd.

10,726. "Electro-magnetic levitating apparatus." E. Bachelet. July 23rd.

10,730. "Screw fittings for electric lampholders, ceiling plates, and the like." W. Parsons & Birmingham Central Supply Co., Ltd. July 23rd.

10,739. "Method of generating high-frequency electric currents." T. F. Wall. July 24th.

10,752. "Electric motor starters and controllers." E. Schattner, T. G. Travis, & J. R. Walton. July 24th.

10,755. "Coil for electrical purposes and method of winding same." H. Wade. July 24th. (J. R. Leeson, United States.) (Complete.)

10,759. "Methods of signalling on submarine cables and other telegraphic circuits." C. V. Drysdale. July 24th.

10,762. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., & A. A. Pollock. July 24th.

10,769. "Crystal detectors, particularly for wireless signalling." Sterling Telephone & Electric Co., Ltd., and T. D. Ward-Miller. July 24th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

25,951. Trolley Wires for Electric Railways and the like. F. Lautenbacher. November 12th. (December 2nd, 1912.)

26,631. Electric Clocks. H. Aron. Elektricitätszahlerfabrik Ges. November 19th. (February 26th, 1913.)

26,899. Electrolytic Measuring Instruments. H. S. Hatfield and Chamberlain & Hookham, Ltd. November 22nd.

26,905. Circuit Arrangements for Telephone or other systems. Siemens Bros. & Co., E. A. Laidlaw, and W. H. Grinsted. November 22nd.

1914.

2,214. Spark-gap Devices for Wireless Telegraphy. R. Goldschmidt. January 27th. (January 27th, 1913.)

2,290. Electric Massage Apparatus. M. Jakowlew. January 28th.

4,447. Electric Switches. T. Jessen. February 20th. (February 24th, 1913.)

4,664. Production of Electric Waves for Wireless Telegraphy, Telephony and the like. Polyphos Electrizitäts Ges. February 23rd. (February 26th, 1913.)

8,800. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt. Ges. April 7th. (April 7th, 1913.)

8,806. Holders for Electric Glow Lamps. C. A. Schaefer (firm of). April 7th. (April 15th, 1913.)

9,103. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt. Ges. April 9th. (Addition to 22,013/10.)

9,105. Telephone Exchange Circuits. Siemens Bros. & Co. (Siemens and Halske Akt. Ges.) April 9th. (Additions to 11,251/10 and 4,698/12.)

9,110. Incandescent Electric Lamps. C. Gladitz. April 9th.

9,278. Magneto-electric Machines for medical use. E. C. R. Marks. (Soc. Gallot et Cie.). April 14th.

9,718. Electro-mechanical Selector. E. G. Godfree. April 20th.

10,171. Carbon Electrodes for Galvanic Cells. V. Scholz. April 24th.

11,844. Induction Meter with Three-armed Driving Core. Allgemeine Elektricitäts Ges. May 13th. (May 17th, 1913. Addition to 3,912/14.)

13,062. Electric Signalling Systems, particularly for use in Mines. Sterling Telephone & Electric Co., Ltd., and F. G. Bell (partly Telephon Fabrik Akt. Ges. vorm J. Berliner). May 27th.

15,939. Starting Devices for Electric Motors. W. G. Wilson & P. L. Harlow. July 3rd.

15,946. Junctions for Overhead Trolley Wires. Cedes Electric Traction, Ltd., & K. D. Bowen. July 3rd.

16,093. Armature Windings of Electric Motors or Dynamos. W. H. Scott. July 6th.

16,315. Electrical Device for Controlling Race-starting Barriers. A. Burt. July 8th.

16,342. Telegraphy. E. C. R. Marks (International Quadrupluex Co.). July 8th.

16,418. Relays and Indicators. Sterling Telephone & Electric Co. (Telephon Fabrik Akt. Ges. vorm J. Berliner). July 9th.

16,471. Electric Relays. Eastern Telegraph Co. & B. Davies. (Cognate application, 17,452/14.) July 10th.

16,712. Telephone Systems, more particularly for Police and Fire Alarms. G. L. Hughes & R. E. Cooper. July 13th.

16,979. Cooling Arrangements for Dynamo-electric Machinery. Siemens Bros. Dynamo Works, Ltd., & E. O. Kieffer. July 17th.

17,133. Electro-deposition of Metal upon Metal by means of High-current Density, specially applicable for Coating Printing Rollers, Hydraulic Rams, and other like purposes. T. R. Harris. July 20th.

18,607. Attachments for Telephones and the like. K. E. Zierau. August 12th.

18,661. Electric Signalling Systems, particularly for use in Mines. Sterling Telephone & Electric Co., Ltd., F. G. Bell, and J. W. Dungey. (Patent of addition, 13,062/14.) August 14th.

18,882. Systems of Electric Distribution. British Thomson-Houston Co (General Electric Co.). August 20th.

19,441. Electric Staff Exchangers. A. Douglas & H. H. Hodgson. September 4th. (October 28th, 1913.)

19,587. Electric Circuit Interrupting Means. British Thomson-Houston Co. (General Electric Co.). September 9th.

20,286. Electrical Heating Unit. F. W. Ball. September 28th.

21,046. Magnetic Lock for Miners' Lamps. John Davis & Son (Derby), Ltd., & W. H. Davis. October 16th.

23,293. Electrical Water-heater. S. le F. Varvel. November 30th.

24,078. Construction of Laminated Slot-keys for Dynamo-electric Machinery. C. B. Burdon (Siemens Schuckertwerke Ges.). December 15th.

1915.

131. Electric Fusible Cut-outs. H. P. Liversidge & Pennsylvania Appliance Co. January 4th.

821. Circuit Arrangements for Telephone Systems. W. H. Grinsted. January 18th.

2,767. Manufacture of Electrodes for Electrolytic Purposes. Siemens and Halske Akt. Ges. February 20th. (February 21st, 1914. Addition to 605/09.)

5,184. Electric Light Systems, more particularly adapted for Vehicles. Robert Bosch (firm of). April 6th. (June 8th, 1914.)

6,618. Electric Motors or Dynamos. W. H. Scott. May 3rd. (Divided application on 16,093/14, July 6th.)

6,619. Brush-gear for Electric Motors or Dynamos. W. H. Scott May 3rd. (Divided application on 16,093/14, July 6th.)

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Page
Electricity on the Rand 193
Copper 194
Electrical Pyrometry 194
The Case for the Electrification of Cane Sugar Mills and Refineries, by E. P. Hollis (*concluded*) 195
Units from Refuse, by John B. Morgan 196
New Electrical Devices, Fittings and Plant (*illus.*) 197
War Items 198
Correspondence—
Limitation of Price Coal Bill 199
The Electrical Cooking Problem: An American Experiment (*illus.*) 199
Recent Progress in Pyrometry, by Chas. B. Darling (*illus.*) ... 200
Business Notes 204
Robert Hammond (*illus.*) 207
A Japanese Railway Electrification (*illus.*) 208
Reviews 212
Notes 213
City Notes 216
Stocks and Shares 217
Electric Tramway and Railway Traffic Returns 218
Share List of Electrical Companies 218
Metal Market—Fluctuations in July 219
The Future of Export Trade 219
Power Supply to the Rand Mines (*illus.*) 220
New Patents Applied for, 1915 224
Abstracts of Published Specifications 224
Contractors' Column ... ... Advertisement page xx

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ELECTRICITY ON THE RAND.

ON previous occasions we have printed full accounts of the extraordinary development of electricity supply on the Witwatersrand—respectively from the point of view of the supply company, as represented by Mr. A. E. Hadley (ELEC. REV., March 28th, 1913), and from that of the consumer, in the person of Mr. J. H. Rider (ELEC. REV., April 23rd to May 21st, 1915).

The presidential address delivered by Mr. Bernard Price to the South African Institute of Electrical Engineers, of which we publish an abstract in this issue, forms a fitting pendant to these articles, providing a comparison between the undertaking and other great schemes, and a general review of the whole system.

The undertaking, as a whole, presents many unique and interesting features: it is one of the largest of its kind in the world, and has been carried out on independent lines, conforming to the special local circumstances rather than to the established practice of other installations; the pressure of transmission from the main station is very high (80,000 volts), and the distributing pressure is also unusually high (20,000 volts, a pressure which in this country has not yet been exceeded in the main transmission lines); no less than 99 per cent. of the supply is consumed by the mining industry, a feature which is hardly paralleled except in the case of large hydro-electric schemes carried out for specific industrial processes; and the output is gigantic—four times the whole consumption of Manchester. The load factor, too, is extraordinarily high, and it will be noticed that even during the last three years the load has practically doubled. The enormous supply of compressed air to the mines represents an entirely unique departure; nowhere else is such a system to be found on the grand scale here met with.

The possibility of using the overload capacity of the plant to deal with peaks of short duration, of which Mr. Price had experience on Tyneside, is here utilised to great advantage; as he points out, the heat capacity of the machines and transformers is so great that the temperature on overload rises but slowly, and the boilers and turbines are well adapted to deal with temporary overloads, so that plant rated at the average load can deal with all ordinary fluctuations, and its efficiency can be maintained at a high level. Mr. Price states that these advantages increase in value with the size of the plant.

Another remarkable feature of the system is the large number of electric winders connected, a class of demand which is not usually regarded as very desirable, owing to the extreme variations of load; but Mr. Price holds that once a few winders have been connected, the more added the better. Probably there is no other district in the world where so many main electric winders are energised by a single undertaking, and in the light of this development it is interesting to recall the detailed and pessimistic comparisons between steam and electric winding that were made in this country some ten years ago; there are always to be found amongst us people who declare that "it can't be done," whenever any new proposition is brought forward, and though they may be confounded by the event, they bob up again somewhere else with undiminished scepticism. We have seen this attitude adopted with regard to main-line electrification, power supply from large central stations, the electric driving of textile mills, and, more recently, to the electric vehicle, electric cooking and heating, electricity supply at ½d. per unit, &c. Nevertheless, as in the case of electric winding, these things generally do come to pass in the long run, and sometimes very quickly. The prophet of failure has a thankless task, and indeed exerts a detrimental influence upon the community.

It is somewhat singular that the load factor of the Rand supply is so high, in spite of the fact that in this case so little benefit is apparently derived from diversity of demand; but probably the method adopted for determining the diversity factor from smoothed curves, instead of instantaneous maximum demands, masks the diversity to a great extent. The question naturally arises: what would be the effect of undertaking other classes of supply, in addition to the mining industry? As Mr. Price points out, the present load curve possesses a peak of long duration which would not overlap the peaks on the curves of a city supply for lighting and traction, and, therefore, the addition of such a load would improve the load factor. Carrying the process further, Mr. Price is led to endorse the view of Dr. Ferranti, that if electricity were employed for all possible purposes an enormous saving in capital and fuel would result. It will be noted that in Chicago the week-day load-factor is already 56 per cent. Such a result can only be attained by the co-operation or concentration of all sources of supply in a district under a single management.

Many other lessons may be derived from a study of Mr. Price's interesting address, which revives our hopes that we may yet see electricity supplied for all purposes at a rate approaching ⅛d. per unit. As a speculation, let us suppose that, owing to increased economy of working and improvements in plant, the cost of generation on the large scale could be halved every time the output was doubled; in that case we should reach the goal when the output was about 16 times the present value.

Copper.

The copper market has had a reactionary tendency in spite of fitful gleams of firmness. There can be little doubt that fundamental conditions are being affected by the growing production, which is particularly manifest in the United States, though it must not be overlooked at the same time that output is rapidly increasing in other parts of the world, more especially Africa and South America, where some very big properties have recently come into effective operation, and are shipping raw copper both to Europe and to the United States. The attitude of the leading producers continues to be one of passive resistance to the less favourable market tendencies observable, and so far as Europe is concerned they have, for weeks past, been practically out of the market, but in America they seem now more responsive to bids. As to Europe, they apparently assumed that their position was so unassailable that they could afford to play ducks and drakes with consumers by declining to make quotations on the basis hitherto obtaining, namely, of sterling prices per ton on c.i.f. terms, quoting instead in cents per lb. f.o.b. America. The natural consequence of this has been, of course, that people in Europe have stood aside; consumers, rendered cautious by the excessively high prices ruling, and taught by experience that the American attitude has always been to drive up quotations wherever possible, have abstained from buying, and business has accordingly been limited to very small proportions. There was a sharp rise just after the holidays, the movement causing some searching of hearts, because circumstances outwardly, at all events, do not appear to justify the increased confidence. It was stated that things had taken a better turn again in America, but this really seems hardly possible, and the actual explanation of the fitful rise was that the Government had permitted several hundred tons of rough copper to be shipped from here to America, where it is to be turned into electrolytic metal, and reshipped to England. The Government have, by this measure, undoubtedly managed to secure a supply of cheap metal, and they have at the same time rendered standard copper a marketable commodity, which it had ceased to be, in consequence of the export prohibitions. Any movement which tends to increase the output of refined copper is good, and it is a matter for hearty congratulation that, at the eleventh hour, there seem to be indications of a little common-sense in one of our Government departments concerned with trade, a quality conspicuously absent during the past 12 months. The statistical position in Europe is not much to boast about, and the possibilities are that there will be a further increase in available stocks as time goes on. Consumption is almost limited now to the provision of war munitions, and business of a general merchant character is actively discouraged by the authorities. So long as war munitions can be turned out on an ever-increasing scale, the consumption of copper is bound to expand, but it is exceedingly doubtful whether, under any circumstances, war consumption can equal the demands of peace. If it cannot, and does not, then refined copper at the present rate of output is still pounds too high. This aspect of the position is beginning to attract some attention in the United States, and accounts for the fact that producers are showing impatience for another buying movement to develop. Generally they are, no doubt, well sold, but this is by no means the universal position of affairs, and, indeed, one of the largest interests is said to be wanting business for almost immediate delivery. No doubt a further buying movement is due soon, and no doubt also the utmost will be made of it, if and when it does appear; but the war position is so exceedingly disappointing, and financial conditions need such careful watching, that a continuance of high prices for such a commodity as copper seems to be out of the question, especially as output is becoming colossal.

Electrical Pyrometry.

The difficulties met with in the determination of high temperatures under workshop conditions were formerly very great, and undoubtedly the lack of means of accurate measurement in this respect greatly retarded the scientific development of many industries, such as metallurgy and pottery; the use of small fusible cones composed of various substances, with melting-points that were approximately known, afforded a fairly close estimate of the temperature, but in many cases the skill acquired by the workmen during long years was relied upon to determine the temperature by eye, and the degree of expertness to which some of these men attained was truly marvellous. It is, however, extremely unsatisfactory to have to depend upon a human thermometer, who may fall ill or migrate to other works, and in any case is useful only within a narrow range of conditions.

The development of the electrical pyrometer, therefore, to its present exceedingly high standard of accuracy and efficiency has conferred benefits upon certain industries which cannot be over-estimated, and it is gratifying to know that it has been so very largely due to the efforts of British scientists and instrument makers. We have now reached a stage at which Mr. C. R. Darling, a recognised authority on this subject, is able to make the claim that British electrical pyrometers are in advance of all others. There is still plenty of scope for research in this field; we publish elsewhere a summary of recent improvements, which may serve also to indicate the directions in which progress is to be anticipated, and we hope that our lead will be maintained and increased.

THE CASE FOR THE ELECTRIFICATION OF CANE SUGAR MILLS AND REFINERIES.

By ERNEST P. HOLLIS, A.M.I.E.E., A.Am.I.E.E.,
M. Assoc. Mining Elec. Eng.

(*Concluded from page* 164.)

Before proceeding to a closer examination of electrification proposals, attention deserves to be paid to bagasse as a fuel.

The utilisation of the cane sugar refuse or bagasse as a fuel for steam-raising purposes is comparatively modern in origin, and whilst the chemical conditions attendant on its burning have been thoroughly investigated, it is, nevertheless, burnt very frequently on unscientific and inefficient lines. Since the complete electrification of a new mill or the overhaul of an old one would probably mean the installation of a new steam-raising plant, and since the benefits accruing from the employment of electricity as a motive force are so closely interlinked with the efficient burning of the fuel, it becomes desirable in connection with any discussion on the electrification of sugar mills to appreciate the position in regard to the burning of bagasse. In a majority of mills little care is given to the fuel. It is fed into a furnace chosen with no particular regard to the fuel which had to burn in it or to the conditions under which the fuel would burn best; the efficiency of combustion has therefore been small. If the end aimed at is to be realised—viz., that the bagasse shall supply the whole of the power of the mill—it must be burned under the most favourable conditions.

A typical sample of bagasse may contain, roughly, from 33 to 50 per cent. of fibrous matter, 32 to 56 per cent. of moisture, and some sugar. In addition, the hydrogen and oxygen present in the sugar and fibre occur in such quantities as to form moisture on burning, with the result that 1 lb. of bagasse contains on an average 0.215 lb. of carbon and 0.79 lb. of moisture. If the bagasse be burned just as it stands the heavy duty is imposed on the furnace of evaporating the moisture and raising it to the temperature of the flue gases, and, in addition, a much larger volume of air is admitted to the furnace due to the heavier rate of firing than would really be necessary if more perfect combustion were obtained. This point has been closely investigated recently, and it has been found that by drying the bagasse a great increase in efficiency is obtained. One pound of undried bagasse containing 53.7 per cent. of moisture evaporated 1.63 lb. of water from and at 212° F., whilst the dried bagasse having 46.3 per cent. of moisture evaporated 2.3 lb. from and at 212° F., which shows a gain in evaporative efficiency for the whole of the fuel burnt of 41 per cent. It is decidedly economical therefore to dry the fuel, for which purpose the waste flue gases are utilised.

A vertical chamber is inserted in the path of the flue gases which, propelled by a fan, pass upwards and emerge at the top. The bagasse enters at the top on a conveyor and falls downwards over a series of sloping drying trays, which are so adjustable in slope that they permit the rate of falling of the bagasse to be varied according to its wetness, giving it a greater or less time for drying. On arrival at the bottom the bagasse drops on to a conveyor and is passed on to the boilers.

To burn bagasse, specially designed boilers are imperative, having large combustion chambers and preventing the admission of too much air as the fuel is admitted. A Dutch-oven type of furnace appears to be the best practice, working in connection with water-tube boilers.

Outline of Electrical Scheme.—In putting the case for electrification before the manufacturer, it is of the greatest importance that concrete proposals for an electrification scheme be put before him, because there are so many special circumstances in sugar mills that put electrification questions on quite a different level compared with an ordinary works. In fact, the sugar mill is just as special as a colliery.

The following is an outline of a typical scheme. Steam would be generated in water-tube boilers, fired by bagasse delivered to the furnaces on a conveyor which passes through a chamber heated by flue gases in order to dry the bagasse before it is burnt. The steam would be superheated and passed on to extraction type steam turbines driving generators producing three-phase power at 50 cycles, and 440 volts, the generators working with an insulated neutral. The steam would be exhausted into a receiver. If it has to be transmitted any great distance care must be taken that a suitable amount of superheat is present, passing the steam, if necessary, through a superheater either separately fired or in the boiler furnace. This small amount of superheat has been found by experience to effect important reductions in the heat lost by the steam when passing through a long pipe-line.

The steam would then pass on to the building through a well designed pipe-line, and would arrive at the pans in a state of saturation. The electrical power would be distributed to the various buildings, inside which it would be carried by acid-proof insulated cables on porcelain insulators, or in well drained conduit according to the circumstances, in order to protect the cables from the effects of moisture. Three-phase motors would be used throughout of the squirrel-cage type for machinery such as the centrifugal pumps, which do not require a very high starting torque or an adjustable speed, while for centrifugals where adjustable speed was desirable, or for conveyors which might have to start up on a heavy load, slip-ring motors would be installed.* Naturally the crushers and rolls call for slip-ring motors. All motors exposed to moisture would be either totally enclosed or pipe-ventilated, and in those rooms where moisture was present only in small amounts, the windings of the motors would be specially impregnated, permitting semi-enclosed motors to be used.

In preparing the scheme of electrification for a sugar mill, a big fight has to be put up for the driving of the crushers, which may be compared in one respect to the winder at a colliery. As is well known, it is the practice to argue against the electrification of the colliery winder that as it consumes a large amount of power it is inefficient to convert the energy in the steam into electrical energy and then back again into mechanical energy, when the conversion into electrical energy may be avoided and the mechanical energy be taken direct from the steam. So it is said of the crushers, and in some large mills which employ electricity extensively the crushers are not electrified, the exhaust steam passing into the mains for steam heating the vats. During recent years, however, quite a number of these large crushers have been electrified, and, as might have been expected, it has been found that, while from the point of view of economy they have compared favourably with the steam drive, there have been other additional advantages which have amply justified electrification.

The Case for Electrification.—The first point to be made for electrification is that it effects such economy that the purchases of additional oil and coal are eliminated. These economies are realised in the following ways:—

(*a*) The introduction of electrification with a modern steam generating plant allows the utmost to be made of what fuel is available, and enables it to be burnt under the most effective conditions.

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* It is realised that for centrifugal driving the slip-ring motors with continuously rated rotor starters are quite satisfactory. There is no need to resort to the rather desperate expedient of a French sugar refinery where generators of different frequencies were installed, the motors momentarily taking their supply at a frequency giving the desired fractional speed.

(*b*) Electrification permits the concentration of the various smaller power generating units into a few large ones ensuring a far higher efficiency.

(*c*) Electrification permits turbines to be used instead of reciprocating sets. These turbines can be of the extraction pattern so that as much exhaust heat can be drawn off as required, and no more. The amount taken can be regulated at will.

(*d*) The long lengths of steam piping for carrying steam to various engines are eliminated. A small loss in the electric wiring replaces a much heavier loss in radiated heat.

(*e*) Power can easily be transmitted to distant pumps.

These and minor other considerations combine to increase the efficiency of the plant to such a point that not only no fuel need be purchased but a reserve of fuel is available to generate more heat to enable maceration to be carried much further, as mentioned previously. Illustrating this point, the bagasse comprises part juice and part fibre. About 12 per cent. of the total weight of the cane had consisted of sugar, and of this 10 per cent. has been removed at the crusher leaving 2 per cent. in the bagasse. Twenty per cent. of the total amount of sugar thus remains in the bagasse.

It is found in electrified mills that fuel is available to permit maceration to be carried on to such a point that half the remaining juice is extracted, thereby making a 10 per cent. increase in production.

Reverting to the question of electrifying the rolls, it will be found present in the minds of sugar manufacturers that steam driven rolls fulfil the very useful purpose of affording a supply of low pressure steam. But with electrification the whole of the exhaust steam is taken from the extraction turbines, and the amount taken is just what is wanted and no more. There is no waste of exhaust steam.

Facility of control is a great advantage in the electrically driven mill. There are no waits during the struggle to get the engines off the dead centres, and the steam packing replacements—a serious item—are eliminated.

A further valuable feature of the electric motor is its readiness to start at any time. Steam engines have to be dismantled, greased, repaired and reconstructed in the between-season hiatus. Indeed, the cost of this work, together with lubrication and packing, has been estimated at from three to four shillings per ton of sugar. This is eliminated with the electric drive.

Cylinder lubrication is an important matter. Oil is a deadly enemy of efficiency in steam heating systems, and though it is attempted to design these engines so that they need no cylinder lubrication, it is known that the drivers rarely fail to apply the oil either openly or surreptitiously. And the tale is soon told in the steam heating coils of the evaporator and so forth. The ability to stop or reverse the rolls rapidly have proved a useful feature of the electric drive when foreign objects have found their way in, or when, as is rarely the case, human life is endangered. On the other hand, the rapid acceleration of the electrical motor is appreciated.

In pumping work the excellent manner in which the motor and centrifugal pump "hit it" together, and the consequent installing of these combined units to replace ram pumps, makes a marked improvement in the operation of the plant. With a few exceptions, the whole of the pumping can be done by centrifugal pumps. Valve troubles and lubrication failures are eliminated.

Again, a saving in labour is effected; skilled labour is not necessary to start the electrical motor, whereas it is with the steam engine.

In conclusion, sugar mill-refinery electrification affords ample scope for good business for the manufacturer, and provided the scheme is tackled in the right way, results giving the fullest satisfaction to the consumer can be attained. There are here problems in steam and in electricity for solution, and, as in breweries, commercial success depends to an important extent on the arrangements adopted to secure the necessary adjustment between the energy taken from the steam for electrification and that for heating purposes. The actual technical electrical problems offer no cause for anxiety.

UNITS FROM REFUSE.

By **JOHN B. MORGAN, A.M.I.E.E., Horsham U.D.C. Electricity Works.**

The article in a recent issue of the Electrical Review on this subject is one that should engage the attention of every engineer who is anxious not only to reduce fuel costs, but also to render his undertaking as independent as possible of the unsatisfactory condition of the coal market.

Labour troubles and high prices have been, and are, a source of keen anxiety to those responsible for the running of many a generating station, and I quite agree that in neglecting to use house refuse as fuel a large waste of valuable material is going on.

Whilst in agreement, generally, with the author's deductions, I think his comparisons between South Wales refuse and other refuse that he has used should not be taken to apply generally. I believe that his experience has been gained in towns where coal is fairly cheap, and I venture to suggest that were he to see what a high degree of efficiency the householder has obtained in these parts in the art of scientific cinder sifting, he would agree that there is a vast difference between the calorific value of the house refuse of Cambuslang and Aberdare, and that of a small provincial town in the South of England. In this town (Horsham) house coal was sold last winter at 42s. per ton, and even now costs 35s. per ton. This, of course, works both ways: it results in poor refuse, but, at the same time, a ton of coal saved here has a greater money value than at Aberdare.

Perhaps the results of the working of our destructor will be of interest, as showing that, while we are not able to obtain such results as Aberdare, a refuse destructor is a thorough success, even in a small town working with low-grade refuse.

The population of Horsham is 11,900, and the town is the centre of an agricultural district. House coal costs 35s. to 42s. per ton, and coal for steam raising is proportionately dear.

The destructor is a two-cell plant in conjunction with a large water-tube boiler. The generating plant run in conjunction with the destructor is generally an 80-kw. high-speed set, condensing. The destructor is furnished with an air heater and motor-driven fan, and an economiser is installed in the main flue. The boiler is fitted with a superheater. These particulars will show that the plant, although small, is quite complete with all the necessities for economical running. The steam consumption for the set is 28·6 lb. per kw.-hour at full load, and 30 lb. at the average of the load at which it usually runs. The destructor plant is a recent addition, the combustion chamber having been built on to the side of an existing boiler setting. The boiler has a heating surface of 2,437 sq. ft.; the steam pressure is 160 lb., and the steam temperature averages 520° F. The boiler is furnished with an external coal-fired grate. The running conditions are as follows:—The destructor banked fires (refuse) are blown up, and steaming begins at 6 a.m., and continues on refuse until the day's collection is destroyed. During the summer months the coal fire has to be started about 3 p.m. In the winter months the destructor often runs on until 6 p.m. The working of the destructor has been carefully recorded since its start, and the following figures are taken from my annual report to the Urban Council :—

Months.	Loads burnt.	Weight.	Running hours.	Weight per hour.	Units generated.	Units per ton.	Value of coal saved.	Clinker sold.	Scrap metal.
		tons.		cwt.			£ s.	tons.	£ s. d.
April ...	171	123·05	213·5	11·5	8,335	67·7	32 16	33·5	—
May ...	162	118·25	203·75	11·6	7,926	67·0	30 12	82·5	—
June ...	156	116·85	179·5	13·01	6,693	57·2	26 13	2·0	7 19 2
July ...	167	118·40	176·0	13·4	6,651	56·2	27 15	17·5	—
August	150	104·45	145·0	14·4	5,425	51·8	21 7	23·0	—
Sept. ...	153	109·85	168·5	13·03	6,104	55·7	18 19	28·0	—
October	159	114·7	206·25	11·12	7,900	68·8	19 13	32·5	—
Nov. ...	149	109·5	222·0	9·8	10,680	97·5	25 9	101·0	—
December	173	129·65	238·0	10·8	12,964	100·0	31 10	132·0	—
January	169	122·95	225·25	10·9	12,982	105·5	30 7	1·0	3 15 2
February	162	118·65	228·75	10·3	10,628	89·5	27 12	127·0	—
March ...	182	135·5	252·0	10·7	10,402	76·8	27 15	150·0	—
Totals ...	1,953	1,421·80	2,458·5	11·5	107,690	76·1	320 8	730·0	11 15 0

An average of 76·1 units per ton is recorded for the whole year. As before mentioned, the destructor steams the day load, which is, in our case, the most inefficient condition of running. As an experiment, on one occasion we steamed the day load on coal and used the refuse on the evening load. The better running conditions gave us a figure of 120 units per ton. These results of ours compare very closely with those of Aberdare. Our running conditions are more efficient, but our refuse is of very poor quality. At this time of the year it is very little more than vegetable refuse, and there is no doubt that with refuse of fair quality and turbo-driven generators, it should be easily possible to obtain 200 units per ton of refuse destroyed.

Previous to the installation of the destructor, the refuse was carted to local brickyards on the town borders, where it was allowed to lie in unsavoury heaps until all vegetable matter was decomposed, leaving a residue of cinders, &c., which were used for brick burning.

Balance Sheet.

Income.

Coal saved	£320 0 0
Income from by-products	68 9 0
	£388 9 0

Expenditure.

Interest and sinking fund	£178 15 0
Repairs	4 0 0
Labour	78 0 0
Balance, being net profit	127 14 0
	£388 9 0

This financial summary shows that a carefully-planned scheme can be operated to the benefit of the town and also of the undertaking, by rendering the generating station less dependent on coal supplies. In many towns the refuse costs considerable sums to cart away, and money would be saved on this item alone; but, in our case, no cartage or disposal expenses are saved, and so the electricity department is charged a sum for the refuse equal to the amount of interest and sinking fund on the loan, and as the destructor is under the electrical engineer's control, the stoker's wages are also charged.

Knocked Out of Time.—As a result of a serious thunderstorm which passed over Edinburgh one day last week, the famous one o'clock time gun at the Castle was not fired. Certain electric circuit clocks in the city and the one o'clock gun are controlled from the Royal Observatory on Blackford Hill, and it appears that the controlling wire was struck by lightning. By this means the electric discharge entered the building and damaged an ammeter and a relay, with the result that the gun was put out of action.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Portable Searchlamp.

A powerful portable searchlamp operated from a storage battery has recently been developed by Thomas A. Edison, Inc., Orange, N.J., in co-operation with the General Electric Co., Schenectady, N.Y. Use is made of a 20-in. waterproof projector and a 35-volt, 750-watt focus-type nitrogen-filled lamp. The projector and battery are mounted on two wheels by means of trunnions, so that the apparatus can easily be handled by one man.

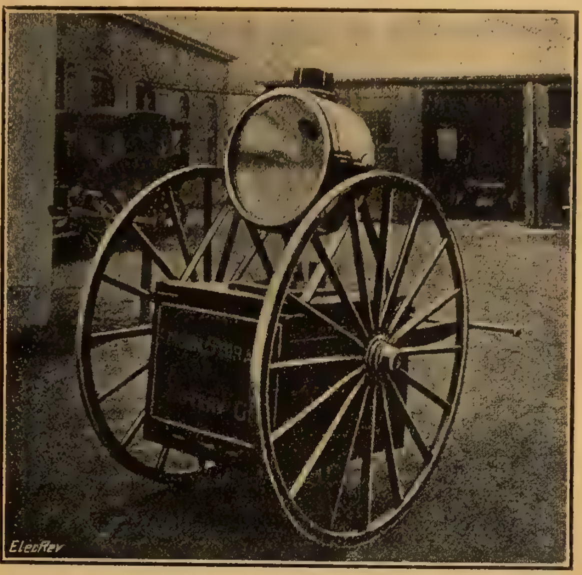


Fig. 1.—Portable Battery-operated Searchlight.

The outfit is approximately 5 ft. high, 3 ft. wide and 3 ft. long. It weighs 600 lb. and is designed to operate continuously for seven hours on one charge. The concentrated beam is sufficiently powerful, it is declared, to show objects half a mile away. By use of the adjustable focussing device, the light may be spread out in fan-shaped beam for close-range work. The equipment is designed particularly for city and factory fire departments; it is also well-adapted for night construction work, illumination of advertising, &c.—*Electrical World.*

An Australian Automatic Cut-Out.

Mr. Turnbull, assistant engineer with the N.S.W. Government Railways and Tramways, and the inventor of a special type of windmill for electric driving which has achieved popularity in that State (and was described in our columns), has recently introduced a novel form of automatic "cut-out" more particularly for use in connection with windmill plants, where the generator is continually "cutting-in" and "cutting-out" with the battery whenever the wind velocity rises or falls.

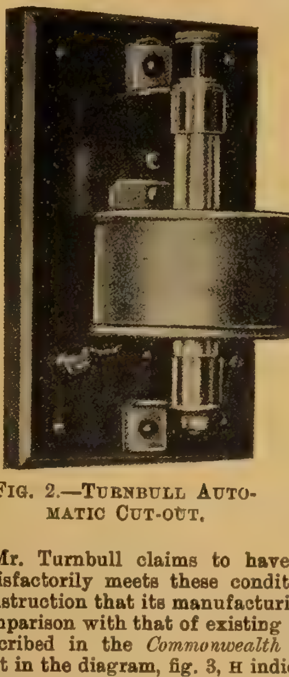


Fig. 2.—Turnbull Automatic Cut-out.

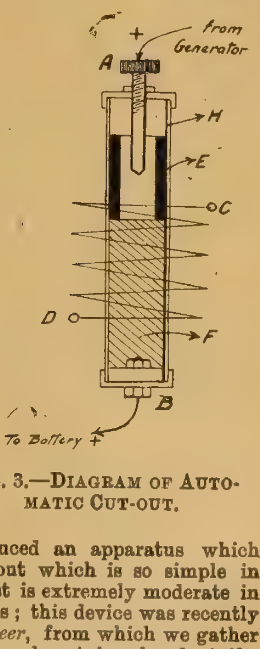


Fig. 3.—Diagram of Automatic Cut-out.

Mr. Turnbull claims to have produced an apparatus which satisfactorily meets these conditions, but which is so simple in construction that its manufacturing cost is extremely moderate in comparison with that of existing designs; this device was recently described in the *Commonwealth Engineer*, from which we gather that in the diagram, fig. 3, H indicates a glass tube, closed at the top and bottom by metal covers, through which pass iron or nickelled copper terminals A and B, of which A is adjustable within wide limits.

The tube is about half filled with mercury, covered with a slight amount of light oil. Floating on the mercury is an iron cylinder E, Surrounding the tube, but separated from it by an air space, is a shunt coil, C D, which is connected across the positive and negative mains leading from the generator.

The generator positive is connected to A, while B is coupled to the battery positive, the generator and battery negatives being directly coupled.

A predetermined rise in generator voltage results in the cylinder E being sucked down owing to the action of the coil C D, thus forcing the mercury up to meet the upper terminal A, and completing the circuit from generator to battery.

Owing to the fact that the iron cylinder will rise again, due to its buoyancy in the mercury, any reversal of the current is impossible; in order to ensure that this action is definite, and to correct the possible instability of the mercury in cylinder E, owing to extreme sensitiveness of movement of the cylinder, a few series turns are added to the shunt coil.

It is stated that, in practical use, the apparatus acts not only satisfactorily, but perfectly.

Glasshouse Pot and "Vitrite" Cap Making at the Ediswan Works.

The accompanying illustrations relate to a very interesting industry, which is little known to the electrical trades, but is carried on by the Edison & Swan United Electric Light Co., Ltd., at their Ponder's End works. This industry is glasshouse pot making, the pots being used in the manufacture of glass for the Royal "Ediswan" lamps.

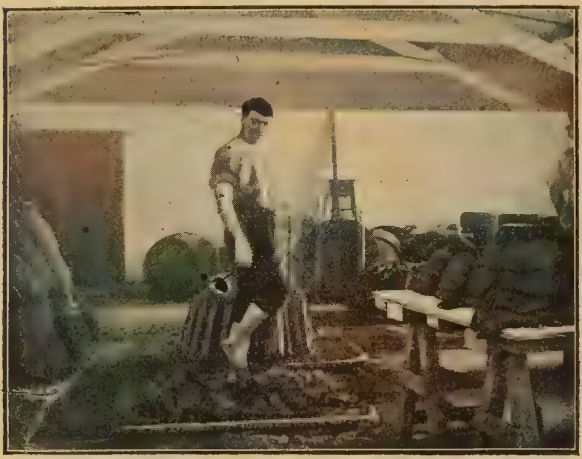


Fig 4.—Tempering the Clay for Pots.

The views show the interior of a room specially built for the making of glasshouse pots; this room when filled holds 120 pots of a size suitable for the company's furnaces. The clay of which the pots are made comes from the Stourbridge district, and is the finest mixture which can be procured for this class of work; it is delivered to the works in bags in a dry state, and is taken in hand by skilled workers who add the requisite amount of water, after which the clay is allowed to stand by for a time. It is afterwards tempered, being turned and trodden by skilled men with their bare feet (see illustration) until it is in a sufficiently plastic state for the pot maker to start operations.

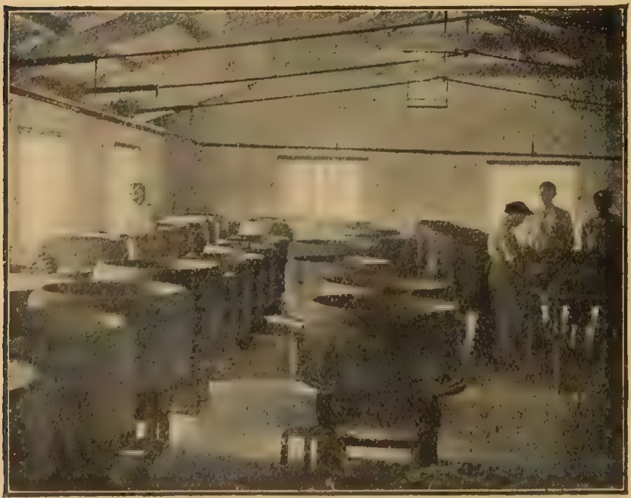


Fig. 5.—Glasshouse Pot Stores.

These pots require to be made at least 12 months before being used, the method adopted here being to dry them to a sufficient state of hardness to allow of their being moved to a room where more direct fire heat is allowed to play on them until they are sufficiently hard or dried to be transferred to the pot arch, when they require at least 14 days to burn sufficiently to temper them before being being transferred to the furnace, ready to be charged with the ingredients for the manufacture of the glass. The last illustration shows a machine for "Vitrite" lamp-cap making at the works. Formerly such caps were almost wholly of foreign production, but the caps used in the "Royal Ediswan" lamps are entirely manufactured at the Ponder's End works.

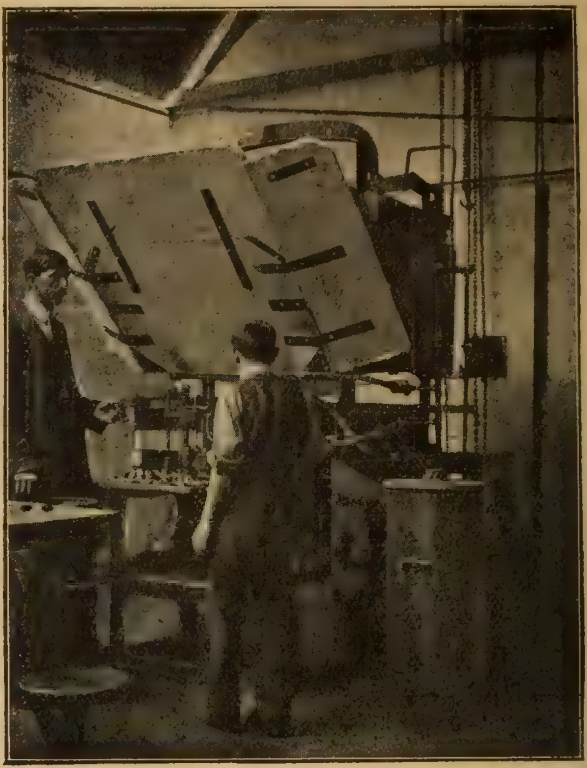


Fig. 6.—"Vitrite" Lamp-Cap Making.

Seamless Tubing.

We have already noticed the seamless steel tubing manufactured by the Ellwood Ivins Tube Works, Oak Lane Station, Philadelphia, Pa., U.S.A. Further samples have now been received, including one of about No. 24 S.W.G. of seamless high-grade tool steel, a remarkable production; we are informed that it was made from the solid bar, and the sample was cut from a 75-foot coil. Larger tubes are made, up to 4 in. in diameter, in tool steel, low carbon steel, copper, brass, aluminium, &c., accurate to $\frac{1}{1000}$th of an inch. Certainly we had not thought that the production of a thin steel tube $\frac{1}{64}$th in. in diameter was possible.

WAR ITEMS.

The War and Electrical Supplies for South Africa.—*The South African Mining Journal* comments as follows:—"As the weeks roll by the difficulty of obtaining supplies of electrical goods becomes greater. Round blocks, 3½ in. for wall switches, are so scarce that two local mechanics have commenced making them at 3s. 6d. per doz., as compared with imported at 1s. 6d. under normal conditions. Ceiling roses are unobtainable in any quantity. Double pure rubber flex up to municipal standard has advanced 100 per cent., and is very difficult to obtain at that. Coils of wire have gone up to such an extent that in some cases it makes it difficult for the smaller contractors to tender, especially as all other electrical goods have gone up from 20 to 25 per cent. and supplies cannot be relied on at these enhanced values, therefore the firms holding stocks necessary for a contemplated contract are the only people who can tender with any safety. Glass lamp shades, as well as all kinds of porcelain ware, have risen anything from 100 to 300 per cent. since the war started, simply because the Continental supplies have had to be replaced with British and American goods, also a few consignments from Holland. It is recognised that electrical smalls require very good and up-to-date machinery, which can only be provided by manufacturers dealing with big outputs, therefore very little can be done in a limited period, and not much can be expected from the Johannesburg factories, but what small makers are doing is to use up second-hand parts and put them together for lampholders and such like articles, at a cost of about double the imported; but what is that when any special lines are wanted for actual use? What is surprising is that the ordinary lamps have not advanced much, which is explained by the fact that a British lamp was specially designed and made for the purpose of competing with the Continental variety, and ran neck and neck with the latter as regards the price before the war."

History Repeating Itself.—A note in the *Times Engineering Supplement* reminds us that the Carron Co., which has been established for over one and a half centuries, made quantities of shrapnel shell, under the inventor, Major Shrapnel, in 1803 and 1804, and that the carronade, which was adopted by the British Navy in 1779, was so called because it was first cast at the Carron Works.

Australia and Metals.—A Reuter dispatch, dated Melbourne, August 4th, states that on the previous day Mr. Hughes (the Commonwealth Attorney-General) conferred with representatives of the Mount Morgan Gold Mining Co. and the Electrolytic Co. regarding the position of the Electrolytic Co., the exclusion of the Hirsch interest, and the general development of the copper industry in Australia. In the Victoria Legislative Assembly, Mr. Mackinnon (the Attorney-General) introduced a Bill providing for the cancellation of all enemy contracts.

In connection with the foregoing, Reuter's Agency in London states that at the outbreak of the war the Mount Morgan Gold Mining Co. and the Electrolytic Co., with which it works, found their operations practically brought to a standstill by reason of their comprehensive contracts with German firms, including Aron Hirsch & Sohn, which company also held an interest in the Electrolytic Co. It is now intended to reconstruct the Electrolytic Co. in such a manner as to exclude the German interest, and the freedom of the Australian companies from German claims will be secured under the legislation which has been initiated.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Limitation of Price Coal Bill.

I should like to draw your attention to a point in the above Bill which appears to be somewhat unfair, and which, so far, seems to have escaped criticism.

I understand that the said Bill limits the price of coal at the pit head to that obtained during the year immediately preceding the war, plus an addition of 4s. per ton, to cover increase of costs owing to the war. Apparently, the additional 4s. per ton is to apply to all qualities of coal, so that the maximum price of "gum coal," which previous to the war could be bought at the pit head for 4s. a ton, will be fixed at 8s. per ton—that is, an increase of 100 per cent.; whereas in the case of coal used for household grates, which previous to the war could be purchased at 20s. per ton, an addition of 4s. per ton represents an increase of 20 per cent. only.

Would it not be more equitable to state the additional sum allowed to cover the increased costs owing to the war as a percentage on the pre-war price, instead of a fixed sum of 4s. per ton?

Roland Marshall.

Electricity Works, Ayr, *August 4th*, 1915.

THE ELECTRIC COOKING PROBLEM: AN AMERICAN EXPERIMENT.

Writing in the *Journal of Electricity, Power and Gas*, of San Francisco, Mr. R. E. Frickey, engineer to the Northern California Power Co., at Redding, Cal., discusses a solution to the above problem, bearing in mind the American view that electric cooking has been held back, owing to (1) high cost of cooking apparatus, (2) high cost of operation due to (*a*) inefficient application of heat, hence high KW.-hr. consumption, (*b*) heavy demand of apparatus, hence large element necessary in rate for interest, depreciation, and maintenance of services, meters, mains, etc., (*c*) high peak load overlapping normal station peak, hence large element in rate for station apparatus, (3) high cost of hot-water supply. Mr. Frickey realised these obstacles and believes he has found, for certain local conditions, a solution of the problem, by the use of a thermal storage cooker, one type of which is illustrated herewith.

This apparatus has an internal heating chamber containing a number of cast-iron disks or radiators which are maintained at practically constant temperature by a surrounding heating element which is kept in constant service, except under circumstances referred to later. A cooking chamber is above the heating chamber, with a movable intervening cover, and the upper chamber is provided with a hinged steam-tight lid. Both chambers are surrounded by heat insulation and an outer water jacket, also heat insulated; means are also provided for filling and drawing off water from the jacket, and an immersion type heater can be provided, for hand or automatic use.

Most of the heat flows outwards to the water jacket, the insulation being so designed that the temperature drop with the normal heat flow, plus the fairly constant water temperature, is equal to the temperature desired in the heating chamber.

Again, the cooking chamber is separated from the water reservoir by suitable insulation; this insulation, as well as the metal lining of the chamber, is maintained at a high temperature, both by the surrounding hot water, and by the heat leaking through the cover of the heating chamber.

The water jacket is constructed of tinned copper, and the cooking chamber is lined with seamless drawn aluminium.

A convenient single-phase A.C. electromagnet is provided for lifting the cover of the heating chamber and the radiators, one at a time.

Broiling, frying and similar operations cannot be performed in the cooker. For these operations a special radiant grill having a demand of 700 watts (say, one horse-power) has been found adequate. This grill is 8½ in. in diameter and is designed to broil or fry, as required; the demand of this grill fixes the maximum demand of the entire apparatus for general cooking. This is so because the heating element within the cooker may be disconnected for short intervals without appreciably changing the temperature of the radiators; in practice, a double throw switch is used to disconnect the cooker while the grill, or other special device, as a percolator, is being used.

For many cooking operations, the cooking chamber may be used without radiators and without previously heating the food. In this manner cereals, rice, beans, and similar food, are thoroughly cooked over night. The energy for these operations comes through the cover over the heating chamber. For most cooking operations a single hot radiator is transferred to the bottom of the cooking chamber. For roasting and for baking operations a radiator is used both below and above the food. When baking two or more pies or cakes at one time, one radiator more than the number of articles is used.

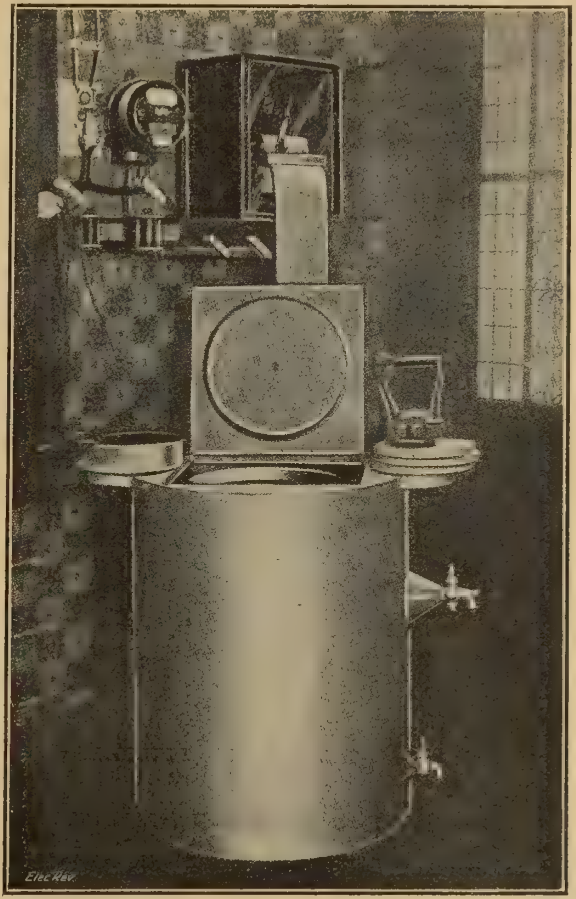


Fig. 1.—Electric Thermal Storage Cooker under Test.

A convenient attachment is furnished with the cooker as an extra. This consists of a radiant electric grid covered by a reflector and air baffle. A tube normal to the reflector at its centre point carries the feed wires. To use the attachment, the cover of the cooker is raised and the tube is inserted through the steam valve opening in the cover. The cover is then closed and by means of the tube and suitable thumb screw the grid is adjusted to the proper height above the food to be cooked.

This device is really not needed for baking or roasting, but many remarkable effects can be obtained by its use; the loading is 400 watts.

The author considers that the results obtained are superior and the operations more simple than for the ordinary fireless cooker. The cast-iron radiators or heaters are always ready for use; the cooking chamber is maintained at a constant temperature because of the equalising effect of the water jacket and heating chamber cover.

An input of 200 watts has been found sufficient to heat ten radiators daily, and to furnish five gallons of water daily, at a temperature sufficiently high for all domestic purposes. This number of radiators has been found to be adequate for cooking for a family of from five to ten people. Additional hot water may be obtained as desired by the use of the immersion heater within the water jacket, but it should be remembered that the energy used for this purpose is utilised at nearly 100 per cent. efficiency, since all losses are already accounted for in the 200 watts normal input. If a constant daily demand exists for more water than is normally provided, this should be obtained by a constant input, providing additional unity load factor load.

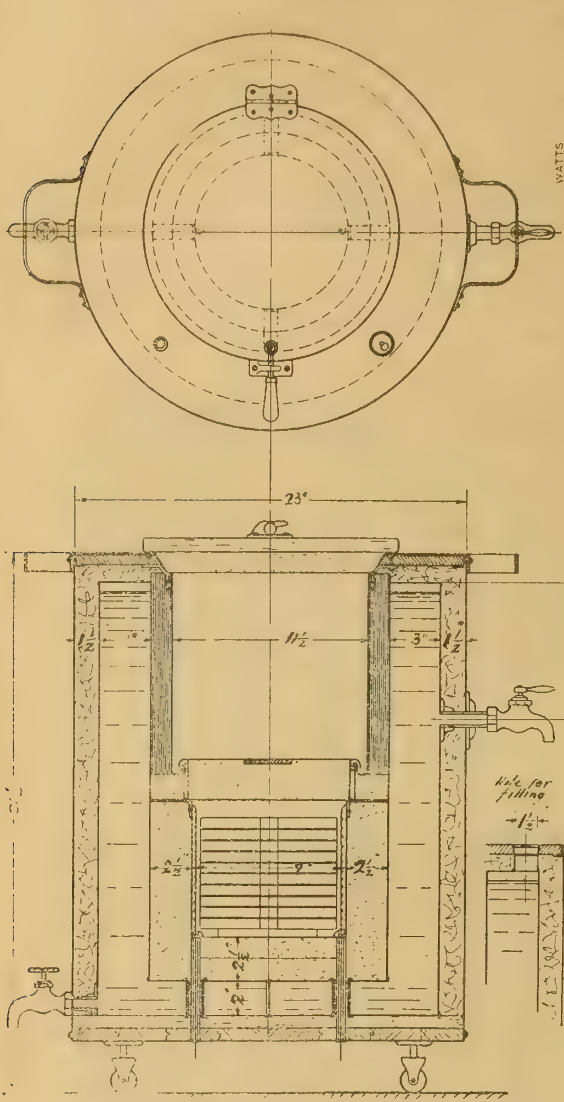


Fig. 2.—Plan and Section of Thermal Storage Cooker.

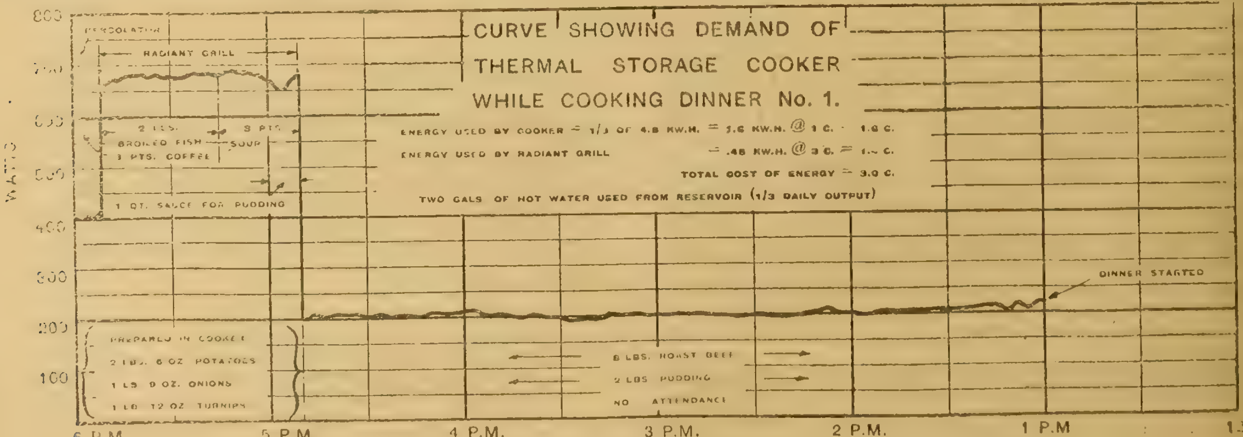


Fig. 3.—Load Curve of Thermal Storage Cooker while Cooking a Dinner.

At 100 per cent. efficiency, approximately 10 gallons of water may be heated in 24 hours from 20 deg. C. to 75 deg. C. with an input of 100 watts.

Under this condition it is possible economically to meet all demands for hot water for domestic uses. The cooker described has been thoroughly tested under working conditions, and the author, taking a recent commercial report upon an ordinary electric range, with which the energy used for each operation and load curves were given for the preparation of a "standard" dinner, makes a comparison with the working of his type of cooker. With the usual type of range 3,901 watt-hrs. were required for this dinner, but only one gallon of water was provided, as compared with two in the author's case.

The graphic curve shown in fig. 3 gives particulars of the energy consumption of the thermal storage cooker in this case; for the rest of the day, there would be a constant load of 200 watts.

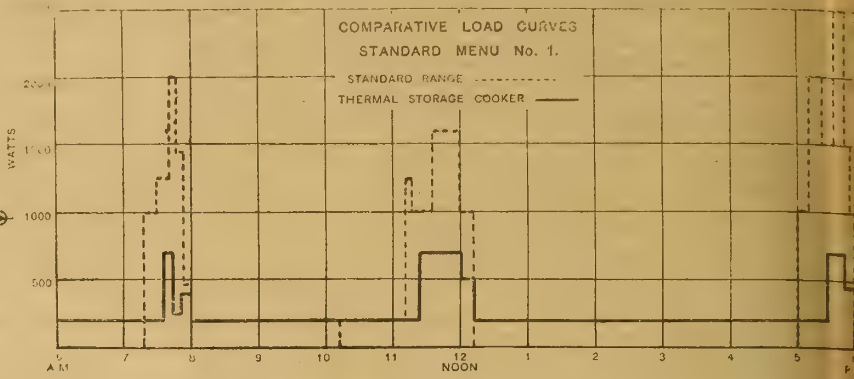


Fig. 4.—Comparative Load Curves for Standard Menu.

The author gives a further comparison in regard to a "standard" daily menu, covering breakfast, dinner and supper, the comparative load curves superimposed being shown in fig. 4.

The maximum possible demand of the range was 3,600 watts, though the highest demand shown in fig. 4 is 2,500 watts; the maximum possible demand of the cooker is 700 watts. The cooker also produced 5 gallons of hot water in addition, while the range produced none except that used in the cooking operations; this additional hot water would have cost 6.7c. if obtained by the method of the range at 3c. per kw.-hr.

The author concludes by pointing out that some coast companies are catering for irrigation business, giving an income of about 1 cent per kw.-hr., in every case building the supply lines, and expresses the opinion that if the power companies are willing to sell 100 per cent. load factor energy at the same price for the cooker described, a new era in electric cooking will result; he adds that the complete cooking equipment will cost less than the cost of transformers, services, and meters required for a standard range.

RECENT PROGRESS IN PYROMETRY.

By CHAS. R. DARLING, A.R.C.Sc.I., F.I.C.

(*Abstract of paper read before the* Royal Society of Arts.)

In 1910 the author delivered four Cantor lectures before the Society on the subject of "Industrial Pyrometry," which contained an account of the appliances in use at that time. During the intervening period many improvements have been introduced, and many new instruments designed.

Apart from the work of Government institutions such as the National Physical Laboratory, practically all recent progress in pyrometry has been due to the efforts of instrument-makers, and little of importance has emanated from our educational institutions. As the result of scientific methods, British makers of pyrometers are not merely independent of other countries, but stand unrivalled in regard to the quality and accuracy of the instruments they supply.

During the period under notice no pyrometers based upon new principles have been introduced, and the advances made, therefore, relate to methods previously in use, which it will be convenient to consider under separate headings.

Thermoelectric Pyrometers.—The past few years have witnessed a great extension of the use of base metals in the construction of thermal junctions. This has been due not merely to the almost prohibitive price of platinum and kindred metals, but to the fact that properly-chosen base-metal couples develop a relatively high E.M.F., and therefore enable a strong and cheap indicator to be used in place of the sensitive instrument required for couples of the platinum series. The chief base-metal couples in use in this country are composed as follows:—

Positive.	Negative.	Highest working temperature.	Maker.
Iron	Constantan ...	900° C.	All British firms.
Iron-nickel alloy	Iron-nickel alloy of different composition	1,000° C.	R. W. Paul.
Nickel-chromium alloy	Nickel-chromium alloy of different composition	1,200° C.	Foster Instrument Co.

For occasional readings, the last-named junction may be raised about 100 deg. C. above the limit mentioned. For work at lower temperatures than 700 deg. C., copper-constantan junctions are frequently used, as, for example, in measuring the temperature of superheated steam. Numerous other combinations are used, particularly in the United States.

Considerable doubt has been thrown on the reliability of base-metal junctions by Kowalke, who investigated a number of couples supplied for commercial purposes by American makers. In all the cases examined sustained heating for twenty-four hours was found to alter the calibration by amounts varying from 20 deg. C. to 130 deg. C., the departure being most noticeable at the higher temperatures used—800 deg. C. and 1,000 deg. C. Depth of immersion in the furnace was found to cause discrepancies in the indications, and the general results showed that large errors might arise owing to defects in the couples sent out by the makers. With most of the junctions, however, it was found that prolonged heating induced a practically stable condition, and the conclusions to be drawn were: (1) the couple should be "aged" by continuous heating at its upper temperature limit before calibration; (2) the depth of immersion during calibration should be the same as that obtaining when the pyrometer is in use; and (3) metals which form solid solutions with one another give the best results. Since the publication of Kowalke's work, I have tested an iron-constantan pyrometer which has been in use in my own laboratory for nearly three years, during which time it has been repeatedly heated to 850 deg. C. At the melting-point of zinc (419 deg. C.) the calibration was strictly correct, and at 800 deg. C. the reading was only 5 deg. too low. This pyrometer is of the heavy type, made by welding a constantan rod to an iron tube, and the slight error thus shown after repeated use compares favourably not only with junctions made of platinum and its alloys, but with any type of pyrometer whatsoever. The general experience of users of base-metal couples of British manufacture is that the changes in calibration are much less than those recorded by Kowalke, which, if generally true, would entirely discredit this class of instrument.

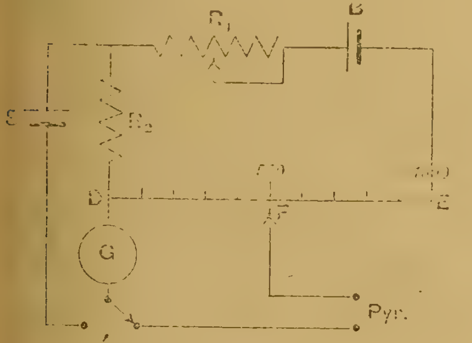


Fig. 1.—Potentiometer Indicator.

An interesting investigation of junctions of carbon and graphite has been made by C. C. Bidwell, who finds that by the aid of these materials temperatures as high as 2,000 deg. C. may be read. It is necessary to subject the junction to a preliminary heating at this temperature before calibration, in order to remove volatile impurities, when constant readings can be secured. Both carbon and graphite can be obtained in thick rods, and can be machined, so that it is possible to build up a robust pyrometer with these substances. If this couple be found to meet the requirements of industrial practice, it should prove extremely useful for temperatures exceeding 1,200 deg. C., and may solve the outstanding problem of determining the temperature of molten steel in the ladle. Its utility in experimental work is already established

Several new materials have been introduced to form the protecting sheaths necessary to shield junctions from the corrosive action of furnace gases. Alundum (oxide of aluminium) is now used for this purpose; but although it possesses a high melting-point (2,050 deg. C.) it is too permeable to gases, particularly at high temperatures, to be of general service. The same remark applies to a new material of the carborundum type, known as "silfrax," recently introduced in the United States. Another material with a carborundum basis, called "silit," is said to give satisfactory results. All the three substances named are brittle, and consequently cannot be subjected to rough usage. A new type of sheath, for use with molten brass or bronze, possesses a tip of molybdenum, connected to a nickel tube covered with a protecting material, so that only the molybdenum and the protection come into contact with the metal. As molybdenum is a good conductor of heat, and only a thin tube is used, a rapid reading of the temperature is obtained, the molybdenum being unacted on by the molten metal. This sheath is said to be entirely satisfactory for this purpose; if so, a troublesome problem in pyrometry may be regarded as solved. Foster's method, in which a junction of Hoskins' alloys is dipped directly into the molten brass, gives rapid readings, but the junction is gradually eaten away.

A new departure in the method of indicating temperatures in commercial instruments has been made by the Leeds and Northrup Co., of Philadelphia, who have adopted the potentiometer principle, previously only employed for accurate laboratory work. The electrical connections of an instrument of this kind are shown in fig. 1. A current from a two-volt accumulator *B*, passes through an adjustable resistance R_1, a fixed resistance R_2 and a uniform stretched wire *DE*. At the point *D* is attached one terminal of a sensitive galvanometer *G*, the other terminal being connected to one contact of the pyrometer. The remaining wire of the pyrometer is fastened to a sliding-wire contact, *F*, which may be moved along *DE*. A standard cell, *S*, is permanently connected to R_2, and may be joined to the galvanometer when desired by means of the switch *A*. To commence with, *S* is connected to the galvanometer, and R_1 adjusted until no deflection is obtained. The switch is then turned over to the pyrometer, and the slider *F* moved along the wire until the deflection is again zero, when the fall of potential between *D* and *F* will be equal to the E.M.F. of the heated junction. From the relation

$$\frac{\text{E.M.F. of junction}}{\text{E.M.F. of standard cell}} = \frac{\text{Resistance of } DF}{R_2}$$

the E.M.F. of the junction is determined; and as the temperature corresponding to this is known by previous experiments, the point of balance on the wire may be marked with this temperature. Similarly, the whole length of the wire may be divided so as to read temperatures directly. It is essential to accuracy that the fall of potential along *DE* must not change; and as the voltage of the working cell *B* falls off with use, R_1 must be adjusted from time to time, so that when the standard cell is coupled to the galvanometer no deflection is obtained. The advantages possessed by an indicator of this kind are (1) great sensitivity, allowing the use of a large scale on which small differences of temperature may be read; and (2) the fact that the readings are independent of the resistance of the pyrometer, and its leads. On the other hand, an adjustment is necessary before taking a reading, and the working cell must be re-charged or renewed from time to time. A skilled observer could obtain closer readings than would be possible with an ordinary indicator, but in the hands of an untrained workman difficulties in use might easily arise.

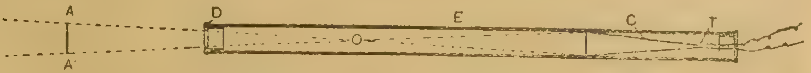


Fig. 2.—Principle of Paul's Radiation Pyrometer.

Another adaptation of the potentiometer principle to indicators has been introduced by the Cambridge Scientific Instrument Co., with a view to obtaining closer readings over a given range. If an indicator be graduated from 0 deg. to 1,000 deg., and the working range be 500 deg. to 1,000 deg., the useful part only occupies one-half of the scale, and accuracy of reading is thereby restricted. If, however, it can be arranged that the pointer remain in the zero position until the pyrometer has reached 500 deg., the whole scale may then be used for the interval 500 deg.-1,000 deg., thus enabling finer readings to be taken. The way in which this may be accomplished may be understood by reference to fig. 1. If the galvanometer, *G*, be replaced by an indicator, coupled up so that the fall of potential between *D* and *F* opposes the movement of the pointer due to the pyrometer, no deflection will occur until this E.M.F. is overcome. If the value of the opposing E.M.F. be equal to that developed by the pyrometer at 500 deg., the pointer will only commence to move when this temperature is attained, and hence the whole scale may be devoted to the range 500 deg.-1,000 deg. Assuming that the indicator be sufficiently sensitive, it is evident that a full-scale reading could be obtained for a less interval—say 200 deg.

the commencing temperature being regulated by altering the position of the contact *F*. In one form of indicator arranged on this principle, the changes in the voltage of *B* are automatically compensated by the standard cell; in a simpler form, the standard cell is abolished, and the varying voltage of *B* allowed for by adjusting resistances in a circuit until the indicator, on being switched into this circuit, shows exactly full-scale deflection.

A similar result to the foregoing is attained by a different method in the instruments made by R. W. Paul. In these, the indicator takes the position of the galvanometer in a Wheatstone bridge, the pyrometer being in the indicator circuit. By adjusting the resistances in the arms of the bridge, a small current from the external battery may be caused to pass through the indicator so as to oppose that due to the pyrometer. This opposing current may, for example, be regulated so that the pointer of the indicator remains at zero until the pyrometer has attained 500 deg., thus leaving the whole scale available for graduation from 500 deg. upwards. Examples of useful ranges on instruments furnished with a double scale are appended:—

Junction.	Full range, °C.	Special range, °C.
Two iron-nickel alloys ...	0 to 1,000	700 to 900
Platinum—Pt Ir	0 to 1,300	600 to 900
Two rhodio-platinum alloys ...	0 to 1,600	500 to 1,100

Combined with this Wheatstone bridge arrangement is a device for correcting automatically for changes in the temperature of the cold junction. In the four arms of the bridge two of the resistances are of manganin, which are unaffected by temperature changes, whereas the other two are of copper, which alters in resistance on heating or cooling. The bridge is accurately balanced at 20 deg. C., but at any other temperature a small current will pass through the indicator, the direction of which will depend upon whether the resistances have been raised or lowered in temperature. The cold junction is located so as always to possess the same temperature as the resistances, which are regulated so that the movement of the indicator pointer, when the bridge is out of balance, covers an amount of the scale representing the difference between 20 deg. and the temperature of the cold junction. This compensation is arranged to hold either for full or special range.

A mechanical "hold-up" for special range work has recently been devised by the Cambridge Scientific Instrument Co. In this case the indicator possesses a suspended coil, and by turning a graduated head a twist is imparted to the suspension, opposing that due to the current passing from the pyrometer through the coil. By turning the graduated head to a given mark, the zero of the indicator may be made to represent, say, 500 deg., and the whole scale used for the remainder of the range.

The general use of superheated steam in engines, including locomotives, has opened a wide field for the useful application of pyrometers. In this instance it is necessary to arrange the pyrometer to withstand pressure, and to provide fittings whereby it may be fastened to a steam-pipe. Thermal junctions of copper and constantan are usually employed. In the case of locomotives, an indicator unaffected by vibrations is requisite, and can now be supplied by the various makers.

Resistance Pyrometers.—There are few changes to record in connection with this class of instrument, the patterns in use five years ago having undergone little modification. Platinum, which is the metal invariably used, has been shown recently by Sir William Crookes to be measurably volatile above 1,000 deg. C., and this explains fully why the readings of these pyrometers went astray when a continuous temperature above this figure prevailed in the furnace. For work at low temperatures, such as occur in connection with cold storage, and also for use in chemical operations at moderately high temperatures, the resistance pyrometer is to be preferred on account of its greater accuracy, and its use for such purposes is extending rapidly. An installation, consisting of a number of instruments connected to a single indicator through a switchboard, is now a common feature in cold stores or up-to-date chemical works. By its aid the attendant can read the temperature at any point by switching the pyrometer located at the spot on to the indicator, and the accuracy of the reading may be either 1 deg. or less if desired. For metallurgical work, resistance pyrometers find an application in cases where great accuracy is essential, and where provision is made to secure a precise adjustment of the temperature of the furnace. A common practice in large establishments is to use thermoelectric instruments for the ordinary work, but to keep one or more resistance pyrometers for specially accurate work, and for checking the various indicators in general use. This is sound practice, as it makes the best use of both systems.

Reference may be made here to the interesting researches of Northrup, which give promise of an extension of the resistance method to a range of temperature beyond its present limit of 1,000 deg. C. Northrup found that certain metals, such as copper, increase steadily in electrical resistance up to the melting-point, and that in the process of melting the resistance is doubled in value, after which the resistance of the molten metal increases uniformly as the temperature rises. It may be possible to devise an instrument in which the temperature is deduced from the resistance of a molten metal; if so, the range of resistance pyrometers could be extended to at least 1,400 deg. C., and higher than this if a protecting sheath capable of withstanding a greater temperature could be found. Another possible extension of the resistance method is suggested by the change in resistance shown by pyro-conductors with rise of temperature. These bodies, of which glass is an example, decrease in resistance with rise in temperature; thus alundum, at 1,100 deg. C., has a resistance of 6,100 ohms per cm. cube, which falls to 190 ohms at 1,600 deg. C.—an average decrease of nearly 12 ohms per degree. A very coarse instrument would readily detect a change of this order, and further investigations in this direction may lead to a pyrometer based on this phenomenon.

Radiation Pyrometers.—The drawbacks incidental to the use of thermoelectric pyrometers for temperatures exceeding 1,000 deg. C. have led to a wide adoption of the radiation method in processes involving readings about this point. The Féry pyrometer, made by the Cambridge Scientific Instrument Co., is extensively used, and has been improved in details. In the early form, a suspended-coil galvanometer was necessary as indicator, owing to the low E.M.F. developed by the junction on which the rays were focused. The use of an alloy of antimony and zinc, in atomic proportions, as one of the junction materials, has enabled pivoted indicators to be used, owing to the greatly increased E.M.F. obtained, which is a great advantage from the standpoint of portability. The gilt mirror formerly used has been superseded by one of a special alloy of higher reflecting power, and the focusing head graduated so that, without sighting, the pyrometer may be focused for any desired distance. Whipple has applied this pyrometer to the determination of the temperature of molten metals by mounting it at the open end of a fireclay tube, the closed end of which is dipped into the metal, and kept permanently in focus. By this means readings as high as 1,500 deg. C. have been taken in small ladles, but so far it has not been found possible to apply the method to large masses which cannot be approached closely.

Foster's fixed-focus instrument has also proved quite satisfactory for general workshop requirements, and has found many applications. This pyrometer as used for molten metals is attached to a fireclay tube, the closed end of which is immersed in the material. A feature of this arrangement is a vertical ventilating tube in front of the mirror, which prevents metallic fumes rising from the fireclay tube, in case of breakage, from entering the upper end of the telescope, and thus avoids any damage which might arise from this cause. Being mounted on a light tripod, the instrument is portable, and can be adjusted in height as required. A pivoted indicator is used. A special form of this pyrometer, designed for lower ranges, such as 500 deg. C. to 1,000 deg. C., can now be procured. Another form of fixed-focus pyrometer, due to Thwing, has been marketed by R. W. Paul. The principle of working is shown in fig. 2, where *E* is a tube containing a polished cone, *C*, at the apex of which is fixed a thermal junction, *T*. Rays from the hot source *AA'* enter the tube at *D*, and pass into the cone, being finally reflected on to *T*, which is connected to the indicator. So long as the lines joining the outside of the cone with the extremities of the entrance *D*, crossing at *O*, fall within the hot source, *AA'*, the reading will be the same at all distances. The actual pyrometer is mounted on a tripod, with a Unipivot galvanometer as indicator, the scale, as in all radiation pyrometers, being divided into temperatures according to the fourth-power law.

The certificates issued by the National Physical Laboratory with radiation pyrometers of all types mentioned indicate the high degree of skill shown by the makers. The corrections are invariably small, and sometimes non-existent.

Mention may be made here of the results of various determinations of the value of the constant *K* in the radiation formula

$$E = K(T_1^4 - T_2^4),$$

where *E* is the energy radiated by a black body in watts per square centimetre. Using the accurate pyrometers now available, the value for *K* has been found to be 5.6×10^{-12}.

Recorders.—The advantages of continuous records of furnace temperatures have been widely recognised during the last few years, and in consequence developments in this branch of pyrometry have been extensive. The modern form of the Roberts-Austen photographic recorder, made by the White Instrument Co., is used in many places; but the modern tendency is in favour of inked records, which are always visible, and require no photographic treatment.

In the recorder made by the Foster Instrument Co., for use with thermoelectric or radiation pyrometers, the galvanometer is pivoted horizontally, the pointer being vertical. At the tip of the pointer is placed a capillary tube, carrying an inked wick, so that a mark is made on the chart when the wick is brought into contact by the action of the presser-bar. This bar is actuated by clockwork, and presses the tip of the pointer on to the paper at definite intervals, between which the pointer swings freely under the influence of the pyrometer. The chart is circular in form, and rotates on its axis at a definite rate. The radial lines from the centre to the circumference are divided into degrees of temperature; and hence the condition of the furnace at any given time may be read off. It is a strongly-made and serviceable instrument. The utility of the Thread Recorder, made by the Cambridge

Scientific Instrument Co., has been extended by adapting it for the purpose of obtaining several simultaneous records. Two indicators are fixed side by side, the pointers of which are depressed at intervals on to an inked thread, which touches the chart and makes a mark. A double chart is mounted on a single drum, which rotates by clockwork, and a separate pyrometer may be coupled to each indicator. When four records are required simultaneously, two threads, wetted with inks of different colour, are used; and by an automatic arrangement the pointer may be made to descend on each thread in turn. Two pyrometers are connected to each galvanometer, and are brought into circuit in turn, so that the records of each appear in a different colour; and thus four records in all can be secured on the same chart. It may be used for thermoelectric or radiation pyrometers. The Leeds and Northrup Co., of Philadelphia, have introduced a recorder which is actuated by an electric motor, instead of clockwork, and which may be used for resistance or thermoelectric instruments. A boom from the coil of a galvanometer is placed between a system of levers, and when on either side of the central position it enables the levers to engage and to cause a disk to rotate. The effect of the rotation is to readjust matters so that the boom is restored to the central position. Used with a resistance pyrometer, the moving disk alters the resistance in one arm of a Wheatstone bridge until a balance is obtained, when the boom assumes the central position and the levers fail to engage. When connected to a thermoelectric pyrometer, the movement causes an arm to move over a potentiometer wire (fig. 1), until the E.M.F. due to the pyrometer is counterpoised, when the boom will become central. The movements of the disk are communicated, by suitable mechanism, to a pen moving over a chart. This recorder is much used in the United States, but has not yet been adopted in Britain.

The motor-drive has also been applied in the recorder made by R. W. Paul. A special device is used to ensure a constant speed of rotation in the motor, which, by suitable gearing, actuates the chart and presser-bar. The pointer of the galvanometer is pressed periodically on to an inked ribbon. beneath which is placed a thin metal rod over which the chart passes. The speed of the various movements may be altered by changing the gear. A Unipivot galvanometer is used when records of thermoelectric or radiation pyrometers are being made; and when a resistance pyrometer is employed a Harris indicator is used instead of the galvanometer. Multiple records may be secured with any type of pyrometer; and specially useful features are: (1) The provision of metal-faced joints in the cover, which makes the recorder dust-proof; (2) the construction of the apparatus in separate units, each of which is easily replaceable; and (3) the use of the motor in place of clockwork, which enables a greater power to be used in actuating the various parts.

Messrs. Siemens & Co., who were the first to introduce an ink recorder, have recently introduced several improvements in their instrument. The case is now constructed entirely of metal, jointed so as to be dust-proof. A pivoted galvanometer is used, and the pointer, made of thin metal, is pressed down periodically on to an inked ribbon, beneath which is placed a metal knife-edge over which the chart passes, so that a small dot is made at each contact. The case is made with a sloping front in which a window is inserted, thus enabling a large portion of the record to be seen at a glance. This front is hinged to permit of access to the clockwork, which is made in three separate parts, controlling respectively the forward movement of the chart, the ascent and descent of the presser-bar, and the movements of the rollers on which the record-paper is wound. Robust construction and small size are features of this recorder.

At the present time, when all are in search of methods of adding permanently to our industries, the example furnished by the manufacture of pyrometers may be cited as a useful guide to success in this direction. All the establishments in which pyrometers are made in this country are under the direction of thoroughly skilled scientific men, who are constantly devising new instruments with a view to greater efficiency and a wider field of application. All are in close touch with the National Physical Laboratory, which has proved invaluable to them in regulating the calibration of their instruments, and securing a uniformity which is now comparable to that which exists in thermometers. The result is a thriving and constantly extending industry, not threatened by foreign competition, and not in need of artificial props to ensure its success. The instruments exhibited, all of British manufacture, cannot be surpassed, or probably equalled, by any other country: and are examples of what may be accomplished by the intelligent application of science to industry.

Discussion.

In the course of the discussion, the Chairman (Sir Robert A. Hadfield, F.R.S.) said that human eyes varied, and two observers trying to observe the temperature of the same heated object generally arrived at quite different conclusions. As showing the extremes of temperature which had been measured, it might be mentioned that Professor K. Onnes had been down to within 1½ deg. of the absolute zero; on the other hand, Mr. O. Lummer claimed to have reached as high as 6,090 deg. absolute (about 5,800 deg. C.), by impregnating the carbons of the arc, and working it under high pressure, that artificial temperature of course approximating to that of the sun. Dr. Whipple, acting under strong advice which he put before him, was now in a position to turn out pyrometers for the supply of which we had hitherto been dependent upon the Continent. They were now "made in England." Nearly all the developments of special steel were due to the possibility of now being able to determine temperatures varying from a few degrees to 1,200 deg. C. or more. The manufacture of modern armour, projectiles, guns, material, and so on, was now practically dependent upon accuracy of temperature observation. At certain physical temperatures a difference of even one degree Centigrade would considerably modify the physical qualities of the steel being treated. Ordinary carbon steel of tool-steel grade quenched at 725 deg. C. would bend considerably, and had a Brinell hardness number of 228. Quenched at 735 deg. C., the same material would only bend 1.5 deg., the hardness number being increased to 512. Quenched at 740 deg. C., or only 5 deg. C. higher, the bend was nil, and the hardness number was increased to the high figure of 713. Thus, there was the remarkable fact that by increasing the temperature only 15 deg. C., one had the phenomenon of complete hardening. The small difference of 15 deg. C. (27 deg. F.), within which range hardening or non-hardening results occurred, represented no more than the change in temperature between a spring and a summer day, yet such slight differences in temperature entirely revolutionised the structure of steel. In a difference of only about 4 deg. C., complete revolution took place in the magnetic qualities of iron. For example, the thermo-couple temperature was kept steady for several minutes at 733 deg. C. in one case without alteration in the magnetometer deflection, which differed very little from that at 730 deg. C. The furnace temperature was then raised very slightly, and, *before* the thermo-couple reached 734 deg. C. a rapid fall of magnetisation set in. In other words, that important revolutionary change in iron could only be determined by the aid of very accurate pyrometers. They were not very sure about temperature observations when they got up to 1,400 deg. C. and higher. Molten mild steel had a temperature of about 1,580 deg. C. Couples exposed to high temperatures were liable to become very brittle and, when immersed in fluid steel, disintegrated. In a general way, speaking from many years' experience, the following represented the experience of the laboratories in Sheffield. With reference to the best form of couples, nothing had been found for all-round service to supersede platinum and platinum-rhodium. There were some good base-metal couples, but they were not serviceable for high temperatures. He found it best to use resistance wires of the platinum alloys throughout. The use of those couples was not so expensive as might at first sight seem to be the case, because the scrap platinum from high-temperature work was useful for low-temperature work. With regard to the various forms of pyrometer instruments, platinum resistance pyrometers were too sluggish for quick readings, not suitable for high temperatures, and were costly to repair. It had been found that the thermoelectric type was best. The vital point about these had been to get an instrument of sufficiently high resistance made up of a material which would not vary with fluctuations of atmospheric temperature. High resistance was absolutely necessary to swamp the changes in resistance of the circuit when using different lengths of couple. Makers were now waking up to this, and the Cambridge Scientific Instrument Co., Siemens Bros., and the Beighlee Co. of America, were found to be quite satisfactory in that respect. Carpentier, of Paris, also made an excellent instrument, having 1,000 ohms resistance, entirely of German silver, and giving a scale 13 in. long. It had been found essential for accuracy to keep the instrument in a fixed position and calibrate it *in situ.* With regard to recording pyrometers, there were very few instruments on the market of sufficiently high resistance, and nothing had been found to beat the Roberts-Austen photographic recorder, made by the White Instrument Co., for serviceability. With regard to calibration, he strongly emphasised the desirability of calibrating with standard melting and boiling points, in preference to relying upon the makers' calibration or on standard couples. As an example of the cost of platinum and platinum-rhodium wire as used in modern pyrometers, he might say that his firm, in 1913, spent on platinum and platinum-rhodium wire £370, in 1914, £415, and the expenditure for this year would probably be about £600. They made many thousands of determinations each week. If any one of these were inaccurate it would mean bad work and the loss of hundreds of pounds. That would give some idea of the importance of pyrometer work.

Mr. Charles E. Foster thought the pyrometer-maker was ahead of the furnace-maker in so far as the control of temperature was concerned. The pyrometer-maker could measure to a finer degree of accuracy than the furnace-maker could make a furnace to maintain that temperature. In order to secure a base metal thermo-couple which was going to be stable, a great deal of refinement had to be given to the alloys before they were used. The base metal thermo-couple usually oxidised much faster than the noble metal. In the noble metal the chief danger was contamination either by furnace gases and metal vapours in the furnace gases, or from the alloy (perhaps 10 per cent. iridium with platinum) in the platinum wire. With base metal thermo-couples that difficulty did not arise. Oxidation and the mechanical fracture of the wire appeared to be the usual end of the life of the base metal thermo-couple, and that, in his experience, generally occurred long before the contamination had reached anything detectable within commercial limits.

Dr. J. A. Harker believed a lot of the difficulty with regard to certain types of pyrometer was not due to inherent lack of homogeneity in the wires themselves, but very often was due to lack of sufficient immersion to give the true temperature of the part which really mattered. With regard to the volatility of metals, supposing a globule of silver was dropped down the porcelain tube of a resistance thermometer, and it was heated for an hour to 700 deg. C., it broke down the whole of the insulation completely.

Mr. Henry C. Jenkins remarked that it was very difficult to make alloys like constantan absolutely uniform. A very small difference in composition would very much alter the E.M.F. obtained from those thermo-couples. The question of the porosity of the sheaths was very important. A little metallic vapour was fatal to any accurate reading.

The Author, in reply, said that, speaking within practical limits, the more fragile the pyrometer, and the less material there was about it, the more accurate it was likely to be, but there were mechanical limitations which had to be provided for. There was no doubt that some of the pyrometers in use were far stronger than was necessary, and the strength was put in at the expense of accuracy. Whether a practical liquid element could be made out for a furnace was a matter which, for the present at any rate, he preferred to leave to the instrument-maker.

BUSINESS NOTES.

Electrolytic Copper in Germany.—It is announced that the Huttenwerke Niederschonweide propose to erect plant in the vicinity of Bitterfeld for the production of electrolytic copper. The energy required is estimated at 2,000,000 KW.-hours per annum, and would be obtained from the Electro Works Co., of Golpa Jessenitz. The carrying out of the scheme would increase to three the number of works turning out electrolytic copper, the two existing being those of the North German Refinery Co. and the Kayser Metal Co.

Private Arrangements. — Venner's Electrical Cooking and Heating Appliances, Ltd., 66 and 68, Wandsworth Road, London, S.W.—In pursuance of the Companies' (Consolidation) Act, a meeting of the creditors of the above was held recently, when the liquidator (Mr. G. E. S. Venner) presented an approximate statement of affairs, which showed liabilities of £1,703 6s. 8d. The assets consisted of book debts £167, plant and fixtures £500, estimated to realise £300, office furniture £136, stock in trade £819 and cash in hand £12, making total assets of £1,434, or a deficiency of £269. It was reported that the company was registered in April, 1914, with a nominal capital of £100,000. The company was formed to take over certain patents, and the vendor (Mr. Venner) received as consideration shares of the face value of £83,500. A sum of £3,806 was also subscribed in cash for shares. It was pointed out that the company had carried out certain experimental work and had been placed on a satisfactory basis. Negotiations were in progress with a view to a reorganisation and the sale of the patents and assets to a new company. After discussing the position, it was decided that the meeting should be adjourned in order that arrangements for the sale of the patents and assets might be carried through. It was stated that the sale should provide sufficient to discharge the creditors' claims in full.

Harold Bourne (trading as H. G. Andrews & Co.), electrical engineers, 16, Royal Arcade, Boscombe, and The Wharf, High Street, Swanage.—The creditors interested herein were called together recently, when a statement of affairs was presented which showed liabilities of £1,263. The indebtedness to the trade was £385, Mr. A. Bourne was shown as a cash creditor for £400, and there was an overdraft at the bank of £478. The assets were estimated to realise £295, less £44 for preferential claims, leaving net assets of £250, or a deficiency of £1,013. No offer was made by the debtor, and it was decided that Mr. H. W. Buckingham, of Messrs. Knapmann & Buckingham, Rood Lane, E.C., should be appointed trustee of the estate, with a committee of three of the creditors. It was stated that an attempt would be made to dispose of the stock by private treaty, failing which a public auction would be held.

Trade Announcements.—Mr. Harry Nance, Dragon Buildings, Cardiff, is now representing the Premier Accumulator Co., Ltd., for South Wales and Monmouthshire, his arrangements with Messrs. Pritchetts & Gold, Ltd., having been determined on July 20th last, this being necessary in connection with the amalgamation of the latter company with the E.P.S. Co.

The agency for the British Isles for the electric vehicles (including the "Ward Special," recently described in our pages) built by the Ward Motor Vehicle Co., of Mount Vernon, N.Y., has been taken up by Mr. Dermot Mooney, 28a, Gillingham Street, Victoria, S.W.

The agency for the "Century" single-phase motors has been acquired by the Swedish General Electric, Ltd., Norfolk House, Cannon Street, E.C., and the London stock of "Century" motors is now under their control. This department of their business is being carried on by Mr. R. A. Marples, who for many years has represented the Century Co. in the United Kingdom.

For Sale.—The Visiting Committee of the County Asylum, Upton, Chester, have for disposal by tender three 35-KW. steam-driven dynamos, main switchboard and feeders, also one vertical engine. Particulars are given in our advertisement pages.

Deeds of Assignment.—George Braulik, 8, Lambeth Hill, and Maiden Lane, London, E.C.—In the matter of a deed of assignment dated June 3rd, 1914, and registered on June 10th, 1914, the statement of trustee's receipts and payments from December 4th, 1914, to June 30th, 1915, has been issued. The total payments into the London City and Midland Bank to June 30th, 1915, were £7,472 15s. 6d., and the total payments to that date, £7,397 4s. 5d. The amounts of liabilities and assets at the date of the execution of the deed as estimated by the debtor were £11,914 2s. 1d. and £11,533 15s. 10d. The terms of the deed of composition have now been fully carried out and the estate has been reassigned to Mr. Braulik.

H. J. Booker, electrical engineer, 51, Tothill Street, Westminster, S.W.—Particulars of claims must be sent by August 25th, to the Trustee, Mr. G. E. Corfield, Balfour House, Finsbury Pavement, E.C.

Liquidation. — Prested Miners' Gas-Indicating Electric Lamp Co., Ltd., Upper Holloway, London.—Liquidator released July 31st, 1915.

Motor Catalogue. — Langdon-Davies Motor Co., 110, Cannon Street, London, E.C.—New 20 pp. price list tabulating in detail particulars, prices, weights, dimensions and code words of electric motors, squirrel-cage and slip-ring types, single-phase 40 to 125 periods, and polyphase, 25 and 50 periods.

Book Notice. — "Handbook of Patent Law." By W. P. Thompson. London: Stevens & Sons. Price 2s. 6d. net.

LIGHTING and POWER NOTES.

Abingdon.—Extension of Area. — The Abingdon Electric Light Co. is applying to the B. of T. for a prov. order to supply current to the outlying district. The R.D.C. has asked the company where the overhead system is to be used and also for the scale of charges.

Barking.—Plant Extensions.—The T.C. last week considered the report of the electrical engineer on the necessity for new plant and extensions at the electricity works. Some months ago the Council's application to the L.G.B. for sanction to a loan of £18,000 for extensions was returned for amendment, the Board suggesting certain omissions. It was stated that in order to meet the demand for power during the next few months, and to guarantee a continuous supply during the coming winter, the installation of new plant was necessary, and it would also reduce the generation costs. The capital expended on the undertaking was over £60,000, but had been reduced by repayments to £30,000. The total loss on the undertaking to 1914 was about £9,000. The report was adopted, and the Council accepted tenders for new plant amounting to £13,536; it was decided to submit a revised estimate to the L.G.B. based on the tenders accepted, and to include £1,600 for buildings.

Belfast.—At the quarterly meeting of the City Council a lengthy discussion took place in regard to the question of reorganising the electric supply department. Apparently a special sub-committee has had the matter under consideration, and has decided that such reorganisation can only be effected by the chief engineer of the undertaking, and as the various schemes submitted by him have not been adopted, the sub-committee reluctantly concluded that he should be given an opportunity of resigning; it was admitted that this was not the view of the majority of the Tramway and Electricity Committee. The Council was asked to come to a decision on this matter, but following a discussion, an amendment was moved, "That all minutes relating to the reorganisation of the electricity undertaking be deleted, that it be an intimation to the Committee that the chief electrical engineer is subject to the supervision of the Committee, who have full control of the organisation and administration of the electricity department, until the Council decides otherwise," and carried by 25 votes to 19. In the course of debate, Ald. Sir Robert Anderson said that during seven years as chairman of the Electricity Committee, he never heard a single accusation brought against Mr. Bloxam (the engineer) for incompetence or anything else; he had been persecuted by every possible means, but he never heard him utter a word against his persecutors. It was further stated that Mr. Bloxam's scheme for reconstruction had never once been discussed.

Blackburn.—The T.C. has been informed that the B. of T. has consented to land at Whitebirk being used for electricity works.

Bootle.—Year's Working.—The report of Mr. T. D. Clothier, the borough electrical engineer, on the working of the electricity undertaking for the year ended March 31st last, shows that 5,173,000 units were sold, as compared with 4,888,000 in the previous year, the increase being due to increased power and private lighting sales. The maximum load was 9,180 KW.; the nominal generating plant capacity is given as 4,150 KW., but this it is noted, includes both the new Marsh Lane station and the old Pine Grove station, which latter is, to some extent, regarded as a stand-by. The total connections to the system, excluding tramways, amounts to 8,015 kw. The new works at Marsh Lane have supplied the bulk of the output during the year, at a generating cost of ·44d. per unit, as against ·54d., the lowest cost recorded at Pine Grove station; had conditions as regards coal been normal, the cost per unit would have been reduced to ·35d. The income for the year was £29,494, and the gross profit £13,488 (as against £11,186 in 1914), and, after meeting financial charges, the net profit was £3,014 (as against £1 340 in 1914). Of this surplus, £1,514 was placed to reserve (the fund standing at £3,556); £246 was placed to renewals (the fund standing at £9,975), and £1,500 was given in aid of the rates. The report gives tabular statistics of the Bootle Street lighting, from which it appears that there are 395 electric lamps of 70,726 c.p. in use in main streets, and 39 such lamps in passages. The candle-power shows a considerable decrease (39,000) compared with the previous year, due to war conditions. An agreement has been made to supply the Litherland Council after the war, and an interconnection with the Liverpool District Lighting Co., for supply to the Mersey Dock and Harbour Board, has been made.

Bradford-on-Avon.—The U.D.C. has consented to an overhead E.L. cable being used by Messrs. Spencer, Moulton & Co., to convey current to Abbey Mills.

Bredbury and Romiley.—Prov. Order.—The Stockport T.C. intends to apply for a prov. order to authorise it to supply electricity within the urban district of Bredbury and Romiley.. The D C. has decided to ask Stockport for a full statement of its proposals.

Bridlington.—L.G.B. Inquiry.—The adjourned L.G.B. inquiry into the application of the T.C. for sanction to appropriate a site adjoining the electricity works for the erection of a refuse destructor, was held on August 4th. Objection was taken to the site, the opponents including the East Riding of Yorks. County Council and Education Authority. The T.C. had previously declined to select any alternative site on account of loss of energy in transmission and the increased capital outlay.

Canada.—Owing to the rapid increase in the consumption of hydro-electric power in the western portion of Ontario, the Hydro-Electric Commission has notified the Ontario Power Co. to prepare for furnishing the last 10,000-h.p. consignment of the 100,000 h.p. contracted for. The total revenue from the municipalities, railways and large users on the Niagara circuit of the hydro-electric system for the six months ended May 1st was $710,324.95; after providing $303,000 for the cost of power, $49,000 for maintenance, $155,000 for interest, $30,000 for operation, and $156,000 for engineering and construction, the sum of $69,808.37 has been applied to the sinking fund, and $50,210.35 to the depreciation and reserve account. In order to provide for future demands the engineering staff of the Commission is investigating the development at Niagara of a hydro-electric plant of its own. It is understood that the plans are being prepared for a 250,000-h.p. development, and it is expected that the Commission will shortly be able to announce something definite relative to this big undertaking.—*Canadian Engineer.*

Chester-le-Street.—Street Lighting.—The U.D.C. proposes, when the present gas contract expires next year, to invite tenders for public lighting by electricity.

Chester.—Year's Working.—With reference to our "Note" under this heading last week, we may add that the total output sold by the electricity undertaking was 2,535,600 units, as compared with 2,531,709 in the previous year, the total costs being ·825d. against ·839d. per unit, and the fuel cost ·211d. as against ·281d. per unit, the actual total cost of coal used being substantially less than in the previous year, owing to the use made of hydro-electric energy. The net profit of £3,194, together with the balance brought forward, amounted to £10,163, from which various allocations were made, as previously stated, including £6,933 to capital account, and a working balance of £1,358 was carried forward. The total of revenue contributions to capital, to date, amounts to £16,792, and the department also has a reserve fund of nearly £7,000. The total loans outstanding amount to £95,239, and the total of debt extinguished and revenue contributions to capital amount to £64,494.

Chesterfield. — Proposed Plant Extensions. — The Electrical Committee has recommended the Town Council to approve of the plan and estimates for a scheme of extensions to meet the requirements for the coming winter, at a cost of £15,200. Subject to satisfactory financial arrangements being made, tenders will be invited for a 2,000-kw. turbo-alternator, condensing and air-filtering apparatus, switchboard and cables, a water-cooling tank, an overhead travelling crane, two superheaters and two mechanical stokers.

The Corporation has increased the charges for electricity for private lighting and power purposes by 12½ per cent., except to consumers under special contract.—*Sheffield Daily Telegraph.*

China.—The China Lighting and Power Co. is building a new power station to contain generating plant of sufficient capacity to deal with considerable increases in load in the area at Kowloon which is supplied by it. The plant, which has been constructed by the British Thomson-Houston Co., consists of two 937-k.v.a. high-pressure B.T.H. three-phase, 60-cycle, 2,200-volt Curtis turbo-alternators with direct-coupled exciters, designed to run at 3,600 r.p.m. These sets will be supplied with steam at 180 lb. gauge pressure, superheated 160° F. The condensing plant will be of the surface type, and will be equipped with rotary type motor-driven pumps throughout. The cooling water for the condensers will be drawn from the sea through a duplicate set of suction mains. In connection with the turbo-alternators, suitable air filters will be supplied. A Lea recorder with integrating attachment will be installed. For controlling the output and distribution from these turbines a nine panel white marble switchboard will be provided, fitted with all the usual operating gear and instruments; the whole of the switchgear will be fitted with duplicate bus-bars to facilitate handling the loads. A B.T.H. Tirrill regulator will be included in this equipment.

The B.T.H Co. is also supplying the equipment for the Hong-Kong and Whampoa Docks. This will consist of two 350-k.v.a., 250-volt, 900 r.p.m., six-phase, 60-cycle rotary converters. With these are being supplied the necessary transformers and control gear, the latter comprising in each case one high-tension alternating-current panel, one low-tension alternating-current panel, and one continuous-current panel. The B.T.H. rotary converters are equipped with self-synchronising starting motors.—*Eastern Engineering.*

Chippenham.—Street Lighting.—The T.C. has approved of the report recommending that electricity for public lighting be adopted for the recently-added area of the borough.—*Western Daily Press.*

Continental. — Russia. — The Governor of Kieff has informed the local Council that the Minister of Trade and Industry has authorised the Kieff Government to remit 32,000 fr. to Paris for the acquisition of electric meters in connection with the electric concern recently sequestrated, and also to send 55,000 fr. to Switzerland for the purpose of buying transformers. The management of the Kieff Electric Co. has notified the town Government that in view of the difficulty in obtaining coal it will be necessary to use liquid fuel. The management has ordered 600,000 poods of mazout, and is asking for the requisite wagons to bring the fuel over from Ekaterinodar and Baku. It is said that the Government of the town proposes to organise a transport of petroleum in hermetically sealed casks or barrels on horse wagons.

Crewe.—The B. of T. proposes to make an order authorising the T.C. to supply electricity to Manor House, Berkeley Towers and the Oaklands, premises situate outside the borough boundary.

Darlington.—Loan Sanction.—The T.C. has received L.G.B. sanction to a loan of £26,100 for additional plant, &c., needed to supply current to the North-Eastern Railway and other works. The total loan applied for was £34,950.

Dartford.—Increased Prices.—The U.D.C. has decided to advance the charges for current as follows as from Michaelmas:—Ordinary lighting, 1d. per unit; long-hour lighting, ½d. per unit; power, ¼d. per unit. The charges will be readjusted as soon as coal can be purchased at or near the rates in force before the war.

Dublin.—The report of the Electricity Committee for the quarter ended June 30th shows a credit balance on capital account for loans of £40,084. For short extensions, house services, meters, &c., £9,500 was available, which would carry them to the end of the year. Until a further loan can be raised no connections will be made except on a guarantee of consumption of £6 a year, and mains will only be extended on very exceptional circumstances.

Hereford.—Price Increase.—The T.C. has increased the price of current supplied to the waterworks department by 10 per cent., as from June 24th.

Heston and Isleworth.—Year's Working.—For the year ended March 31st last there was a total income of £10,494 on the undertaking, an increase of £238 over the previous year. The total working expenses amounted to £5,453, an increase of £484, leaving a gross profit of £5,041. After paying interest and loan charges amounting to £4 651, there was a net surplus on the year's working of £390. By debiting the revenue account with the balance of £1,549, cost of consumers' "free wiring," this surplus is converted into a technical deficiency of £1,190. This is accounted for by the fact that early in the year it was decided to place all "free wired" consumers on the same terms as ordinary consumers, and to discontinue the practice of carrying out repairs to all "free wired" installations. In effect it means that this year the Electricity Committee repays the Council as much of the borrowed money as it can—represented by its credit balances of the last few years—and carrying forward the difference to a future occasion. 1,509,227 units were generated during the year, compared with 1,407,351 for the previous 12 months, an increase of a little over 100,000 units

Holywell.—Workhouse Lighting.—The B. of G. has decided to have inquiries made as to the cost of an E.L. installation at the workhouse laundry, power to be derived from the electric plant at the new infirmary.

Ilkley.—E.L. Scheme Inaugurated.—On Monday last the Council's new electricity works were opened by Dr. Bates; supply is given in Ilkley and Middleton. The scheme has involved an outlay of £21,000; the plant, which includes two generators of 100 kw. and a large storage battery, is to be duplicated immediately. Some four miles of feeder cables and 15 miles of distributing cables have already been laid, and there are over 50 consumers on the mains. It is hoped that satisfactory arrangements will be made with several of the large local hydros to take supplies of current and to eventually supply outside townships. Dr. Bates, who started the plant, was presented with a gold key by Mr. George Wilkinson, consulting engineer to the scheme, on behalf of the contractors.

India.—Messrs. Walker, Sons & Co., Colombo, Ceylon, have submitted their report regarding a proposed electric lighting scheme for Ootacamund, in the Madras Presidency. The report recommends the use of the Kunda River and Falls, and the installation of the three-phase alternating-current system, with overhead transmission lines to a central sub station in Ootacamund. In the latter there would be transformers for the street lighting and for local house lighting. The scheme is estimated to cost Rs. 2,10,000, the annual maintenance charges at Rs. 37,000, while the income is placed at Rs. 52,000.—*Indian Engineering.*

Leyton. — L.G.B. Inquiry. — An inquiry into the Council's application for sanction to borrow £17,158 for generating plant, and £1,000 for mains, was held by the L.G.B. on the 30th ult. Of the last-mentioned sum £500 had been spent, the balance being required principally for extensions in connection with Government work. The Inspector expressed the opinion that the Board might grant the £500 expended, although he doubted the granting of the other £500 in prospect. With regard to the main application, it was pointed out that the Council did not press for an early sanction, but wished to be prepared for possible contingencies.—*Walthamstow Guardian.*

Lincoln.—The. T.C. has decided to arrange terms, on a sliding scale, for a supply of current for power to Messrs. Foster and Co., Ltd., engineers, on a five years' agreement.

Lytham.—Proposed Loan.—The U.D.C. has instructed the electrical engineer to prepare the necessary plans, &c., to enable an application to be made to the L.G.B. for sanction to a loan for the purposes of electric lighting.

Manchester.—A notice of motion that a special committee should be appointed to inquire into the working and the policy of the Corporation electricity department should have been dealt with at a meeting of the City Council on the 4th inst., but owing to lack of time the matter was adjourned for a month.

Marsden.—E.L. Proposals.—The U.D.C. has decided not to entertain the proposal of the Huddersfield Corporation to supply electricity to the district and apply for a provisional order therefor.

Nelson.—Sewage Works Motors.—The T.C. has approved the decision of the Sewage and Streets Sub-Committee to install electric motors for driving the machinery at the sewage works in preference to gas engines. An effort was made to refer the matter back last week, on the ground that a quarter of a mile of gas mains which had been laid to the works would practically have to be scrapped if electricity were adopted, but the recommendation was approved, the chairman of the Committee stating that it was satisfied it could economise as well as improve in efficiency by using electricity.

Rochdale.—A free supply of electricity has been granted to the Y.M.C A. Soldiers' Institute; the Electricity Committee has also agreed that for the present no charge shall be made for the current supplied to the Ambulance Drill Hall Military Hospital.

Coal Supply.—With a view to considering whether any benefit may be obtained by a readjustment of coal contracts, the town clerk has been instructed to prepare a report on the new Coal Act and its probable effect on the contracts of the Electricity and Gas Committee.

St. Annes.—The output of electricity sold during June was 68,136 units, against 72,486 for June last year; the chief reduction is on the tramway section. From April 1st to the end of June, however, the aggregate sale was 241,843 units, against 225,756 last year.

St. Helens.—Proposed Plant Extensions.—Subject to L.G.B. approval, the T.C. proposes to spend £15,000 on electricity extensions.

Shanklin.—Street Lighting.—The Isle of Wight E.L. Co. has declined to accept the proposal of the U.D.C. that the allowance on the charges for public lighting for the quarter ending March 21st (owing to restricted lighting) should be one-half of the contract price, and has offered to submit the matter to arbitration. The company had offered a rebate of £50, and to make a rebate for the June quarter based upon the number of units of current not supplied. The Council has decided to take no further steps at present, but to abide by the offer already made.

Stockton-on-Tees.—The T.C. has decided that it is not at present advisable to make any alteration in the existing prices for current.

Torquay.—Proposed Loans.—The L.G.B. has informed the T.C. that it is prepared to sanction loans of £1,577 and £3,518 for liabilities actually incurred, but it proposes to defer the issue of its consent until it has been decided what other sums could be included.

Turton.—Street Lighting.—The U.D.C. has decided that the electric street lamps be reduced from 100 c.p. to 50 c.p. during the ensuing season.

Waterford.—E L. Scheme.—In reference to the application of the Corporation for sanction to a loan of £30,000 for an electric lighting scheme, the L.G.B. states that the scheme submitted may, from an engineering point of view, be regarded as satisfactory, but having regard to the present restrictions on borrowing by local authorities, the matter is one which must be postponed.—*Freeman's Journal.*

Wednesbury.—Plant Extension, &c.—The accounts of the electricity undertaking for the year ended March 31st show a loss of £116. The Electricity Committee recommends the purchase of additional plant for the King's Hill sub-station, at a cost of £1,580, also an expenditure of £420 for mains, and an application is to be made to the L.G.B. for sanction to a loan of £2,000. The Committee also recommends an additional expenditure of £815 on mains extension at King's Hill.—*Birmingham Daily Post.*

Wimbledon.—Year's Working.—During the year ended March 31st last, the electricity undertaking sold 3,569,217 units, as compared with 3,367,517 units in the previous year. The output sold included 1,369,382 units for power and lighting. The consumers numbered 7,041 (1,155 being supplied on the "fixed price light" system), and the total connected load was 9,850 kw.; the generating plant capacity was 4,825 kw., and the maximum load 2,120 kw., this latter being slightly less than in the previous year. The total revenue was £38,668, and the gross profit £19,608; the net profit carried forward was £2,184. The balance of the suspense account carried forward amounts to £7,849, while the reserve fund stands at £14,906.

We note that in Wimbledon there are 1,155 consumers connected on the "fixed price light" system, which was referred to in our issue of May 15th, 1914; these are practically all very small consumers, and their connected load is 138 kw., while the revenue derived from them is nearly £7 per connected kw., as against only £3·3 per kw. connected from ordinary private lamps, motors, radiators, &c., and about £4 per kw. of total connected load including public lighting. These figures are evidence of the possibilities of the small consumer, if suitable means are adopted for supplying this class of load.

Wolverhampton.—Year's Working.—The accounts of the Corporation electricity undertaking for the year ended March 31st last show a gross profit of £28,631, as compared with £27,436 in the previous year; the net profit was £7,444, as compared with £8,676; £2,215 has been transferred to the relief of rates, and £5,229 to the reserve fund. The total income shows an increase of £1,862. The number of units sold was 13,126,271, an increase of 112,357 over the previous year. During the year 981 h.p. in additional motors were added, the total h.p. of motors now connected being 9,745, while in connection with heating and cooking, apparatus absorbing 980 h.p. was connected. The total cost of production per unit sold was ·551d., coal costing ·220d. The maximum load was 6,260 kw., and the connected load about 14,000 kw. The balance of the reserve fund stands at £17,806.

TRAMWAY and RAILWAY NOTES.

Australia. — The construction of the Sydney City Railway is to be commenced as soon as the scheme has received the sanction of Parliament. Electric traction will be used, and it is intended to connect with North Sydney and the Nelson's Point Railway.

The estimated cost of wiring from the present Nelson's Point terminus to Hornsby is £108,000; in addition, further expenditure will be necessary to provide rolling stock, transmission lines and sub-stations. The question of funds for the electrification of the Nelson's Point-Hornsby Railway is to be considered in connection with the next loan estimates.—*Sydney Daily Telegraph.*

The Victorian Railway Commissioners have stated officially that they have no intention at present to supply energy from the Newport power house for commercial purposes. The power house is designed as part of the suburban railway electrification scheme for the needs of the railways only, and it is not considered there will be any surplus available for commercial purposes.—*Melbourne Age.*

Burnley.—The Tramways Committee has decided that all persons engaged upon the manufacture of munitions be allowed the privilege of travelling on the local cars by workmen's discount tickets at any time during the week.

(*Continued on page* 211.)

ROBERT HAMMOND.

By the death of Mr. Robert Hammond, on August 5th, the electrical engineering industry has been deprived of one of its most popular and influential members. Mr. Hammond possessed a personality which rendered him unique amongst his fellows—bluff, hearty, sympathetic, and courteous, with a keen sense of humour and a ready wit; he was a fluent speaker, with a powerful voice, and his speeches always commanded the interest and attention of his audience. He took a prominent part in public affairs, particularly in connection with the Institution of Electrical Engineers, of which he was Honorary Treasurer for nearly 13 years, and his administration of the funds of the Institution was marked by sound finance and commercial acumen of the highest order. Born in 1850 at Waltham Cross, he became an ironmaster and established works at Middlesbrough, but on the introduction of electric lighting he entered this new field with characteristic energy, and was the first to obtain a concession from the Anglo-American Brush Co. for the exploitation of their system in this country. His first essay in electric lighting was carried out in 1880 at the iron-works of Messrs. Bernhard Samuelson & Co., of Middlesbrough, where he installed a number of arc lamps near the blast furnaces; in the following year he lighted the rail-straightening department of Messrs. Bolckow, Vaughan and Co., entirely at his own risk, to enable a night shift to be run, and this enterprise was so successful that many other firms immediately invited him to install arc lamps in their works.

Robert Hammond, M.Inst.C.E., M.I.E.E., M.I.Mech.E.

In October, 1881, Mr. Hammond laid down what he claimed was the first public lighting station in this country where arc and incandescent lamps were fed from a high-pressure circuit, using a Brush dynamo which gave 10 amperes at 2,000 volts. This was at Chesterfield. In the same year he gratuitously installed electric lamps in the streets of York, during the visit of the British Association to the city, and a public lighting scheme was put in hand at Cockermouth.

Mr. Hammond also lighted an exhibition at Brighton in the winter of 1881 with Brush arc lamps, under the charge of Mr. Arthur Wright, and at the request of certain local tradesmen he subsequently installed the plant on a permanent basis and commenced the public supply of electricity in February, 1882; this undertaking shares with a station established by the Edison Co. at the Holborn Viaduct the honour of being the first of its kind, supplying electricity for arc and incandescent lighting to private consumers, but, unlike the Holborn venture, which expired after a brief and troubled existence, it continued in operation for 13 years, and eventually was purchased by the Brighton Corporation in 1894. It is interesting to note that the supply was carried on for some years with bare overhead wires at 2,000 volts; incandescent lamps were run in parallel-series, as at Chesterfield.

Mr. Hammond was also responsible for the electricity works which were inaugurated at Eastbourne and Hastings in 1882; underground mains were used at Eastbourne under an agreement with the Corporation, which, as a matter of fact, was entirely *ultra vires*; in 1890, however, the lighting company obtained a provisional order. Mr. H. M. Sayers was the first engineer at Eastbourne, and later became chief engineer of the works laid down for an English company by Mr. Hammond, at Madrid. The generating plant consisted, as usual, of Brush arc dynamos, driven by semi-portable engines; but in 1886 the alternating-current system was introduced, with Lowrie-Hall alternators and transformers, the latter being made at the Eastbourne works, and the success of this plan put an end to the series-parallel grouping system. Both the Eastbourne and the Hastings undertakings were eventually purchased by the local authorities.

From the foregoing it will be seen that Mr. Hammond occupied a prominent position in the front rank of pioneers of the electrical engineering industry; moreover, he claimed to be the author of the first book on the electric lighting of private houses, and the first in Europe to light his own house with electricity throughout. His activities, however, were not confined to innovation. Commencing practice as a consulting engineer, he was responsible for the design and erection of a large number of electricity works in the United Kingdom, of which the principal were those at Leeds, Hackney, and Dublin, as well as several foreign undertakings. He also acted as consulting engineer for a number of electrical tramways. Most of his work, which involved the expenditure of several millions sterling, was carried out in conjunction with municipalities, and he was credited with the possession of persuasive faculties which enabled him to convince the most sceptical town councillor of the soundness of his proposals. Another *rôle* in which he was particularly successful was that of Parliamentary expert witness, in which capacity he took a large share in the various proposals for the improvement of the electricity supply to London; and as expert in legal actions and arbitrations he undertook heavy responsibilities, in some important cases himself acting as arbitrator.

During the earlier years of electric lighting he paid many visits to the United States for the purpose of studying electrical developments there, and he travelled extensively also on the Continent and in South Africa. In 1905 he read an important paper on the distribution of electrical energy on the Rand, at the meeting of the British Association at Johannesburg; recognising the immense possibilities of the district, he outlined a scheme for supply on an enormous scale at 0·6d. per unit, and in the following year, in a communication to us, he formulated a trenchant criticism of the proposal to utilise the power of the Victoria Falls on the Zambesi River, 700 miles away. It is interesting to note that the hydraulic scheme was abandoned, and a huge power station was erected at Vereeniging, the site which he put forward in his B.A. paper as the most suitable for supplying the Rand.

In 1902 Mr. Hammond took his son, Mr. R. W. Hammond (who is now on active service as Captain in the Public School Battalion of the Royal Fusiliers) into partnership, and the style of the firm became "Robert Hammond and Son."

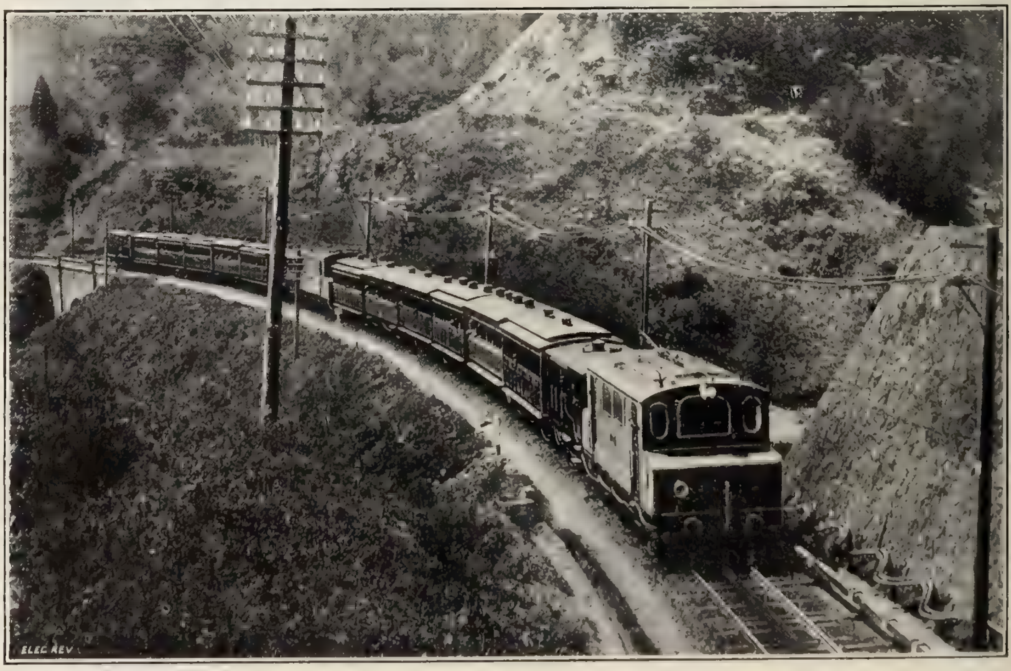
Perceiving the necessity of making provision for the training of students in electrical engineering, as long ago as 1882 Mr. Hammond established a school called the "Hammond Electrical Engineering College"; in 1889 the functions of this institution were taken over by the Electrical Standardising, Testing and Training Institution ("Faraday House"), in the management of which from the first he played an important part. He was a Member of the Institutions of Civil, Mechanical, and Electrical Engineers, as well as of the Association of Consulting Engineers and of the South African Institution of Engineers. An ardent politician, he was a member of the leading Liberal clubs, and of the Whitehall Club, which is the home of many electrical engineers. He was the author of many papers and addresses before the Institution of Electrical Engineers and other societies, and was an enthusiastic statistician; in pursuit of this hobby, as "Chesterfield Junior" he conducted in *Lightning* a detailed analysis of the costs of production of electricity in British works. His paper on the "Cost of Generation and Distribution of Electrical Energy," read in 1898 before the I.E.E., contained an enormous mass of data, which he classified and discussed in masterly style. His stalwart presence and his rugged eloquence will be sorely missed at the meetings of the Institution, and his innumerable friends will long mourn the loss of his hearty good-fellowship and cheery greeting.

The funeral took place on Monday last, at Golder's Green Crematorium, in the presence of relatives and a large gathering of friends, amongst whom were noted Sir John Snell, Dr. Alex. Russell, and Messrs. J. H. Rider, W. M. Mordey, Spencer Hawes, John May, F. Ince, H. M. Sayers, A. H. Preece, Frank Gill, J. E. Kingsbury, A. A. Campbell-Swinton, A. M. Sillar, Alex. Siemens, H. W. Wyld, Sydney Sharp, A. W. Heaviside, W. P. Nicholas, and Wm. Soper.

A JAPANESE RAILWAY ELECTRIFICATION.

An important step towards the electrification of Japanese trunk lines was taken with the adoption of electric operation on the Usui-Toge Railway, a line crossing the chain of mountains some 120 km. to the north-west of the metropolis and passing through 26 tunnels.

In order to overcome the difference in level of 560 m. in a track length not exceeding 11 km., the Usui-Toge line is designed as a single-track mixed adhesion and rack railway, on the Abt rack principle; the rack system, apart from the approaches, is constructed with a gradient of 1 : 15, and the adhesion sections with a maximum gradient of 1 : 40. In the centre of the line the only turn-out is situated on a stretch of level ground 125 m. in length, confined between two rocky ridges. The maximum train length is determined by the length of this turn-out, which has no continuous rack. The line is of the standard Japanese gauge of 3½ ft., with rails 30 kg. per m., and the iron sleepers, to which the triple-bar rack is also fixed, are placed 80 cm. apart and anchored.



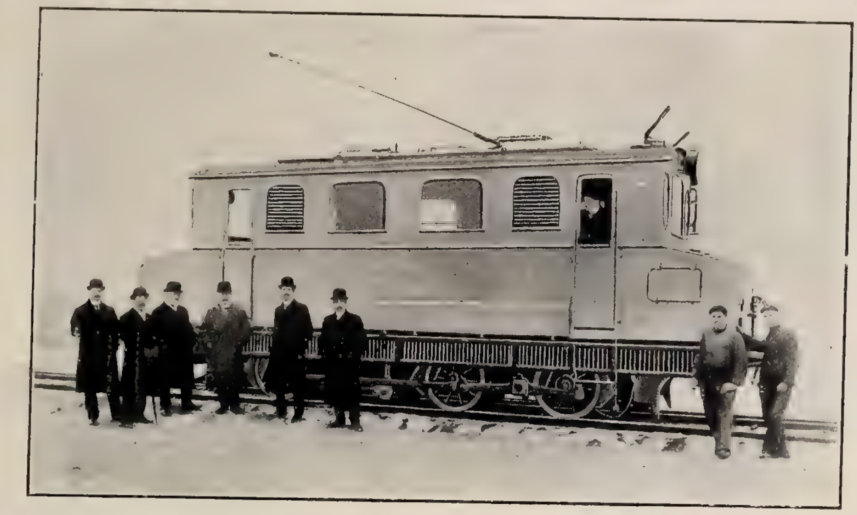
Electric Train, Usui-Toge Railway, Japan.

The electrical energy for the whole plant is obtained from a power station specially erected in the neighbourhood of Yokogawa. Three vertical 1,000-kw. Curtis turbo-generators built by the G.E. Co. (New York) have been installed and supply current at 6,600 volts and 50 cycles, while exciting current is provided by two 75-kw. 125-v. exciters, direct coupled to vertical steam engines.

Steam is supplied by eight water-tube boilers, fitted with superheaters and automatic stokers. The whole boiler plant was constructed in Japan, and local coal is used. The current generated at the power house is led to two sub-stations through underground armoured cables, and stepped down to 240 volts by transformers, to be converted to direct current at a pressure of 650 volts, by means of four 450-kw. rotary converters. Each sub-station has been provided with a stand-by in the form of a buffer battery of 312 cells having a capacity of 1,322 ampere-hours, in conjunction with a 100-kw. Pirani booster, which arrangement is also of service in dealing with peak loads.

The comparatively low pressure of 650 volts was chosen mainly on account of the difficulty of securing satisfactory insulation in the narrow tunnels, which made the adoption of a H.T. overhead line impossible. On the other hand, with the outputs and currents in question only the third rail system could be considered for the rack section of the line.

On the side tracks, at the stations of Yokogawa and Karuizawa, where the installation of a third rail would have been difficult owing to the intricacy of the points and crossings, and no heavy currents have to be transmitted, the current is collected from an overhead line having a section of 100 sq. mm. The form of suspension adopted is the well-known catenary system, a special messenger cable being employed. The overhead line is fed by four insulated feeder cables connecting each converter station with the line, which is carried on wooden masts in the open and on insulators in the tunnels; the current is returned through the rails and special cables laid beside the track.


General View of Locomotive.

The electric locomotives are designed on what is known as the mixed system, *i.e.*, with separate drives for adhesion and rack operation respectively, and will haul a train of 90 tons, or, when two locomotives are used, a double train of 180 tons, on a gradient of 67 per cent., at a speed of about 16 km. per hour.

The drive is effected by elevated motors and parallel-crank mechanism, this arrangement being entailed by the considerable output, as well as by the design of the locomotives for rack running. The weight of the locomotive (42,000 kg.) is distributed nearly uniformly over three adhesion driving axles; the output of each motor is 350 h.p., at 650 r.p.m.

Views showing Tunnel Entrance before and after Electrification.

The motor intended for adhesion operation is firmly fitted into the spring-suspended main frame of the locomotive, and works through a cog-wheel transmission of 1 : 6·4 on to the intermediate shaft, and thence through a parallel-crank mechanism on a loose shaft firmly mounted in resilient frames, whence the last drive is effected by means of connecting rods.

The two driving pinions are mounted on the inside frame, which is firmly mounted on two axles. This arrangement allows carrying springs of sufficient resilience to be used, thus protecting the sensitive electric apparatus, which would otherwise be exposed to heavy shocks.

The inside frame also carries the driving motor for the rack gear, which is partly spring supported. The motor is free to rotate in a cast-steel trestle on the inside frame, and, like the adhesion motor, works on to toothed wheel gearing, and thence through a connecting rod directly on to a driving pinion axle. The two axles are connected together by coupling rods. The cranks are set at an angle of 90°, as in the case of the adhesion drive. Both motors are subdivided, the upper half, like the armature, being lifted and fitted by means of a crane.

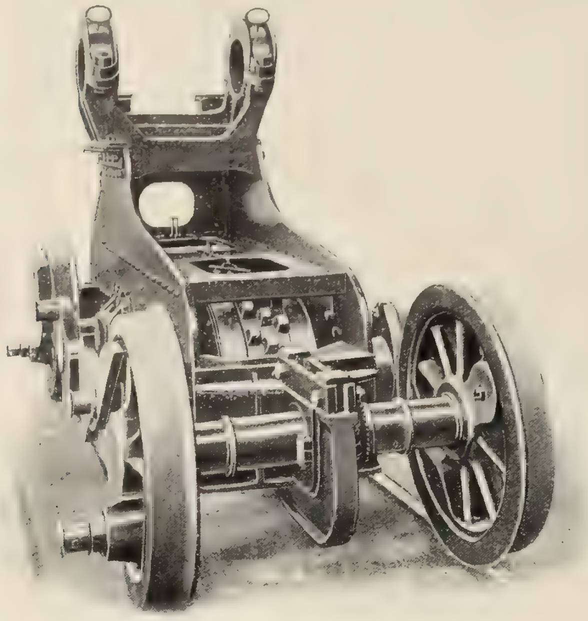
A friction clutch, which slips on a given torque being exceeded, is fitted between the armature shaft and the pinion and protects the driving gear, which is rigidly coupled by the rack and the driving pinions, in the case of sudden jerks, short-circuits, &c.

The current is collected from the underside of the third rail by sliding shoes, fixed at the front and rear of the locomotive. Two trolley collectors (one for each direction of travelling) are provided on the roof of the the locomotive, for the overhead line of the side tracks.

The motors of the locomotive are controlled by a set of 32 contactors, arranged in side compartments lined with asbestos. The contactors and the reversing switch installed on one side of the locomotive are worked by an 80-volt auxiliary circuit from a battery of 40 cells. When this battery is exhausted it is replaced at special charging stations.

The adhesion motor when on the adhesion section is used exclusively for the operation of the locomotive. The rack motor at the same time runs idle, at a speed approximately equal to that of the adhesion motor, thus allowing the locomotive to change to rack operation when running at considerable speed.

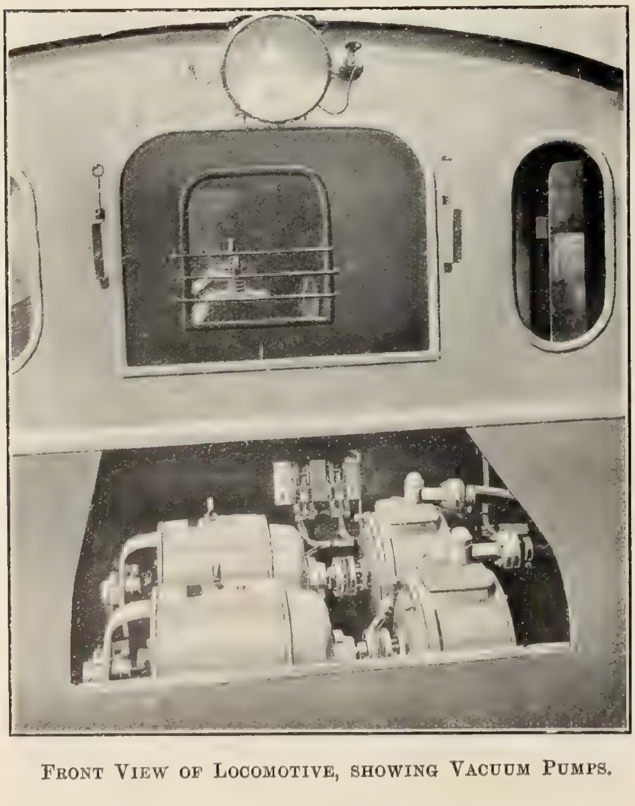
Synchronism between the loaded motor and the rack motor running idle is obtained by the field of the latter being in series with the field and armature of the adhesion motor, while the armatures of the two motors are connected up in parallel. The conditions determining speed are the same for both motors, pressure drop and armature reaction being neglected.



Rigid Inside Frame of Locomotive.

A small resistance connected up to the armature of the rack motor partly compensates for the practically rigid coupling; this is indispensable, as on switching in the current, while the adhesion motor is running, a considerable slackening of speed would otherwise take place, the adhesion motor armature being short-circuited through the idle rack motor armature, while running in a strong field.

The same resistance also gives the system the elasticity required in respect of the wear of the uncoupled wheels, and thus facilitates the entrance on to the rack section.



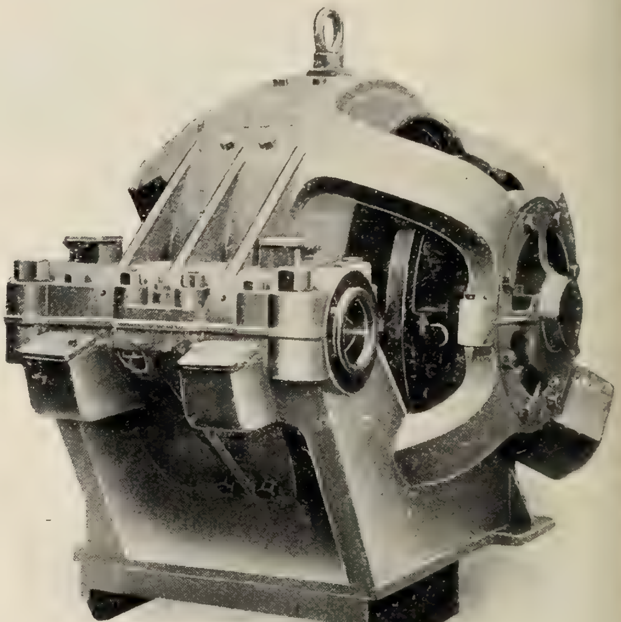
Front View of Locomotive, showing Vacuum Pumps.

The motors are worked on the rack section in ordinary series-parallel connection, with 15 starting steps. During the first nine steps the motors are arranged in series, and during the remainder in parallel; on the ninth and fifteenth steps the motor fields are shunted. By altering the shunt resistances the distribution of load between the two motors, which varies according to the wear of the running wheel diameter, is adjusted as required.

The first six positions of the controller are used to actuate the electric brake. In the case of the short-circuit brake, which is always used in travelling downhill, the armature of one of the motors is connected up in series with the field of the other motor and a set of resistances. This "crossed" brake connection ensures absolute security in braking effect, irrespective of the position of the reversing switch.

The current generated is converted into heat in the resistances which serve for starting.

The arrangement of connections on the locomotive prevents the rack motor from being switched in on the adhesion track, so as to race as a series motor working under no load. This is effected by a relay which interrupts the controlling circuit of the contactors carrying the travelling current, and at the same time actuates the vacuum brake of the whole train whenever the "group" drum on the adhesion section is not adjusted to "A." The relay in this case receives current through a switch on the roof of the locomotive, which is actuated by a stop provided on the track besides each rack entrance. If the "group" drum is adjusted to "A," another relay prevents the former from working.



350-h.p. Traction Motor, Usui-Toge Railway.

Each locomotive has been equipped with two cable drums each carrying about 60 m. of cable. This arrangement allows two locomotives, at the lower end and in the centre of the train respectively, to be coupled together electrically, so as to be controlled from one driver's cabin.

The pneumatic brake generally used in the case of steam-operated rack locomotives has been replaced by a short-circuit brake, working as described, on amply designed resistances; this brake, on going downhill, is assisted by a vacuum brake, in addition to which a hand-brake, combined with the levers of the vacuum brake and a hand-operated hand-brake working on the driving pinions, has been provided.

The vacuum is generated by two vacuum pumps fitted in the front of the locomotive, one of which works permanently at a low speed, while the locomotive is in motion, thus maintaining the vacuum, and is only operated at full speed in order to release the brake quickly. The other pump serves as stand-by.

The locomotives above described have been in operation for nearly two years. After overcoming a few initial difficulties in connection with the parallel-crank mechanisms, electric operation has been going on quite smoothly, and the excellent results obtained in the service have induced the Japanese Railway Department to consider the electrification of other lines.

TRAMWAY and RAILWAY NOTES.

(*Continued from page 206.*)

Continental.—Italy.—By recent Royal Decrees the following electric tramway schemes have been authorised:—Les Tramways Florentins, three extensions in the city of Florence; Municipality of Milan, two extensions and the conversion to double track of an existing line; Società Anonima Livornese, construction and working of an electric funicular tramway for passengers and goods from a point near the city of Leghorn to the Santuario della Madonna di Montenero; Società Anonima Tramvie e Ferrovie Elettriche di Roma, construction and working of a branch from the existing Genzano-Velletri tramway to Lanuvio (Civita Lavinia); Società Romana Tramways Omnibus, construction and working of a branch from the existing urban tramway at Porta Cavalleggeri to Madonna del Riposa; the firm of Marsaglia (Ditta Marsaglia), concession, without subsidy, for an electric tramway from San Remo to Ospedaletti and Taggia; and the Società Tramvia Elettrica Offida, construction and working of an electric tramway from Offida Castel di Lama to the city of Offida.

Dublin.—Petrol-Electric Traction.—The Dublin and Blessington Tramway Co. has introduced the first petrol-electric car used in Ireland. It is well-appointed, lighted by electricity both inside and outside, and has seating accommodation for 75 passengers. The current is generated by a 65-kw. petrol-electric set in the motorman's compartment, but the car can, if necessary, run over the Dublin United Tramways system—in which case the motors are supplied from the trolley wire in the usual way. Other cars of the same type will shortly be introduced on the Blessington route.

Manchester.—War Bonuses.—The Tramways Committee was paying £7,142 per year in war bonuses, prior to the recent award of the Government Committee on Production, and that is now to be raised to about £17,000 under the award. To have acceded to the request of the workers would have meant an expenditure of over £20,000 per annum.

War Services.—The collections on the tramcars, which have now been suspended for a time, have realised nearly £14,000 for various relief funds. The enlistments from the tramway department number 2,000; the holidays of the present employés are postponed, and staffs are having to work overtime to deal with the work. In the electricity department there have been 320 enlistments, and the office staff is having to work late every night.

Rochdale.—The construction of the new car-shed is to be hung up for some months. An arrangement was proposed whereby the contractors would go on with the work, themselves defraying the expense, and they were to be reimbursed at the end of the war. It now appears that the contemplated arrangement has fallen through.

Salford.—War Bonuses, &c.—The Tramways Committee has agreed to allow Red Cross nurses serving in local military hospitals to use the cars free during the period of the war. A war bonus of 2s. each per week has been granted to inspectors, timekeepers and receiving clerks in receipt of 38s. per week or less, with a smaller amount to those receiving over 38s. and under 40s., sufficient to raise the normal weekly wage to 40s.

Worcester.—Electric Vehicle.—The Electricity Committee has recommended the purchase of a 3-ton Edison lorry, but, according to the *Commercial Motor*, the matter has been referred back for further discussion.

TELEGRAPH and TELEPHONE NOTES.

Australia.—Next year's estimates provide for the installation of more automatic telephone systems in Melbourne and Sydney. The amount, according to the Postmaster-General, will be £220 000. No more switchboards of the existing type will be erected in these cities.

Italy.—Certain modifications were made in the telegraphic service when the mobilisation of the Italian army was ordered towards the end of May. Telegrams within Italy and Libya must be in Italian. Those coming from or directed to foreign countries must be in clear language and in French or English. All telegrams are accepted at sender's risk, and no claims or reimbursements for any reason are admitted. In internal telegrams the use of telegraphic addresses and signatures is allowed. The Post Office recommends that letters be posted open, in order to facilitate the work of censorship. Insured letters will, as heretofore, be accepted closed and sealed. For money remittances the use of the P.O. order is recommended.

South America.—From statistics drawn from an American source, published in the *Revista de Correos y Telegrafos*, it appears that the number of telephones in January, 1914, in Central and South America was as follows:—Argentina, 74,296 apparatus; Mexico, 41,861; Brazil, 39,183; Chile, 19,708; Cuba, 16,097; Uruguay, 13,589; Venezuela, 5,029; Peru, 4,000; Colombia, 3,177; Ecuador, 2,926; Panama, 2,635; Bolivia, 2,500; Guatemala, 1,769; San Salvador, 1,728. Argentina thus holds the first place with 32 per cent. of the total number of apparatus. The three States having the largest sums invested in telephones are:—Argentina, £3,246,800; Brazil, £2,261,300; and Mexico, £1,081,700. The revenues from these three premier States were as follows:—Argentina, £1,937,000; Brazil, £1,139,500; and Mexico, £49,400; and the extent of their networks 142,153 miles in the case of Argentina, 49,169 miles in that of Mexico, and 38,304 in that of Brazil, the next in order being Chile with 23,000 miles. The yearly volume of messages was: Argentina, 10,628,000; Chile, 5,900,000; Mexico, 5,285,000; and Brazil, 4,300,000.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Adelaide.—September 1st. Condensers, testing sets, rheostats, Morse sounders, and Wheatstone transmitters for the P.M.G. See "Official Notices" July 23rd.

Perth.—August 25th. Common-battery telephones, for the P.M.G. See "Official Notices" July 30th.

September 29th. Telephone switchboard parts, for the P.M.G. See "Official Notices" July 30th.

Sydney.—September 13th. Council. A.C. and D.C. electric motors. Specification (10s. 6d.) from E.L. Department, Town Hall.*

September 6th. Metropolitan Board of Water Supply and Sewerage. Centrifugal pumps and electric motors at Richmond pumping station.* Acting Secretary, 341, Pitt Street, Sydney.

August 26th. Telephone parts, switchboard parts, coal-tar composition, soldering solution, and tape, for the P.M.G.*

September 23rd. Condensers, galvanometers, relays, and sounders, also incandescent electric lamps, for the P.M.G.'s Dept. See "Official Notices" to-day.

October 25th. Six electrically-operated wharf capstans, for the Sydney Harbour Trust. Forms of tender from the Engineer-in-Chief, Harbour Trust Offices, Circular Quay.

Melbourne.—September 29th. Fuse blocks (complete and spare porcelain bases and fuse clips) for the Victorian Railway Commissioners. Particulars at the Contractors' Room, Spencer Street.

Hawthorn.—November 30th. Refuse destructor plant, for the Hawthorn-Malvern-Camberwell and Kew Destructor Trust. Specification from the Trust Engineer's Office, Town Hall.

Bristol.—August 23rd. Corporation. One 6,000-kw. three-phase steam turbo-alternator with condensing plant. See "Official Notices" July 23rd.

August 20th. Electric lighting, base supply sheds, Avonmouth, for the Corporation Docks Committee. Mr. T. A. Peace, Engineer Cumberland Road (returnable deposit of £1).

Earby.—August 16th. Dynamo, wiring, &c., for electric light at the sewage disposal works, for the U.D.C. Mr. J. E. Aldersley, Engineer and Surveyor (returnable deposit of £1 1s.).

London.—H.M. Office of Works.—August 13th. Twelve months' supply of incandescent electric lamps. See "Official Notices" August 6th.

August 20th. Enamelled electric conduit and fittings. See "Official Notices" to-day.

L.C.C.—August 23rd. Installation (74 wiring points, 93 lighting points) at Winchester Street Elementary School, Pentonville Road, N. See "Official Notices" to-day.

Nottingham.—August 19th. Twelve months' supply of coal for the Electricity Committee. Specification from Mr. H. J. Talbot, Electrical Engineer.

South Africa.—Johannesburg.—August 25th. 8,600 drawn-wire spiral filament traction lamps, spare parts for tramcars, for the Municipal Council.*

September 25th. For the T.C. Two turbo-alternator sets, condensing plant, switchgear, &c. Specification, &c., on deposit of £2 2s., from Mr. J. H. Dobson, General Manager.*

Spain.—Municipality of Cullera, Province of Valencia. Installation of an electric lighting system for that town. Some particulars published in the *Gaceta de Madrid* may be inspected at the Board of Trade Commercial Intelligence Branch in London.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Aldershot.—The U.D.C. has accepted the tender of Messrs. George Kemp & Co., at £89, for alterations to the electricity station.

Australia.—The Melbourne City Council has accepted the following tenders for the Electricity Department:—

Babcock & Wilcox, Ltd.—Four mechanically-fired boilers, £840.
W. & T. Avery, Ltd.—Coal-weighing machine, £2,740.
Strachan, Murray & Shannan.—Two fuel economisers, £1,816.
C. W. Webster.—Arc lamp carbons of Spanish manufacture, £8,431.

—*The Age.*

Dartford.—The Electricity Committee has purchased the following quantities of coal:—

E. J. & W. Goldsmith, Ltd.—200 tons Hetton Wallsend, at 27s. per ton.
Beadle Bros., Ltd.—200 tons Yorkshire rough small, at 25s. 6d per ton.
John Hudson & Co., Ltd.—Three barges (240 tons) South Hetton, at 26s. 9d. per ton.
J. Waddell & Sons.—100 tons Yorkshire 1½-in. rough small, at 24s. 6d. per ton, and 100 tons Yorkshire 1¾-in. rough small, at 25s. 6d. per ton.

Glasgow.—The T.C. Committee on Tramway Works and Stores recommends the acceptance of the following offers:—Blinds for Govan depôt, Messrs. John Bryden & Sons; Witting armature coils, Manchester Armature Repair Co.

Hampshire.—The County Council has accepted the tender of Messrs. Hill, Upton & Co., at £15,849, for electric plant at Park Prewett Asylum.

Hull.—The Electricity Committee has accepted the tender of Messrs. Dick, Kerr & Co., Limited, at £13,315, for the supply of a turbo-alternator.

Reading.—The T.C. has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for 12 motors and 12 controllers for tramcars, with gears, pinions, and gear cases, and standard type "K" controllers, at £1,596 net.

Rotherham.—The tender of Messrs. Chadwick & Co., Ltd., at £1,854, for extending the boiler house at the electricity works, has been accepted.

The Tramways Committee has considered tenders received for the supply of stores, and recommends the Council to enter into no contracts this year for the supply of heavy metal goods, the tramway manager to purchase them as required. No contracts are to be entered into for the supply of cable and electricity meters during the ensuing year; the engineer is to purchase as required.

Salford.—The Electricity Committee has accepted the tender of Messrs. Gerrard & Sons for alterations and additions to buildings and construction of foundations at the Frederick Road electricity station, in connection with the additional 5,000-kw. turbo-alternators.

Sheffield.—The Electricity Committee has accepted the tender of Messrs. H. Boot & Sons, at £2,853, for the erection of a pump room at the Neepsend power-house.

The following tenders have also been accepted by the Electricity Supply Committee in connection with the emergency Westinghouse generating plant:—

Mellowes & Co.—Cast-iron cistern and brackets, £5.
Stewarts & Lloyds.—Steam pipes, £60.
The Lea Recorder Co., Ltd.—Water-recording apparatus, £115.
Wragg & Biggin, Ltd.—Ironwork, £40.
Sharpe & Co.—Water pipes, £200.
Reyrolle & Co., Ltd.—Switchgear, £240.

Wigan.—The Tramways Committee has placed a contract with the Woods-Gilbert Rail Planer Co., Ltd., for the remodelling of the narrow-gauge track.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, August 21st. Visit to Messrs. Pilkington's Tile & Pottery Co., Clifton Junction. Ladies invited.

REVIEWS.

Alternating-current Electricity and its Application to Industry, First Course. By W. H. Timbie and H. H. Higbie. London: Chapman & Hall. Price 8s. 6d. net.

The authors state in their preface that this book is planned to meet the need for an elementary text-book on alternating current electricity simple enough to be understood by beginners, and, at the same time, complete enough to be a proper foundation for engineering practice or for later advanced study. Accordingly, very little mathematical knowledge is assumed—in fact, an appendix explains the simple trigonometrical functions and their fundamental relations—and the reader is not expected to possess more than a sound elementary acquaintance with the laws of continuous-current electricity.

Beginning with this very modest equipment on the part of their pupil, the authors aim at giving him a knowledge of the subject of alternating currents which shall be at least as thorough as that conveyed by a good many of the text-books which cater for students who start with a much more advanced training. Naturally, the result is a work of considerable dimensions, and the present volume of some 540 pages is only one half of the complete course.

We may say at once that the authors have carried out their plan admirably, and we have nothing but praise for the careful and thorough manner in which they lead the student on step by step from the simplest and most tangible conceptions to those which are more difficult and less easily realised. We would only say that for any student who has had a somewhat broader education than that assumed by the writers, even if he possesses no knowledge of alternating currents, a less laboured treatment would be much more easily followed, and a freer use of equations in mathematical form would be a relief. The reader who has already some general knowledge of electrical engineering will often feel some impatience at the careful but elementary method of approaching every new part of the subject.

Numerous problems and examples are interspersed throughout the book, and afford useful practice for the student who is studying the subject for the first time; while at the end of each chapter is placed a useful summary of its contents in large print, followed by further problems. Perhaps the number of problems (nearly 1,500) is too great for the average student to work through; but as they are well chosen, and many of them are of a very practical character, they may be expected to prove an attractive feature of the book.

It may be useful to give a brief statement of the contents of the volume before us.

The first chapter is devoted to a general descriptive account of modern systems of power transmission, in which the part played by alternating-current machinery and apparatus in the general scheme of power distribution is explained and illustrated.

The second chapter deals with the fundamental ideas of the nature of an alternating current, while the third treats of current and voltage relations and series and parallel circuits. Subsequent chapters deal with power and power-factor; inductive reactance; single-phase generators; polyphase generators; wave-form of generator E.M.F.; armature windings of alternating-current machines.

Hydraulic analogies are freely used in the earlier parts of the book for conveying qualitative and physical conceptions rather than a quantitative or mathematical appreciation of the principles under discussion. While this plan is helpful in the case of a book which is purely introductory in character, it has disadvantages which have already been alluded to in the case of works which have a more extended scope.

The second volume is to contain a more detailed treatment of matters relating to the construction and characteristics of operation of the various common types of alternating-current machines and appliances.

In conclusion, we may repeat that the book is excellent from the point of view of the elementary student who wishes to plod his way steadily and surely to a fair working knowledge of alternating-current machinery and appliances.

Automatic Telephony. By A. B. Smith (formerly Professor of Telephone Engineering, Purdue University) and W. L. Campbell Fellow, A.I.E.E. London: Hill Publishing Co., Ltd. Price 17s. net.

It is not so very long ago since one of our enterprising London dailies asserted with a characteristic tone of finality that automatic telephony was merely an inventor's dream. If any refutation were needed, it is to be found in the comprehensive work before us. Automatic telephony has come, and one has but to glance through these pages to appreciate what has been done in the process of realising this "inventor's dream" and bringing it within the actualities of everyday life.

A considerable amount of literature in the form of contributions to current technical journals and papers read before various societies has appeared on the subject of automatic and semi-automatic telephony, but this work may fairly be regarded as the first exhaustive treatise on these subjects which has yet appeared.

The authors do not attempt to deal with all the various systems in operation, but confine themselves to those types which will prove most important and instructive, although when dealing with long-distance line equipment, central-office design, and development and traffic studies they follow exclusively the practice of the Automatic Electric Co.

The sixteen chapters into which the work is divided deal with trunking, switchboard appliances, subscribers' equipment, the automatic systems of the Automatic Telephone Co Siemens & Halske, and Lorimer, traffic distributor equipment, the Clement auto manual, Western Electric automati and semi-automatic systems. The concluding chapters ar devoted to long-distance suburban and rural line equipment, power plant and testing equipment, etc., and include some interesting considerations on development studies, office location, ultimate capacities, annual charges, and operating costs, maintenance, etc.

The description of the Siemens-Halske traffic distributor equipment is taken from a paper delivered by the Engineer-in-Chief to the British Post Office before the Institution of Electrical Engineers, and will doubtless be familiar to man of our readers. Considerable space is given to Clement's semi-automatic system, which, in its present form, and under certain conditions, is a serious rival of the full automatic; and it may be remembered that a number of years ago Mr. Clement predicted that the exchange of the future would be the semi-automatic. Whether Mr. Clement's forecast will eventually prove to have been correct time alone can tell; but there are many to-day who are in agreement with him.

The reader will find no unessential or obsolete matter in this work. The descriptions of systems and apparatus are illustrated throughout with excellent diagrams and reproductions of photographs, which are of great service in enabling one to follow the context.

The authors are to be congratulated on the production of the first comprehensive manual on the subject of automatic and auto-manual telephone.—A.F.

Motor Cycles: A Practical Handbook on their Building, Care, and Management. With special chapters on Ignition. Edited by Bernard E. Jones, Editor of *Work*. London: Cassell & Co., Ltd. Price 1s. net.

The handbook now before us would seem to be the joint product of a number of writers, who all appear to be thoroughly conversant with the sections of the general subject they handle. Whether, however, a good deal of the matter included in the pages will appeal to motor-cyclists is another question, which we cannot altogether answer in the affirmative. For instance, although we have no fault to find with the text, in view of the fact that, as is stated in the book itself, practically all modern motor-cycles are fitted with the high-tension type of magneto for ignition purposes, it seems unnecessary to devote over a fifth of the work to an elaborate disquisition on the now superseded types of accumulator-coil and low-tension magneto forms of ignition. There are also two long chapters which, while interesting and instructive in themselves, will, we fear, appeal to but a limited circle of amateur mechanics. We refer to those entitled "Making a Two-stroke Engine" and "Building a Light Frame and Completing the Machine."

Apart from these subjects, however, there is a good deal of useful matter in the book. The first four chapters, for instance, deal respectively with "How the Engine Works," "The Elements of a Motor Cycle," "Carburettors and Carburation," and "Locating Engine Faults," the different subjects being not only treated in an exhaustive manner but elucidated by clear illustrations. The first chapter should be especially useful to novices, as it deals very thoroughly with the principle of working of internal-combustion engines of both the four and two-cycle type, the latter of which has in recent times made great strides as regards its adoption for motor-cycle propulsion.—C.J.W.

Dynamometers. By Frederick John Jervis-Smith. Edited and amplified by Charles Vernon Boys. London: Constable & Co., Ltd. Price 14s. net.

Than the late Rev. Frederick John Jervis-Smith, M.A., F.R.S., there was no man more competent to present to engineers an authoritative volume relating to dynamometers, a subject which Jervis-Smith had made peculiarly his own. Though trained for the Church, the author of the work under review had immense mechanical aptitude, and soon after he took charge—in 1886—of the Millard Engineering Laboratory attached to Trinity College, Oxford, he did work on the measurement of the torsion of rotating shafts which is the basis of the means now adopted on large turbine steamships for measuring the power transmitted by the turbines. We are reminded of this fact, and also of his interest in telephonic matters, in an excellent obituary notice which the editor of the volume, Mr. Charles Vernon Boys, F.R.S., has included in Jervis-Smith's monumental work. In his introductory chapter the author emphasises the importance of dynamometric methods, and quotes John Penn's dictum of 1858: "There could not be too many dynamometers," which is peculiarly true to-day, when the need for exactitude in machine construction and power measurement is greater than ever. As the author says, "the dynamometric test either of a prime mover, such as a steam or gas engine, or of a driven machine, such as a dynamo or spinning loom, should form a definite part of the workshop procedure of the mechanical and the electrical engineer, since such tests would definitely show progress or the reverse in the machine produced in the works."

The three classes into which dynamometers may be divided—the gravity, the frictional, and the transmission forms—are considered in order by the author, and well-known types, such, for example, as those by Brotherhood, Morin, Heenan and Froude, Morris and Lister, and Watson, are described with the help of illustrations, in which the volume is unusually rich, Jervis-Smith's own machines, of course, not being omitted. The chapter dealing with dynamometric tests of motor-car engines and high-speed internal-combustion engines, and the peculiar difficulties—*e.g.*, the necessity for flexible couplings—which are introduced by the testing of such engines, is not the least interesting and valuable section of a book which the editor has succeeded in bringing right up-to-date, and on which he is deserving of the congratulations as well as the thanks of all engineers engaged on testing work.

NOTES.

The "Electrical Review" Telephone Number.—We shall be obliged if our readers will kindly take note that the number of our telephone for the Editorial Department is unaltered, but for Advertisement and other business communications the number has now been changed from Holborn 933 to **City 997.**

Field Telephones.—Before the Royal Society of Arts on July 28th, Mr. Chas. R. Darling delivered a special war lecture, with experimental illustrations, on "Field Telephones." The speaker dealt with the duties of the field telephonist, and with the components and operation of field telephones as now used in the British Army. The Japanese were the first to make extensive use of the telephone in large scale warfare, and, during the past year of trench warfare, the telephone has proved an indispensable and generally the only practicable means of communication in the fighting zone.

As source of current two small dry cells are invariably employed. These rapidly become exhausted, and the range of voltage for satisfactory communication is only from 1·5 to 1·3 volts per cell. A high-pitched buzzer is used for calling purposes and also for telegraphic communication by Morse code. Speech transmission is rarely practicable near the firing line. To save weight and space the induction coil and buzzer may be combined in a single apparatus, and the latest Service buzzer, the D-Mark III, with bipolar, double-wound magnets and a double-ended reed oscillating about its centre, gives a remarkably pure and even note, considerably better than that given by older patterns of buzzer with reeds vibrating about one end. Watch pattern receivers and carbon granule microphones are invariably employed. With a head receiver strapped in position, a sleeping operator is awakened with certainty by the calling buzzer. Earth return is always employed, and since the receiver cord forms part of the line circuit, there is special advantage in using two receivers in parallel, apart from the possibility of two persons then listening at once to important messages. The standard D-Mark III field set, complete with leather case, weighs just over 8 lb. Certain privately-manufactured sets, which are now being used in addition to the Service equipment, are a little lighter, but have not the special Mark III buzzer.

For quite temporary communication, the Japanese practice of using single iron wire lines varnished for insulation, is generally followed. Such wire is not worth picking up again. More permanent installations demand the use of stranded steel wire with weatherproof insulation; copper is never used, chiefly on account of the ease with which it is broken. To prevent frequent interruption of service by spies cutting wires or by shell splinters breaking the lines, an irregularly-constructed "ladder" line is often used, this consisting of two main lines interconnected by as many "rungs" as possible. Many branches in the network thus formed may be broken before through communication is interrupted, but it is not always easy to make the numerous joints required when laying the line, and earth faults at breaks may place the line out of service in wet localities before through connection is broken. An alternative is to provide multiple conductors brought into one or more intermediate "dug-outs," but not interconnected by rungs. Operators in the intermediate dug-outs test the lines at frequent intervals and make cross-connections as required to replace a broken section of one line by the corresponding section of one of the other lines available. A broken line being thus disconnected, gives no trouble by earth faults.

In conclusion, Mr. Darling pointed out that drill, discipline and bravery were not sufficient to make a useful telephonist. Knowledge of the construction and methods of working and repairing his instruments was essential, and the speaker suggested that teachers from polytechnics and secondary schools, now on vacation, should offer their services to train field telephonists. If electricity and physics teachers would do this, substantial units of trained telephonists could quickly be formed in every district, and though his suggestion in this respect was not in any way "inspired," he hoped some definite arrangement might be made to apply the voluntary effort of technically trained civilians to this most important military need.

Foreign Trade.—The July Figures.—The following are the electrical and machinery figures given in the official returns for July:—

	Month of July. £	*Inc. or dec.* £	*Seven months, 1915.* £	*Inc. or dec.* £
Imports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	98 248	− 41,098	553,456	− 390,535
Machinery ...	896,510	+ 263,578	5,273,900	+ 496,624
Exports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	262,051	+ 92,534	1 749,049	− 309,765
Machinery ...	1,715 229	−1,589,659	11,515,970	−11,258,473

The Electric Vehicle Association of America.—The annual meeting of the Association is to be held in Cleveland, O., in October next. The Association now embraces 16 local sections, and has an individual membership of 1,058, the 1,000 mark having been passed in June last.

New Inventions Board.—The Minister of Munitions has constituted a Munitions Inventions Branch of the Ministry, and has appointed as Comptroller Mr. E. W. Moir, M.Inst.C.E.

The branch, which for the present is located in Armament Buildings, Whitehall Place, will have the duty of considering projects for inventions relating to munitions for warfare on land, or matters appertaining thereto.

The Comptroller and staff of the branch will be assisted in their work of examination, and, if thought necessary, in the investigation and development of any projects that may be considered worthy of being developed, by a panel of honorary scientific and other experts. Amongst those who have accepted Mr. Lloyd George's invitation to act on this panel are :—

Mr. W. Duddell, Dr. S. Z. de Ferranti, Dr. Glazebrook, Sir Robert Hadfield, Sir Alexander Kennedy, Mr. F. W. Lanchester, Mr. Michael Longridge, Mr. W. H. Maw, Sir Hiram Maxim, Sir Henry Norman, Mr. F. G. Ogilvie, Mr. James Swinburne, Sir J. J. Thomson, and Mr. A. J. Walter, K.C.

All communications should be addressed to the Comptroller at the above address.

Institution and Lecture Notes.—Institute of Metals.—The following are amongst the papers to be submitted at the meeting of the Institute of Metals on September 17th :—"The Corrosion of Gun-Metal," by Dr. C. H. Desch ; "A Thermostat for Moderate and High Temperatures," by Messrs. J. L. Haughton and D. Hanson ; (*a*) "Structural Changes in Industrial Brasses," (*b*) "Hardness of Copper-Zinc Alloys," by Dr. D. Meneghini ; "Specifications for Alloys for High-Speed Superheat Steam Turbine Blading," by Mr. W. B. Parker ; "Detection of Internal Blow-holes in Metal Castings by Means of X-Rays," by Mr. C. H. Tonamy. Further particulars can be obtained from Mr. G. Shaw-Scott, Secretary, Caxton House, S.W.

British Association.—Amongst the papers to be read at the meeting on September 7th-11th, at Manchester, are the following :—"Thermal Efficiency of a Gas Engine," by Professors Asakawa and Petavel ; "Apparent Specific Heats in Gaseous Explosions," by Prof. W. M. Thornton ; "Gas-Producer for Steam Boilers," by Mr. E. C. Mills ; "Thermal Conductivity of thin Air Films," by Mr. A. A. Griffith ; "Electric Oscillations in Coupled Circuits," by Dr. Eccles and Mr. A. J. Makower ; "Capacity of Aerials," by Prof. G. W. O. Howe ; and "Eddy-Current Losses in End-Plates of Turbo-Generators," by Prof. Miles Walker.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—Headquarters—Marconi House, Strand, London, W.C.

Company Orders.—By Lieut.-Colonel C. B. Clay, V.D., Commandant, for week ending August 21st, 1915.

Monday, Wednesday and Friday.—Drills, 6.30 and 7.30 p.m.

All applications for enrolment should be sent to the Commandant, Marconi House, Strand, from whom all particulars can be obtained.

E. G. FLEMING,
Company Commander and Acting Adjutant.

The General Committee of this Corps includes the names of many of the prominent members of the three principal branches of Engineering, and among them we note the Presidents and also the Secretaries of the Institutions of Civil, Mechanical and Electrical Engineers. The Corps has not only the hearty support of the heads of the engineering profession, but is warmly supported by General Sir O'Moore Creagh, V.C., the General advising the Central Association V.T.C.

To enlarge the usefulness of the Corps further recruits can be accepted either from among the membership of the Institutions, or from others who are willing to be trained in fortress engineering work under the Staff of the London Electrical Engineers (T.F.), at their Headquarters in Westminster.

3RD BATTN. (OLD BOYS') CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, August 11th, 1915 :—

Week-end Parades.—Saturday.—The Battalion will parade as strong as possible at Cumberland Gate, Regent's Park, 2 30 p.m., on Saturday next, the 14th inst., and proceed by march route to Wembley, *viâ* Gladstone Park. Dress : Full parade kit with rucksacks.

Sunday, 7 a.m., Reveille ; 10 a.m., Church Parade ; 10.20 a.m., Parade under Company Commanders ; 2.15 p.m., Battalion Parade.

Musketry.—Acton Range will be open for those who have not yet qualified, as follows :—Tuesdays, 2.30 p.m., "B" and "D" Companies ; Thursdays, 2.30 p.m., "A" and "C" Companies ; Saturday, voluntary. First 21 men sending in their names to Headquarters not later than Friday, 6 p.m.

Bisley Range.—On Saturdays, as usual, for men who have qualified at Acton, and not yet shot at Bisley, 12.45 p.m., at No. 9 Barrier, Waterloo, under Sergt. Cotter and Corp. Crabbe. Names to be in at Headquarters by Fridays mid-day.

A. G. JOINER, *Captain and Adjutant.*

Lieut. Greely and His Patent Insulator.—A good story is told of the experiences of the late General A. W. Greely, at one time chief of the Signal Corps, U.S.A., with a patent telegraph insulator.

Lieut. Greely—he was a plain lieutenant then—went to Texas in November, 1875, to build a telegraph line to San Antonio from Fort Brown. He had an insulator which he and other experts had gotten up in Washington especially for this line. It consisted of a well-lacquered sheet-iron cap over a dry wood screw and had the general appearance of a tomato can on the end of a broomstick, when in position.

The line was built 400 miles and for two weeks or a month it worked like a dream. Suddenly warm weather set in, and when warm weather strikes lower Rio Grande it takes hold for keeps. The thermometer crawled up to 100, and after several weeks of this spell the line began to get mysterious kinks in it. There was trouble somewhere and plenty of it. The line was not down, but it seemed to have its grip on all through messages. San Antonio had to do all its business with Fort Brown by relaying at Laredo. In a few days Laredo could only telegraph as far as Ringgold Barracks, south, or to Fort Clark, north, and through messages from San Antonio to Fort Brown had to stop off three times *en route* and take a rest. At the end of the week the trouble was worse, yet Lieut. Greely sent couriers galloping down the whole circuit. They could not find a place where the wire was down or in contact with trees or with anything else, but they reported something queer with the "insulators." Lieut. Greely was wild with indignant surprise. The idea of an insulator going wrong which had been concocted in Washington especially for Texas. Still the telegraph line was not working any better as a telegraph line than as a fish line or a clothes line, so he borrowed a mule from a quartermaster and started out to investigate. He came back in light marching order that evening with a sad secret in his heart, several lumps on his countenance and minus the wayward army mule.

The simple truth was that the Texas hornets, which are lazy beasts, thought the new insulators were a shelter kindly provided by the Government for their special use and had gone to work and filled every blessed one of them from San Antonio down with mud, sour honey and general cussedness and the line was literally 400 miles of Hades in active eruption. Lieut. Greely wrote to Washington experts, who promptly got a new breed of insulators, solid as a brick and burglar proof. They were shipped and Lieut. Greely induced a gang of unsuspecting linemen to sign a cast-iron contract to take the old insulators off. The "repairing" party left Fort Brown on April 10th. By this time the hornets had raised an uproarious family in each insulator and the first lineman who shinned up to serve the writ of ejectment got a dose of trouble that made his hair curl, and in his haste down let the pole slip up through his hands, burning them, besides taking all the buttons off his clothes. The way the hornets expressed their opinion of signal service hospitality was sinful. It cost the contractor 46 able-bodied men, 19 barrels of bread poultice and a cask of refined arnica to "repair" the first eight miles, and operations ceased. When the linemen got so they could see well enough out of one eye to shoot, they went gunning for Lieut. Greely, but he had already fled the State in a blue fog, and the next that was heard of him he had barricaded himself somewhere in the neighbourhood of the North Pole. The line remained in an active and warlike status until winter and the telegrams were forwarded by the aid of a slow but persevering mule. After the first blizzard had calmed the hornet families into solid lumps, the contractor resumed his labours and recouped his loss by shipping the insulators to Baltimore for canning clams, and seven dozen crates of assorted stings to England for sale as sewing machine needles.—*Telegraph and Telephone Age.*

Fatalities.—George Fernie, a young electrical engineer, was killed almost instantaneously in the new pit at Kinglassie Colliery, Fife, through coming into contact with a live wire.

Archibald Hemingway, 39, a car cleaner in a Halifax tramway shed, was cleaning the top of a double-decked car when another cleaner heard a scream and saw Hemingway lying on his side in a state of collapse. He died shortly afterwards. It is thought that the insulation of the electrical equipment of the car was damaged in the storm the previous day, and that Hemingway touched a live part.

Appointments Vacant.—Three shift engineers (£104) and switchman (37s. 6d.), for Birmingham electric supply department. Particulars are given in our advertisement pages.

Educational Notes.—UNIVERSITY OF EDINBURGH.—The preliminary or entrance examinations in the Engineering Department will be held in September for the new session, which opens on October 12th.

NORTHAMPTON POLYTECHNIC INSTITUTE.—The Engineering Day College entrance examinations in Civil, Mechanical, and Electrical Engineering will be held on September 28th and 29th. Day Courses commence October 4th. Particulars are given in our advertisement pages.

Smoke Abatement.—The proposed Smoke Abatement Exhibition to be held at Glasgow has been postponed, at the request of the Board of Trade Armaments Committee, as manufacturers at present employed in the manufacture of munitions who might exhibit require all their time and attention for the output of Government work.

Capturing Foreign Trade.—The following letter, signed "W. G. S.," appeared recently in the *Journal of the British Chamber of Commerce for Italy* (*Inc*):—"Will you allow me to point out how our foreign trade is handicapped? I am a commercial traveller representing a British house on the Continent of Europe. Fortunately for me, my firm has adopted the metric system, otherwise business would be impossible. There are, however, thousands of British manufacturers who could get a footing in Continental markets, but who fail to do so, not through any fault in their products, not even because their prices may happen to be high, but solely because they refuse to quote and invoice in decimal coinage and in metric weights and measures.

"Time after time have customers shown me offers received from British firms, the same being made out in £ s. d., cwt., qr., lb., ft., in., &c. What we have to realise is that such offers are largely meaningless to the Continental buyer, and that if we wish him to purchase our goods we must at least make ourselves intelligible to him.

"Naturally, great waste and inconvenience are caused in having to convert from one system to the other. Why, then, cannot we as a nation boldly adopt the international standards, and so facilitate our trade with other countries?

"The metric system is now taught in our elementary schools. It is so simple that it can be mastered in a few minutes. It is conducive to accuracy and rapid reckoning. Being a time-saver, it lowers the cost of production. We wish to extend our foreign trade. Then why handicap ourselves by retaining methods which our competitors have discarded as obsolete?"

New Battery Signalling Bell.—At a meeting of the North of England Institute of Mining and Mechanical Engineers at Newcastle-on-Tyne, on the 7th inst., Dr. W. M. Thornton read a paper on "A New Battery Signalling Bell." He spoke at some length on the igniting power of an electric break-spark, and in demonstration caused a considerable explosion, which left no sign upon the bell apparatus. The new device, which could be fitted to any existing bell, was a small attachment by means of which the spark at the trembler contact was prevented, the current which caused the spark being diverted through a by-pass. So long as the device was in normal action ignition could not occur. In a letter, Mr. H. R. Kempe (late of the G.P.O.) expressed the opinion that the use of the device should be made compulsory, while Dr. Wheeler, of the Home Office, wrote that he had tested the new bell, and could testify to its efficiency.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Salford Electricity Committee has granted permission for the borough electrical engineer to act on the Sub-Committee of the Manchester Munitions Committee, with respect to the appointment of inspectors for the inspection of war materials.

The Ilkley District Council has approved the appointment of Mr. S. H. Bill as electrical engineer and manager as from August 1st, at an annual salary of £250. Mr. Bill received his early training at Birmingham University and with the Westinghouse Co., including six months in America. Afterwards he visited South Africa, and upon his return was appointed chief electrical engineer to the Mersey Dock Board; he was later chief engineer of a large brewery in Birmingham, but resigned this post to take the position of clerk of works in succession to Lieut. Wilkinson, of Harrogate, who is now a prisoner of war in Germany. Mr. Bill was granted a commission in the Army Service Corps at the outbreak of war—he having already resigned his position with the Birmingham brewery to take up a position in Germany, which he had to relinquish owing to the war—and was engaged in commandeering motor vehicles for the service. His commission was, however, later cancelled on account of an old bullet wound.

The Kingston-on-Thames T.C. has increased the salary of Mr. Kingham, chief assistant at the electricity works, to £3 per week, with an advance to £3 10s. in November next, and to £4, a year later.

Mr. W. E. Claret, station superintendent at the Maidenhead Corporation electricity works, has accepted the appointment of chief electrical and mechanical engineer to the British Xylonite Co., Ltd. He is succeeded by Mr. W. Leighton Chubb, of Stafford. Mr. H. D. Gamble, of the electricity staff, has also resigned.

Mr. David Dunn, of the Kilmarnock electrical and tramway department, who has received an appointment in London, has been presented with a suit case, and an umbrella for Mrs. Dunn. Mr. Dunn was formerly with Messrs. Siemens Bros. and the Silvertown Co., and for six years had charge of the electric power plant at Messrs. Andrew Barclay's works.

We are informed that an error occurred in the paragraph in our last issue, which stated that Mr. R. H. Fox had been appointed chief electrical engineer at Musselburgh; Mr. Fox has been appointed chief assistant engineer, and his salary is not as stated.

Mr. R. H. Parsons, superintendent of the municipal power plant at Edmonton, Alta., has tendered his resignation to the Commissioners, and has returned to Manchester, England, where he is now connected with a large factory engaged in the manufacture of munitions of war. Mr. C. E. Cope, chief engineer of the plant, has been recommended to succeed Mr. Parsons.

Tramway Officials.—Another Blackburn soldier has been commended for gallantry in the field, the honour falling to Private F. Gertson, who was formerly employed in Blackburn Corporation tramway department.

The marriage took place at Oxton, on July 31st, of Lieutenant Samuel Wilfrid Carty, of the Army Service Corps (Mechanical Transport), who was chief of the overhead line department of the Birkenhead Corporation Tramways, and Miss Maud Eleanor Hedley daughter of the late Mr. Matthew Hedley, Chief Inspector, Department of Agriculture for Ireland.

Mr. C. R. Everson has been appointed manager of the Plymouth Corporation Tramways for a period of three years, at £450 per annum, with house.

General.—The marriage took place last week at Hallgarth Church, of Mr. J. Craggs, electrician at Horden Colliery, and Miss Edith Thompson, daughter of Mr. John Thompson, Sherburn Hill (Co. Durham).

Second-Lieut. Arthur R. Croker, who was on the staff of the British Insulated and Helsby Cables, Ltd., of Prescot, has been gazetted temporary Lieutenant in the Second Field Company, Home Counties' Divisional Engineers.

Lance-Corporal P. V. Stent, of the Fifth Service Battalion, Oxford and Bucks Light Infantry, who was on the staff of Messrs. Willans & Robinson, has been awarded the D.C.M. for service in France.

On the occasion of his marriage to Miss Nellie Howard Halford, elder daughter of Mr. John Halford, of Rugby, Mr. John P. Thompson, son of Councillor J. Thompson, J.P., of Stanhope (Co. Durham), has been presented with a marble clock by the staff of the Loughborough Electrical Engineering Co.

In the list of aliens to whom certificates of naturalisation were granted during July the following appear:—

Christian Fredrik Barnholdt (Sweden), electrical engineer, residing at Preston.

Frederick William Becker (Germany), telegraph engineer, residing at New Barnet.

Mr. A. S. Brodie, contract manager for the Post Office telephones at Blackburn, is about to leave to take up a similar appointment at Aberdeen, and it is understood that the Blackburn vacancy is to be filled by the transfer of Mr. Shears, who is at present contract manager at Chester.

Lance-Corpl. Wm. Stenton, 8th Batt. Manchester Regiment, who has just been awarded the D.C.M., was till recently employed at the British Westinghouse Co.'s works.

Mr. V. A. F. Bellamy, second assistant engineer of the Manx Electric Railway Co., has been appointed assistant outside supervisor to Messrs. J. B. Saunders & Co., of London.

Mr. D. H. Slack, of the firm of Messrs. Bauer, Imrie & Slack, chartered patent agents, has been promoted to the rank of Captain in the Kent Fortress R.E. (Lights Companies).

Roll of Honour.—Rifleman Henry Oakwell Wood, of the Rifle Brigade, who was on the staff of the Kingston-on-Thames Corporation electricity department, has been killed in action in France.

Private Robert Dennis, of the 7th Battalion Lincs. Regt., who was with the Urban Electricity Co., at Stamford, has been killed in action. He joined the regiment last August, although in his 50th year, and went to the Front a month ago. With the 2nd Lincoln Regt. he went through the Boer War.

Private A. H. Day, of the 7th West Yorkshire Regiment, who was on the electricity staff at Leeds of the Great Northern Railway Co., has died from wounds received in action.

Sergeant Geo. Wm. Jackson, D.C.M., of the Coldstream Guards, who has been killed in action in France, served his apprenticeship with Messrs. Siemens Bros. at Stafford. He joined the Guards last September, and went to France in December.

Lieut. H. L. Downes, of Messrs. Downes & Davies, electrical supply agents, of Stanley Street, Liverpool, is reported as "believed to be killed" in action in France. Lieut. Downes was last seen during a bombardment of the trenches, getting bombs through to the front. He was in the Irish Battalion of the King's Liverpool Regiment, and went to France in April.

Obituary.—The death recently occurred of Mr. Ernest J. Mayne, late of the electricity supply department, Dublin.

Will.—The estate of the late Mr. C. E. P. Spagnoletti, of Frognal Lane, Hampstead, late chief electrical engineer to the Great Western Railway Co., has been proved at £35,070.

NEW COMPANIES REGISTERED.

Snyder Electric Furnace Co., Ltd. (141,210).—This company was registered on August 6th, with a capital of £1,000 in £1 shares, to acquire and turn to account any inventions relating to the manufacture of iron, steel, metals and chemicals of all kinds, to carry on the business of electrical, mechanical and general engineers, founders, machinists, tool makers, chemical manufacturers, etc. The subscribers (with one share each) are: G. J. Stock, The Villas, Middleton St. George, Darlington, analytical chemist; C. J. H. Stock, 34, Swinburne Road, Darlington, analytical chemist. Private company. The number of directors is not to be less than three or more than seven; the first are G. J. Stock, C. J. H. Stock, G. H. Watson, and F. T. Snyder. Qualification, £1. Solicitors: Watson & Watson, Darlington. Registered by Jordan & Sons, Ltd., 116-7, Chancery Lane, W.C.

Accumulators, Ltd. (141,197).—This company was registered on August 6th, with a capital of £100 in £1 shares, to carry on any business bearing on the application or employment of electricity, electrical batteries and accumulators, and the business of engineers, machinists, etc. The subscribers (with one share each) are: W. J. Matthews, 69, Freegrove Road, W., accountant; H. Fulton, 1, Lawrence Pountney Hill, E.C., solicitor. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first directors. Qualification, one share. Registered office: Maybury Hill, Woking.

Irish Hydro-Electric Syndicate, Ltd. (141,203).—This company was registered on August 6th, with a capital of £10,500 in 10,000 ord. shares of £1 each and 10,000 shares of 1s. each, to acquire water and other power, and rights and concessions in respect of the use of waterfalls, rivers and waterways for the generating of power, and any other properties and hereditaments, to carry on the business of suppliers of power by water and electricity, etc. The subscribers (with one share each) are: E. J. Hayman, 18, St. Swithin's Lane, E.C., secretary; W. Pocock, 11, Bowen Road, Harrow, clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by Ingle, Holmes Sons & Pott, Capel House, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Simmonds Brothers, Ltd.—Charge (supplemental to various agreements) on moneys payable under army contracts, dated July 22nd, 1915, to secure all moneys due or to become due from company to Parrs Bank, Ltd.

Colley's Patents, Ltd.—Particulars of £6,000 debentures, created by resolutions of January 2nd, 1906, March 14th, 1907, and July 8th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £3,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Carville Site and Power Co., Ltd.—Issue on July 28th, 1915, of £10,000 debentures, part of a series of which particulars have already been filed.

La Plata Electric Tramways Co., Ltd. (101,431).—Capital, £450,000 in 200,000 pref. and 250,000 ord. shares of £1 each. Return dated May 11th, 1915. All shares taken up; £170,007 paid on 170,007 pref.; £279,993 considered as paid on 29,993 pref. and 250,000 ord. Mortgages and charges: £100,000.

Nairobi Electric Power and Lighting Co., Ltd.—Issue on July 26th, 1915, of £1,000 debentures, part of a series of which particulars have already been filed.

Hart Accumulator Co., Ltd.—Charge on 35 and 10, Marshgate Lane, Stratford, dated July 27th, 1915, to secure all moneys due or to become due from the London County and Westminster Bank, Ltd., Lothbury, E.C.

Pritchett and Gold and Electrical Power Storage Co., Ltd.—Deposit on July 29th, 1915, of deeds of freehold land and buildings at Highfields, Feltham, dated July 29th, 1915, to secure all moneys due or to become due from company to Barclay & Co., Ltd., 95, Victoria Street, Westminster. Stamped to cover £4,000.

CITY NOTES.

Tyneside Tramways and Tramroads Co.

The directors' report for the half-year ending June 30th, 1915, shows a surplus of receipts over expenses of £5,411, which, with the balance brought forward from last half-year of £732, makes a total to the credit of profit and loss account of £6,143, and after deducting interest on debentures, loans, etc., amounting to £1,012, there remains an available balance of £5,131. This profit the directors propose to appropriate as follows:—Dividend on preference shares at the rate of 5 per cent. per annum (less income tax), £601; dividend on ordinary shares at the rate of 3 per cent. per annum (less income tax), £2,008; reserve for renewals, depreciation, and other contingencies, £1,200 (this, with £303 interest on investments, will increase the fund to £20,666); reduction of registration and formation expenses, etc., £330, leaving to be carried forward to next half-year £991. The traffic receipts show a decrease of £422, as compared with the corresponding period of last year. The shareholders are asked to sanction the contribution by the company to charitable purposes in connection with the war of a sum not exceeding £200 during the half-year ending December 31st, 1915.

The half-yearly meeting of the company was held at Newcastle-on-Tyne on the 10th instant, Dr. J. T. Merz (the Chairman) presiding. In moving the adoption of the report, the Chairman said the revenue had been £400 less than in the corresponding half-year, and the profits had been almost exactly the same as last half-year. A very large item in the receipts in the first half of the year was usually the holiday traffic; this traffic, owing to the races at Gosforth Park not having been held this year, had been very much less. They had lost in that way, compared with the corresponding half-year, £1,457, but on the other side they had made up about £1,000 on the ordinary traffic, owing to the increased workmen's traffic. They had been obliged to run fewer cars owing to the reduced staff. The receipts per car mile had gone up from 10.48d. last year to 11.06d., and the expenses had gone up from 6.58d. to 7.15d. The expenses had been the same for the half-year as in the corresponding six months, although wages had gone up. Their men had been very loyal, and had worked considerable overtime. The dividend they proposed was the same as last year. The reserve fund amounted to £20,666. They had invested £20,306, but as against that they had a debt to the bank of £4,000. They had exercised the option of converting Consols into War Loan, and they would hold over £9,000 in the Loan, which would be nearly half of their reserve fund. This would mean an increase of £23 in their income. They had insured against aircraft and bombardment for £20,000, and that would cost about £86. The traffic receipts were still going up.

Mr. George E. Henderson seconded the adoption of the report, which was carried.

A letter was read from two shareholders protesting against the proposal to devote £200 to charitable purposes. It was stated that a similar sum was given last half-year.

The Chairman explained that they had only spent £132 of the sum last voted, of which £98 was paid to the dependents of men who had enlisted, so that only £34 was spent on charitable contributions, which was equal to the amount that the employés had spent.

The meeting agreed to the proposed contribution.

French Electrical Companies.

The extracts published a few weeks ago from the annual reports of various French supply companies showed, in general, that they have suffered from the effects of the war, whilst in the case of the Parisian companies in particular a further disadvantage was experienced by the transfer of their undertakings within the municipal area of the city to the Compagnie Parisienne de Distribution d'Electricité at the beginning of 1914. The unfavourable results find fresh confirmation in the following list of other companies engaged both in the supply business and transport services:—

The *Compagnie Générale de Distribution d'Energie Electrique* records net profits of £28,000 for 1914 on an ordinary share capital of £640,000, this sum comparing with £50,900 in 1913. No dividend is in contemplation, whereas £1 per share was distributed in the previous year.

The *Société Lyonnaise des Forces Motrices du Rhône* earned net profits of £97,000 in 1914 on a share capital of £1,200,000. The sum of £41,000 has been allocated to an experiment account, and the balance allows of the distribution of 12s. 7d. per ordinary share, as contrasted with 18s. 9d. in 1913, but the holders of deferred shares, who received 19s. 7d. in 1913, have been passed over for 1914.

The *Compagnie des Tramways de Paris et du Departement de la Seine*, which has an ordinary share capital of £2,200,000, realised net profits of £70,000 in 1914, as contrasted with £87,000 in the preceding year. Notwithstanding the decrease, the dividend remains at 8s. per share, as in 1913. As fresh capital is needed, and the issue of a definite loan appears to be doubtful of success for the present, it is intended to raise the money by the offer of short-term bonds for £500,000.

The *Compagnie Générale des Omnibus de Paris*, which not only monopolises the motor omnibus services, but also the principal tramways in the central parts of the city, reports that the conversion of the lines to electric traction was completed in 1914. After the motor 'buses were requisitioned by the military authorities the receipts were solely derived from the tramway traffic, the compensation paid for the vehicles being £893,000, which is said to represent an appreciable loss to the company. The net profits have permitted of the payment of a dividend of 16s. per share on the capital of £3,320,000, the loan capital amounting to £4,000,000.

The *Société Le Triphasé* (*Nord Lumière*), which is a subsidiary of the Secteur de la Place Clichy, experienced a heavy decline in the net profits in 1914 in consequence of the dearness of coal and the great diminution in the consumption to 63 per cent. of the former average consumption. As a result, the net profits receded from £143,000 in 1913 to £8,000 last year, and the dividend from 29s. 3d. per share to no distribution in the two years respectively. The ordinary share capital is £607,000, and the loan capital £453,000, of which the sum of £365,000 is invested in other electricity supply undertakings.

The *Société du Secteur de la Place Clichy*, whose supply undertaking was absorbed by the Compagnie Parisienne de Distribution d'Electricité on January 1st, 1914, has since devoted its efforts to the supervision of subsidiary companies, including the Triphasé. The net profits for 1914 are returned at £16,000, as compared with £100,000 in 1913, when a dividend of £5 8s. per share was declared, but no distribution is proposed for last year. The repayment of share capital of £240,000, which was decided upon in July, 1914, has been rendered impossible, as the partial disposal of shares held in the Triphasé has been out of the question under the changed circumstances.

The report of the *Société d'Eclairage et Force par l'Electricité*, which was formerly known as the Secteur Rothschild, discusses the unsound rivalry which prevailed among the different lighting companies in connection with competitions for concessions, and mentions that the concession for the district of St. Denis has been transferred to the Compagnie Parisienne de Distribution. At present the Société d'Eclairage only carries on, or is interested in, suburban and provincial concessions, and under the altered conditions the gross profits declined from £166,000 in 1913 to £34,000 last year, and the net profits from £38,000 to £22,000 in the two years respectively. It is, however, not intended to pay any dividend.

Victoria Falls and Transvaal Power Co., Ltd.

The report for the year ended December 31st, 1914, states that the issued share capital amounted to £3,000,000 and the debenture capital to £4,543,920, £82,580 of the 5½ per cent. second mortgage debentures having been purchased during 1914, towards the amounts falling due for redemption in January, 1915, and January, 1916, in the terms of the trust deed. The year's business has resulted in a profit of £555,694, which, with the £105,199 at the credit of the profit and loss account as at December 31st, 1913, remaining after payment of the dividend on June 17th, 1914, makes a gross total of £660,893. After providing for interest on debentures for the year 1914, amounting to £234,843, and for depreciation, income tax, etc., amounting to £159,603, the balance remaining is £266,447, in respect of which a dividend was declared on December 17th last, at the rate of 6 per cent. per annum, less income-tax, for the six months ended June 30th, 1913, on the preference shares, and a further dividend on the preference shares also at the rate of 6 per cent. per annum, less income-tax, for the ten months ended April 30th, 1914, was declared on June 10th, 1915. These dividends were paid on January 6th, 1915, and June 21st, 1915, respectively, and absorbed £160,000, leaving £106,417 to be carried forward. Since the last report three 10,000-H.P. compressors have been brought into commission, together with the necessary boiler plant, etc., and considerable extensions to the air pipe system of the Rand Mines Power Supply Co., Ltd., have been made and put to work. At the Brakpan power station 33,500 H.P. of electrical plant has been added and half of this is now in commission. The combined companies have now an ample reserve of air and electrical plant installed at their several stations. The judgment which was given against the company in the action by the Consolidated Langlaagte Mines, Ltd., was reduced by the Appeal Court from £29,000 to £19,000.

The directors record the death of Mr. R. G. Fricker, and the vacancy on the board has been filled by the appointment of Lord Brabourne as a director. Mr. H. L. Cripps retires in accordance with the Articles, but on account of ill-health his name is not submitted for re-election. On the outbreak of war, Mr. Rathenau, being a German subject resident in Germany, ceased to be a director. The Press has since reported the death of this gentleman. Mr. Brakhan resigned his seat on October 15th last. It is not proposed to fill these two vacancies.

Annual meeting: August 20th.

Puebla Tramway, Light and Power Co., Ltd.—According to the *Financial Times*, a meeting of the holders of the first mortgage thirty-year 5 per cent. gold bonds was recently held in London, at which a resolution sanctioning the modification of the rights of the bondholders was unanimously passed by votes representing upwards of two-thirds of the outstanding bonds. The effect of the resolution is to make the interest on the first mortgage bonds during the five years from January 1st, 1915. payable only if and when there are any earnings of the company available for the purpose; to enable the company to satisfy any interest unpaid at the expiration of five years by the issue of 5 per cent. non-cumulative income warrants at par; to suspend the operation of the sinking fund for a period of five years, and to extend the date of maturity of the bonds for five years from 1937 to 1942. The service of the prior lien bonds has been duly met.

L. & N.W. Railway Co.—This company held a special meeting last week, at which authority was given for the issue of new preference stock in place of consolidated stock authorised in 1901, and not now required. The issue is for £1,500,000 10-year redeemable preference stock, which is required for the completion of the Euston and Watford Electric Railway, and for other purposes. The price of issue is 96, and the interest 4½ per cent.

Oldham, Ashton and Hyde Electric Tramways Co., Ltd.—The directors have declared an interim dividend of 5 per cent. per annum on the ordinary shares for the past half-year, payable on the 16th inst.

Chelsea Electricity Supply Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum, less income-tax, on the ordinary shares for the half-year, payable on September 15th.

Northampton Electric Light and Power Co., Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum (6d. per share) on the ordinary shares for the past half-year.

Telephone Development Co., Ltd.—The accounts for the year to June 30th show a surplus of £10,458, which it is proposed to carry forward.

Western Union Telegraph Co.—The report states that for the six months to June 30th the income was $24,019,260; expenses, including maintenance and reserves, $19,359,745; interest on bonds, $668,600; net income, $3,990,915, being an increase of $1,891,080 above the corresponding period of last year.

South Metropolitan Electric Light & Power Co., Ltd.—The transfer books and register of members will be closed from August 18th to 31st, 1915 (both days inclusive), for the preparation of warrants for dividends payable 31st inst. on the 7 per cent. cumulative first preference shares and 6 per cent. cumulative second preference shares.

Brompton and Kensington Electricity Supply Corporation, Ltd.—Interim dividends for the half-year to June 30th—On the ordinary shares at the rate of 9 per cent. per annum (less tax); on the preference shares at the rate of 7 per cent. per annum (less tax).

STOCKS AND SHARES.

TUESDAY EVENING.

An unusual number of interesting incidents have developed this week in the Stock Exchange markets; and although, generally speaking, the volume of business is meagre, in certain sections there has been something approaching activity. This is more particularly the case with the Marconi group; while upon Brazilian Tractions, and various of the companies —Canadian and American—engaged on war work for the Allies, a lot of attention has been focused by reason chiefly of the boom in industrial shares on the other side of the Atlantic.

On this side, we have seen nothing so sensational as that provided by the trans-ocean brigade in Wall Street. The London Stock Exchange does not deal, for instance, in Bethlehem Steel shares, the price of which has risen from 30, some fifteen months ago, to about 300 at the present day. Markets here are unacquainted with Electric Boats—whatever these may be—the price of which gyrates to the tune of 80 points a day, and seems to think nothing of it. Westinghouse issues are known on this side only through the medium of the British Westinghouse capital—the shares and debentures in the local company moving not at all what time their namesakes in America are undergoing all sorts of volatile fluctuations.

The boom over there, however, has certainly been instrumental in waking up the Marconi market, and also in stimulating business in New York Telephone bonds, as well as in a few other specialised departments. The market for the new War Loan has settled down to a steadiness and composure which have an effect in permitting public interest to switch on to other markets. Several of the big Home Railway companies are known to be contemplating fresh issues of capital, following the example of the London & North-Western and, some months ago, of the North-Eastern Railway.

Mexican stocks and shares show a reviving tendency. The Latin-American Conference, held a few days ago in Washington, has been adjourned to New York, where it is to be resumed when the spell of torrid weather is broken. A caustic observer remarked that in dealing with such hot stuff as Mexico, it might have been supposed that the warmer the weather, so much the more appropriate it was. There does seem to be a chance, however, of serious effort being made at last by the United States to explore the possible avenues leading to pacification, although, as we have pointed out previously, such talk in the past has so frequently proved abortive, from the practical point of view, that scepticism may be pardoned for demanding visual proof of good intentions before it invests money in Mexican securities.

At all events, Mexican Light & Power shares are in timid demand at a rise of about 5 points, and the Company's first mortgage bonds, which were marked down to 40, have steadied to their previous quotation of 45. Mexico Trams are better also, and it is possible to sell certain of the issues which for weeks past have been a drug in the market.

The cut in the dividend announced by the Brazilian Traction Co. was followed almost immediately by a vivid rise in the price of the common shares, which carried it to 51 before a slight reaction occurred which took it back to 49½. By odd coincidence, the rise took place on the day following the declaration of the decreased dividend, from which it was inferred that there must have been bears who were only waiting for the news to be announced before they endeavoured to cover their tracks. In this supposition there was a reasonable amount of likelihood; but, as it happened, just about that time the Brazilian Government rather unexpectedly paid off some of its treasury bills, and this evidence of its financial position put fresh heart into the supporters of Brazilian issues in general. The company, as we have shown before, is doing well; and if it were not for the low rate of exchange, the 6 per cent. dividend could have been easily maintained. For the first five months of the company's current year, the aggregate net earnings of 18 million mils. showed an increase of 767,000 mils. above those of the corresponding period in the previous twelvemonth.

Most of the Latin-Canadian Power companies are making good money. The Alabama Traction announced that payment of its bond interest will be resumed next month, and the expansion of earnings is quite satisfactory. The Consolidated Gas, Electric Light & Power Co., of Baltimore, has a useful increase of $136,000 for the eleven months of the company's financial year, the total net earnings being nearly three million dollars. The Pennsylvania Water Co., the Shawinigan and the Mississippi River Power Companies are all doing better than they were a year ago. The market in most of the securities is firm, from the reflection of the strength in the War Specials to which reference has been already made. Business in the United States advances substantially month by month, but there is a good deal of deprecation, even in New York, of the gamble which the speculators have set going in the shares of American-Canadian armament and allied companies.

The most active market of all at the present time, after that in the War Loan, is in Marconis. American Marconis have been varying between a guinea and 17s. 6d., closing this (Tuesday) night at 20s. Each reaction brings in a fresh set of buyers, of whom it is claimed that the majority send orders from the United States. The mere fact of the company not having paid a dividend in respect of the past year carries no weight with the present buyers. Those people who invested their money in American Marconis what time the shares were placed upon the market, must be thanking their lucky stars for the unexpected turn in fortune's wheel, particularly those who made the investment with borrowed money. Canadian Marconis have come into demand at 6s., and Spanish are about the same price. New York Telephone bonds rose a trifle to 96½, and have changed hands as high as 97½.

Beyond this Marconi excitement, there is nothing very cheering about telegraph stocks. The decline in Eastern Telegraphs continues, the ordinary having slipped back to 117. The 4 per cent. debenture stock, however, is a point harder at 81; and Anglo-American deferred recovered the ¼ which it lost last week. United River Plates have receded a little. The Western Telegraphs which have been recently on offer round about 11½ are being steadily absorbed. Electricity Supply shares are mainly firm, the only exception being Metropolitan ordinary, which fell to 2⅞. The reduction in the interim dividends has rendered the market a trifle unsteady as a whole, but there is not a great deal going on.

British Westinghouse preference and debenture have both given way, the latter shedding 2 points to 68. British Insulated ordinary, while nominally 11, could probably be bought in the neighbourhood of 10⅝; half-a-dozen sellers of small lots have appeared in a market unsupported by any buying orders, and those who wish to pick up shares at a low price might easily be able to do so with a bid below the figure quoted.

The Victoria Falls & Transvaal Power Co. has just issued an excellent report, showing an increased profit of £33,000. This enables the company to pay 8 per cent. on its preference shares for the year, which brings the dividend on these up to April 30th, 1914. The substantial sum of £106,000 is carried forward, so it seems obvious enough that it will not be very long before all the arrears are cleared off. The price of the preference is firm at 15s., and the ordinary are quoted at 4s. 6d.

The Adelaide Electric Supply Co. has issued a further letter to the holders of its 5 per cent. debenture stock, and a modification is suggested of the previous proposals—quoted here last week—with reference to the placing of the sinking fund on a 1 per cent. cumulative basis. Instead of this, it is now proposed to substitute 3 per cent. for 1 per cent., and the directors calculate that this would have the effect of redeeming the whole of the issue in 20¼ years, that is, slightly earlier than the due date of 1936. The root of the objection to the scheme seems to us to lie in the tampering at all with the trust deed, which should be kept inviolate. To admit the principle that trust deeds can be altered for any reason whatever is a dangerous excursion in finance; and, however excellent may be the reason for suggesting it, to our mind the principle should be held sacrosanct in the interests of public confidence in any such security.

The Armament group is a little more active, though without any corresponding movements being caused in prices. Rubber shares are good. The tone seems to have taken a change for the better; and although the florin shares standing round about par are still somewhat neglected, they will probably participate before long in the present demand for higher-priced shares in this market. The public disposition seems willing to buy more or less speculative shares yielding high rates, in order to mix with the War Loan, with its 4⅝ per cent. return, and thus by the selection to obtain about 6 to 7 per cent. on the money. As a pure investment, the War Loan is by far the most popular stock in the markets; and it may be of interest to the curious in such matters to learn that the weight of the scrip certificates which have been handed out within the past month—each individual certificate weighing about ¼ oz.—amounted in the aggregate to nearly twenty tons.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Blackpool-Fleetw'd	July 31	5,001	−1,256	30	17,842	− 3,920	8	..
Bristol	„ 30	40,448	+ 669	31	280,952	+21,154	30·5	..
Chatham and Dist.	..	..	..	..	..	..	..	..
Cork	„ 29	2,195	− 95	30	14,829	− 302	54·25	..
Dublin	„ 30	25,636	−1,534	30	182,059	+ 5,805	9·89	..
Hastings	„ 29	4,349	− 725	..	..	− 1,957	19·3	..
Lancashire United	„ 21	7,687	+ 743	29	49,043	+ 1,154	42	..
Llandudno-Col. Bay	„ 30	1,993	409	35	10,058	+ 848	6·5	..
Tyneside	„ 28	2,629	+ 93	4	2,404	+ 225	11	..
Anglo-Argentine ..	Aug. 5	203,783	−13,937	30	1,583,027	−149,203	..	..
Auckland	June 30	19,139	+ 116	52	267,218	+ 914	25·42	1·06
Calcutta	July 31	17,947	− 731	..	..	− 6,478	..	..
Kalgoorlie, W.A. ..	May	3,269	..	21	13,472	..	..	..
Madras	July 17	4,017	+ 26	28	21,994	− 195	..	..
Montevideo ..	July	25,161	−1,256	39	251,858	−31,810	..	..
Dublin-Lucan Rly.	July 30	676	− 93	4	676	− 96	7	..

SHARE LIST OF ELECTRICAL COMPANIES.

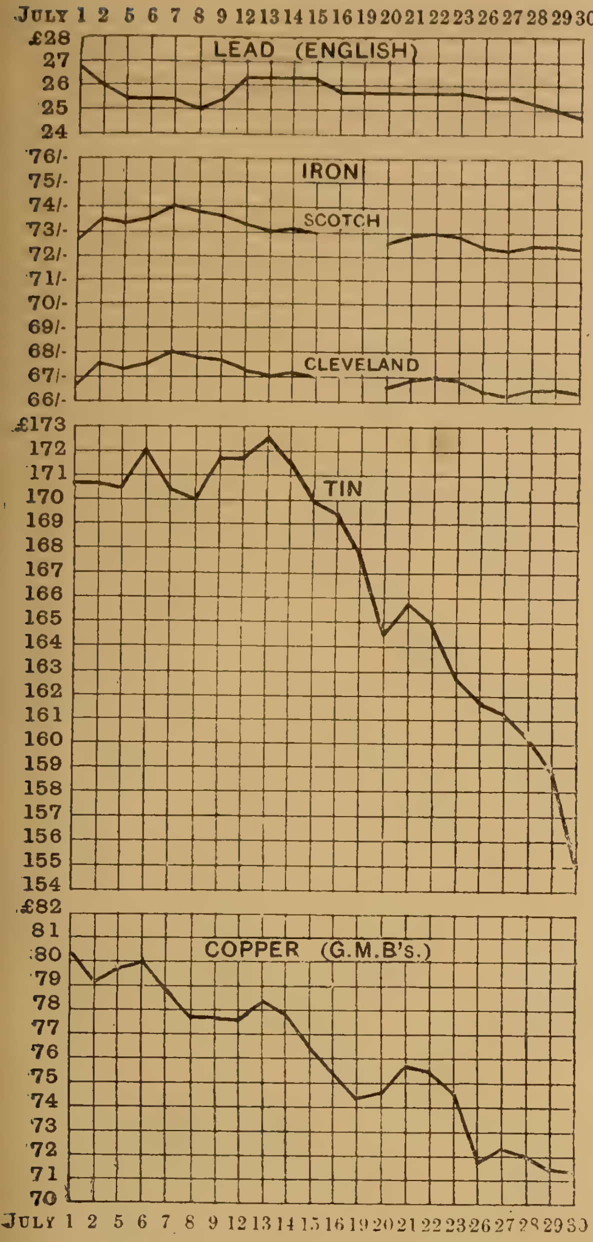
	Dividend, 1914.	Price Aug. 10, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	8	—	£6 5 0
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4	—	6 5 0
do. do. do. 4½ Pref. ..	4½	4	—	5 12 6
do. do. City Pref.	4½	3⅞	—	5 16 2
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4½	—	5 11 1
do. 4½ Deb.	4½	[illegible]	—	4 17 10
City of London	9	13	—	6 18 6
do. do. 6 per cent. Pref. ..	6	11	—	5 9 1
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10½	—	6 13 4
do. do. 6 per cent. Pref. ..	6	10½	—	5 14 3
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6½	—	6 18 6
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref. ..	6	4¾	—	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	3½	2⅞	— ⅛	6 1 9
do. 4½ per cent. Pref. ..	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	7	—	7 0 0
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	3	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7	—	6 8 7
do. 4½ Pref.	4½	4⅝	—	4 17 4
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	97	—	6 3 6
do. Def.	1½	21¼	+ ¼	7 1 2
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8¼	—	6 1 3
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11	—	*7 5 6
do. 4 Deb.	4	78	—	5 2 7
Eastern Tel. Ord...	7	117	− 3	*6 17 6
do. 3½ Pref.	3½	70	—	5 0 0
do. 4 Deb.	4	81	+ 1	4 19 0
Globe Tel. and T. Ord.	6	9½	—	*7 4 4
do. Pref.	6	10	—	6 0 0
Gt. Northern Tel.	22	33	—	6 13 4
Indo-European	65/-	50	—	6 10 0
Marconi	10	2 1/32	+2/-	4 18 3
New York Tel. 4½..	4½	96½	— ½	4 13 3
Oriental Telephone Ord.	10	2	+ ⅛	5 0 0
do. Pref.	6	1⅛	—	5 6 8
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5½	— ¼	*8 6 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	11½	—	*6 19 0
do. 4 Deb.	4	81	—	4 16 5
Home Rails.				
Central London, Ord. Assented ..	4	73	−1	5 8 1
Metropolitan	1½	23¾	—	6 6 5
do. District	Nil	14	—	Nil
Underground Electric Ordinary ..	Nil	1½	—	Nil
do. do. "A"	Nil	6/-	—	Nil
do. do. Income ..	6	74	−1	*9 5 0
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref. ..	5½	4	—	6 17 6
do. 2nd Pref.	5½	3½	—	7 17 2
do. 4 Deb.	4	73	−2	5 9 7
do. 4½ Deb.	4½	75	—	6 0 0
do. 5 Deb.	5	75	—	6 13 4
Brazil Tractions	4	49½	+4	7 1 5
Bombay Electric Pref.	6	10¼	—	5 16 10
do. 4½ Deb.	4½	90	—	5 0 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds ..	—	50	—	Nil
do. 6 per cent. Bonds ..	—	85	+5	Nil
Mexican Light Common	Nil	25	+5	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	45	—	—
Adelaide Sup. 6 per cent. Pref. ..	6	5	—	6 0 0
do. 5 Deb.	5	99	—	5 1 0
Manufacturing Companies.				
Babcock & Wilcox	14	2¼	—	6 4 5
British Aluminium Ord.	5	1 1/16	—	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	11	—	6 18 4
do. Pref.	6	6	—	5 0 0
British Westinghouse Pref.	7½	31/6	−2/-	9 10 6
do. 4 Deb.	4	68	−2	5 14 4
do. 6 p. lien	6	100	—	6 0 0
Callenders	15	11	—	6 16 4
do. 5 Pref...	5	4¾	—	5 5 3
do. 4½ Deb.	4½	95	—	4 14 9
Castner-Kellner	15	8¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/6	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	60	—	6 13 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	12/	+6d.	10 0 0
do. do. Pref.	7	1	—	7 0 0
Gen. Elec. Pref.	6	9¾	—	6 3 1
Henley	20	14	—	*8 8 8
do. 4½ Pref.	4½	4¾	—	4 14 9
do. 4½ Deb.	4½	95	—	4 14 9
India-Rubber	5	8¾	—	5 14 3
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

Pacific Gas and Electric Co.—The accounts for the year 1914 show a gross operating revenue of $16,912,688, an increase of $1,043,682, while the net income rose by $1,435,451 to $8,306,582. The available balance, however, is only $992,621 higher at $3,645,666. After deducting dividends and allowances for depreciation, a balance of $1,476,320 is carried forward.—*Financier.*

METAL MARKET.

Fluctuations in July.



The Glasgow Iron Market was closed on July 16th and 19th.

U.S. Central Station Users of Electric Vehicles.—A recent issue of the *Central Station*, New York, contains tabulated data referring to the use of petrol and electric vehicles by 250 central stations in the States, from which it appears that 328 of the former and 864 of the latter are in use in the stations enumerated. Foremost in the list are the Commonwealth Edison Co., Chicago, with 114 electrics, and the New York Edison Co., with 130 electrics, neither company showing any petrol cars in use. The Boston Edison Co. operates 56 electric and 3 petrol cars; the Rochester Railway and Light Co. has 53 electric cars and 1 petrol car; the Philadelphia Electric Co. has 40 electric and 26 petrol cars; the Baltimore Consolidated Co. has 27 electric and 8 petrol cars; the Detroit Edison Co., 25 electric and two petrol cars; the St. Louis Union Co., 20 electric cars only; and so on, these being the principal station users in the list.

King Albert's Civilian Hospital Fund.—An urgent appeal is made for assistance for the civil population of the portion of Belgium still held by its heroic people, which presents a picture of overwhelming distress. It is proposed to establish small movable hospitals which can be quickly set up in villages as necessity arises, and managed as self-contained units. The ground over which the fund will work must be traversed by our troops as they advance, and it is imperative that it should be quickly restored to a healthier and more sanitary condition. Cheques may be made payable to "The London County and Westminster Bank," crossed "King Albert's Civilian Hospital Fund," and sent direct to the Bank at 62, Victoria Street, S.W. Contributions of clothing, boots, linen, medical stores, sheets, blankets, bedding, household requirements, foodstuffs, &c., will be gratefully received at the Hospital Depôt, care of Harrod's Stores, 116, Brompton Road, S.W.

THE FUTURE OF EXPORT TRADE.

After a year of war, and the prospect of hostilities still being continued for a further period, the length of which it would be impossible to specify with any degree of certainty, the question of the future of the export trade of some of the nations which are engaged in the present contest has had provisionally to be subordinated to the absolute necessity for meeting requirements in the matter of adequate supplies of arms and ammunition, which have been shown to be more essential than ever under existing conditions of position fighting, in order to bring the war to a successful conclusion in favour of the Allies as soon as possible. Under these circumstances it is comprehensible that while the general object of capturing a large portion of the export trade hitherto carried on by Germany and Austria-Hungary is not by any means being lost sight of, some relaxation of effort must have occurred in view of the more important problems which await a satisfactory solution at the present time. In this connection it has to be borne in mind that the financial conditions in several of the Republics of South America—one of the great markets which was held in prospect for development—had become extremely critical before the outbreak of the European war, and the situation in these countries has been aggravated indirectly by the war, whilst nations in other parts of the world are also suffering indirectly from the world conflagration. Naturally, the cultivation of export trade under existing conditions is a matter of difficulty to some of the belligerents, and quite impossible to the others.

But even the North Americans (United States), who, less than 12 months ago, were equally as zealous as British firms in the desire to capture German export trade, particularly in South America, have been greatly disillusioned with regard to South American markets, notwithstanding that the United States have retained their freedom of activity through not being involved in the war as belligerents. Instead of increasing their export trade to the whole of the South American Republics, and to British, Dutch and French Guiana, the figures issued by the Department of Commerce at Washington are reported to show a decrease of £4,400,000 in the value of the exports to those destinations in the financial year ended with June, 1915, as compared with the previous year, whereas the imports from those countries increased by £1,000,000 as compared with the year 1913-14. The imports into the United States from Canada experienced a still greater advance, whereas the value of the exports to Canada underwent an enormous diminution.

If then the efforts put forth by British firms to expand their export trade in the past 12 months have not been crowned with that particular measure of success which was originally expected, the explanation lies chiefly in the financial situation of transmarine countries all over the world as affected indirectly by the war, and we have at least the consolation of knowing that North Americans, although not directly hampered by the war, have hitherto failed to make any material progress in the South American markets notwithstanding the swarms of travellers who were sent out expressly to get into touch with possible buyers. It is, however, less with the past than with the future that we are concerned at the present time, and the same observation applies to France, Russia, Italy, and Germany and Austria-Hungary; Belgium, Serbia and Turkey do not come into consideration for the time being. Now each of the allied countries is determined to render itself independent of enemy countries as far as is possible in regard to manufactures and other products which were previously imported from them. But when we reflect on the export side of the problem, we find that whilst almost complete unanimity prevails in Great Britain as to our future possibilities, a diversity of opinion exists both in France and Germany, where both pessimists and optimists give expression to their beliefs. In France, where certain commercial associations have been formed recently or developed from a pre-war period, the formation of export banks is advocated, which would enable exporters to ascertain the solvency of foreign customers and regulate payments according to the customs and in the currency of the countries concerned. The suggestions made by M. E. Morel, vice-president of the Lyons Chamber of Commerce, best summarise the opinions of many circles. He states that Frenchmen must (1) learn to know foreign customers, for they do not know them; (2) send out travellers who speak the language; (3) manufacture products required by customers instead of forcing upon them French products; (4) offer the goods freight and duty free, and accept payment in the currency and on the conditions prevailing in the foreign market; (5) deliver the goods punctually; (6) learn the art of packing the goods in a faultless manner; (7) agree cautiously to the usual system of credit abroad; and above all (8) desire to conquer foreign markets. Whilst these objects are praiseworthy from the French point of view, there is another side of the question to be dealt with before the French can hope to succeed in the former aims. This particular side refers to the setting in order of French domestic affairs, to which M. Victor Cambon, the well-known economist, recently devoted a series of lectures, which were delivered before the Association of Engineers in Paris. The lecturer stated that the goal would be reached with France exhausted of men and money, the lack of which would be most seriously felt, apart from the absence of the hundreds of thousands of Belgian, German, and Italian workmen who were employed prior to the war. The financial difficulties, he declared, would be considerable, and apart from those now engaged on Government orders, most of the industrial companies would be half ruined, some through the stagnation in business and the others through the destruction of their works. And yet thousands of buildings and works will have to be rebuilt in part of the country, concurrently with the reconstruction of railways, roads, underground water and sewer services, and other public installations of different kinds. M. Cambon, who is far from being sanguine as to the future, asks, if Germany becomes exhausted and ruined, what can the Allies do in regard to an indemnity with a country which has sacrificed its last pfennig on the continuation of the war?

Turniing now to Germany, where the future of the export trade is equally occupying increasing attention, a Mr. J. Marz discusses the problem in a pamphlet which has just been published in Berlin. He remarks that pessimists declare that the exasperation created in enemy countries through the war must produce a feeling which will last for years after the conclusion of peace, and that it will induce those countries to adopt far-reaching measures for protecting themselves against German goods, facilitated by the boycotting movement and the activity of the associations formed for this purpose. Although the author does not assume that all these proposals will be carried into effect, he considers that the danger of such a propaganda in regard to the renewal of commercial relations should not be underestimated. As far as Great Britain in particular is concerned, it appears that opinions of German manufacturers and merchants are divided. On the one hand serious apprehensions are entertained, while on the other it is contended that British firms will resume their long-standing trading relations with their former German friends, especially in so far as they bring business to the former. Even the most embittered economic war, in the opinion of the author, will be unable to secure the renunciation of the principles which regulate international trade—the law of supply and demand—and the participation of Germany in the world's markets has so strengthened the position of that country, that it is submitted that it cannot be shaken even through the complications of the world war. In addition, it is held that the great specialisation of German industry, and the independent inventions on the basis of economy, industry, and technics, would not allow of her share in supplying the world markets being appropriated by other countries without much difficulty, whilst Germany herself requires certain raw materials, semi-finished materials, and manufactures for which substitutes could not be provided at once in neutral countries. The author, therefore, concludes that the assumption is justified that after the war commercial relations between the belligerent countries will probably soon have to be resumed, and that Great Britain, France and Russia will sell goods to Germany, and in turn will have to procure commodities from the latter country.

It is reasonable to assume that when a period of peace once again prevails in Europe, the resources of France and Belgium will be very largely, if not entirely, absorbed by the national requirements in the direction of the reorganisation and rehabilitation of the districts which have been devastated by the enemy, unless it should prove to be possible to carry out these works gradually and concurrently with the driving out or withdrawal of the hostile armies; we are, however, rather inclined to accept the opinion of M. Victor Cambon, which, if it should prove to be correct, would imply delay in the execution of the programme outlined by the vice-president of the Lyons Chamber of Commerce.

In the case of Germany the situation as it affects Great Britain is extremely delicate. On one point, however, there can be no shadow of doubt, with the present terrible results of the war before us—that whatever we can produce for ourselves or, failing that, whatever we can import from countries other than enemy countries, we shall not seek to procure from Germany or Austria-Hungary in the future. But, in other respects, it will scarcely be possible to avoid an interchange of trade. It is, however, particularly in the oversea export markets that the commercial contest will become keen—keener by far than in recent years—and we must necessarily steadily prepare ourselves by all means in our power for the great economic struggle of the future. It is doubtless correct that the finances of Germany will by that time have become so greatly exhausted that it will no longer be possible for that country either to produce as economically as in the past, or to continue the long credits which have been the custom in oversea countries; but we must not place too much confidence in this assumption, or in the supposition that neutral countries, on account of Teutonic atrocities, will not resume their former business relations with Germany when the war is over. All we have to do is to be in a state of readiness to meet the great trade contest, and the preparations which are in progress for this purpose should be continued as vigorously as is possible under the conditions prevailing at the present time, and those which may be expected to exist in the period which lies before us.

POWER SUPPLY TO THE RAND MINES.

The latter part of Mr. Bernard Price's presidential address to the South African Institute of Electrical Engineers, delivered in May last, dealt with the above subject, and comprised a description of the main features of the Power Co.'s business and a comparison of its characteristics with those of other typical schemes. The following is an abstract of his remarks:—

The business is controlled by two companies, the Victoria Falls & Transvaal Power Co., Ltd., and the Rand Mines Power Supply Co., Ltd., the latter company being a subsidiary of the former, and the combined system being operated and managed by the Victoria Falls & Transvaal Power Co., Ltd. For present purposes, therefore, the business may be treated as one complete scheme, and as such it ranks as one of the largest in the world.

The following general description of the system is necessary for a proper appreciation of the statistics which follow. Typically the scheme is one which supplies a single industry, comprising a relatively small number of relatively large consumers scattered over a compact area. The area takes the form of a narrow strip about 45 miles long, stretching from east to west. There are three generating stations along this strip, namely, Brakpan, at the far eastern end, Rosherville at about the centre, and Simmerpan between the two. There is also an outlying station on the Vaal River at Vereeniging, situated about 35 miles due south of Johannesburg, which feeds into the area at Robinson Central, a point about five and a half miles west of Rosherville. It will be seen, therefore, that there are four points of supply along the narrow area, and as the density of the load is greatest in the neighbourhood of these four points, the average distance of distribution is small compared with that which would be necessary in many schemes.

Distribution is carried out at 20,000 volts overhead or underground over all sections of the area, excepting that in the neighbourhood of Simmerpan and a small portion of that fed from Brakpan, where the pressure is 10,000 volts. The choice of these relatively high pressures has been determined by considerations of economy in capital cost of lines, cables and switchgear, rather than of pressure drop. The main transmission system virtually consists of overhead inter-connectors at 40,000 volts between the four points of bulk supply and of two similar lines running west from Robinson Central to feed the relatively small section of the load at the extreme western end of the area. The power generated at Vereeniging is transmitted to Robinson Central at 80,000 volts. The railage charges on coal from the Middelburg colliery district (which lies some 70 miles to the north-east of the area of supply) are heavy, and the supply of cooling water within the area is restricted. It has, therefore, proved advantageous to expend capital upon transmission lines from an outlying station situated favourably as regards water supply and in close proximity to a colliery, and to transmit energy therefrom in the form of electricity rather than in the form of fuel. Under these conditions, the stations at Vereeniging and Brakpan, which are nearest to the source from which their fuel is drawn, are operated at the highest possible load factor, and Simmerpan and Rosherville are left to take the remainder of the load at a lower load factor. The following table gives particulars of the demand and consumption of the three classes of consumers served by the companies:—

Particulars of Consumers Connected to the Power Companies' System.

Class of consumer.	No. of consumers.	Aggregate of non-simultaneous maximum demands at points of delivery, January, 1915.		Units consumed per annum.	
		KW.	Percentage of total.	Millions of units.	Percentage of total.
Mining	65	95,000	98·0	514·5	99 00
Industrial ...	8	1,100	1·1	2·8	0·55
Bulk supplies to municipalities...	5	900	0 9	2 3	0 45
Totals ...	78	97,000	100	519·6	100

It will be noted as an outstanding feature that no less than 99 per cent. of the business is represented by supply to the mining industry.

Figs. 1 and 2 give a general idea of the type of supply taken by such mining consumers as have completely electrified their mine. Fig. 1 is for a mine working single shift and fig. 2 for one working double shift. The compressor load for this latter mine is probably somewhat higher than that for an average case, but otherwise the charts may be considered typical. I shall return to these diagrams later, but in the meantime it may be noted that the load in both cases is at its highest between the hours of 8 a.m. and 4 p.m. in the day time. Fig. 3 shows certain load curves of the power companies' system, including only the electric business proper. As you are aware, the Rand Mines Power Supply Co., Ltd., also supplies upwards of two million tons of compressed air per annum at a gauge pressure of about one hundred pounds per square inch, and a portion of this air is compressed by means of electrically-driven compressors at Robinson Central. As I am now dealing solely with the electric power actually sold as such, the power used for driving the power companies' compressors has been excluded. The curves shown on the left-hand side of fig. 3 have been plotted from half-hourly readings of the units sent out from generating stations on Friday, January 5th, 1915, and Sunday, January 7th, 1915, whilst the week-day curves shown on the right represent the average of six normal week-days during January, 1915, and January, 1912, the Sunday curve being an average of four Sundays in January, 1915. All three curves on the right have been obtained from hourly readings, and the curves on the left have been included merely to show the half-hourly fluctuations which occur on a normal day. A similarity between the shape of the load curves of typical consumers and of the power companies' system will be at once apparent, this similarity being due to the fact that the cycle of operations is virtually the same on all mines. Whilst no doubt a certain number of consumers work double shift, this does not influence the fact that the periods of maximum demand for all consumers overlap. The shape of these curves is of first importance, because upon it depends to a very large extent the cost of furnishing the supply, and it may therefore be of interest to carry the analysis somewhat further.

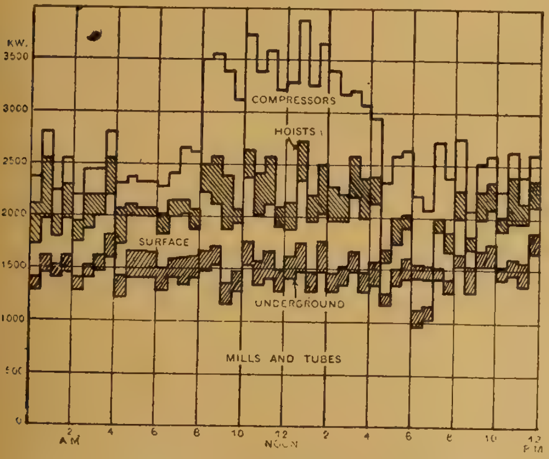


Fig. 1.—Typical Single-shift Mine Load.

It will hardly be necessary to explain that the cost of producing and furnishing a supply of electric power is mainly dependent upon two factors, namely: (a) Capital and other fixed charges, which are dependent upon the capacity of the plant and system required for meeting the maximum rate of supply; (b) running charges. The first of these two charges varies inversely as the load factor, whilst the second item, though also dependent upon the load factor, to a very considerable extent, is not directly inversely proportional to the load factor. The load factor of the combination of a number of individual supplies may be influenced by both the load factor and the diversity factor of the individual supplies, and the inter-relationship between these two factors is not always easy to follow. The complexity of the subject is, however, reduced when dealing with a very large system such as that under consideration, because the effect of all short-time fluctuations may then be ignored. Standard plant of the type and size now in use, when fully loaded by the hourly average rate of supply, is capable of meeting the short-time peaks without undue strain. Large generators and transformers

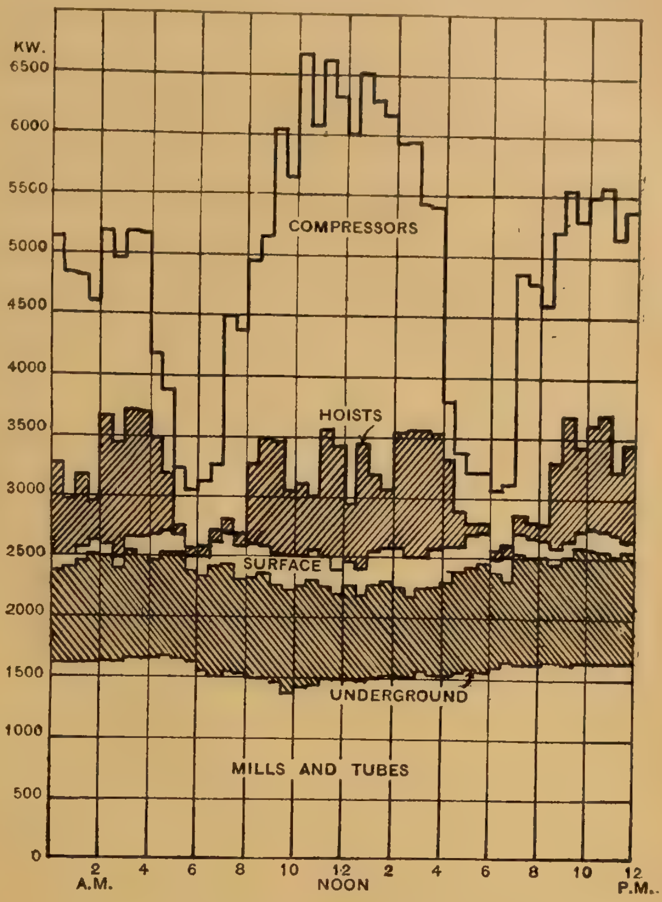


Fig. 2.—Typical Double-shift Mine Load.

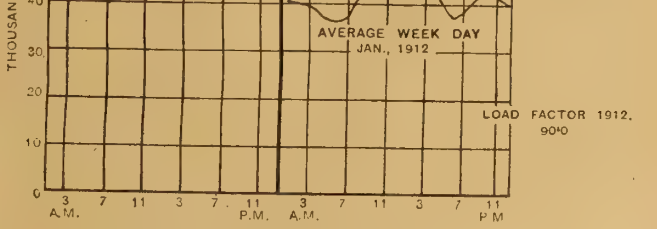


Fig. 3.—Typical Daily Load Curves.

absorb a considerable quantity of heat for a relatively small increase in temperature, and consequently respond but sluggishly in temperature to the fluctuations of heat generated within them. Similarly the boiler plant has a considerable storage capacity for energy, and one of the special characteristics of a steam turbine is its ability to meet heavy overloads without distress. It may, in fact, be said that as the size of a system increases the percentage short-time variation in load tends to decrease, whilst the ability of the plant to deal with such variations increases owing to the increase in the size of units of plant which can be usefully employed. Although some of the winders in this district are unusually large, the largest of them represents a momentary peak of only about 3½ per cent. of the system peak, and at times when two such winders happen to synchronise the variation will be only about 7 per cent., lasting for a couple of minutes at the most. The average rate of supply taken over an hour is therefore a satisfactory guide as to the amount of plant required for meeting the service, and for this reason statistics regarding loading are taken on the basis of units per hour. I will refer to load curves made out on this basis as "Smoothed Load Curves," that is, curves on which the short-time fluctuations have been averaged over an hour. This basis is very convenient in every-day practice, because integrating instruments have to be provided in any event for measuring station output and consumers' consumption, and such instruments are very reliable and accurate. Moreover, it is a simple matter to provide attachments to the sub-station integrating instruments which will record on a dial the maximum of the hourly consumptions, thus rendering it unnecessary to record each of the many hundred hourly figures, and to then select the maximum therefrom. These attachments operate on the same principle as a maximum and minimum thermometer. By means of a clock the mechanism of the integrating watt-hour meter is brought into gear with the attachment at a given time, and thereafter for one hour the movement of the meter turns the pointer on the dial of the attachment round the scale of units. At the end of an hour the clock resets to zero the mechanism which has been actuating the said pointer, leaving the pointer itself where it is, and this process is repeated during the second hour, and so on. If the number of units consumed during one of the subsequent hours is greater than that during the first hour, the actuating mechanism reaches the pointer before the end of the hour and moves it further round the scale, so that it may register the greater consumption. The position of the pointer at any given time, therefore, shows the maximum of the consumptions taken during successive hours since the time when the pointer was last set back to zero by hand. The installation of such apparatus at every point of supply throughout the system enables accurate and complete data to be obtained regarding the load factor and diversity factor of the smoothed curves of the various supplies.

The diversity between any given selection of supplies may be considered as being of two independent types. Firstly, there is such diversity as may be due to a fundamental difference in the shape of the smoothed load curves of component supplies, having due regard to time ("fundamental diversity"); and, secondly, there is the diversity which is due to irregularities in that portion of each of the smoothed load curves which falls within the period of the maximum demand on the system ("general diversity"). In most large schemes the general shape of the load curves of individual supplies differs more or less for the several classes of consumer served on account of differences in the type of business carried on, and differences in the cycle of operations peculiar thereto. In other words, most schemes derive considerable benefit from fundamental diversity between the demands made by several different classes of consumers, whereas there is virtually no fundamental diversity on the system of the power companies in this district at the present date. The diversity here may be attributed entirely to general diversity, that is, to the inter-leaving of the fluctuations on the smoothed load curves of individual consumers during the period of maximum demand of the resultant supply. Reference to figs. 1 and 2 will show, however, that this general diversity will not be inconsiderable, as the amplitude of the hourly fluctuations on the smoothed load curves of individual consumers during the period of the peak is by no means small. The clearest way to express diversity is to take the ratio between the aggregate of the individual maximum demands (which are non-simultaneous), and the maximum aggregate of simultaneous individual demands taken at the points of delivery in each case. The aggregate of the non-simultaneous maximum demands is arrived at by adding together the readings of the maximum demand attachments of the sub-station watt-hour meters above described. The maximum aggregate of simultaneous individual demands cannot be conveniently measured at points of delivery which are scattered all over the area, but is arrived at by selecting the maximum number of units sent out from generating stations during the successive hours of the period in question, and then correcting this figure for loss in transmission and distribution. In fig. 4 statistics are given regarding the load factor, diversity factor, and losses for the power companies' system in the form of monthly figures extending over the last four years. It will be observed that the diversity factor (which is calculated as above described) varies between 1.2 and 1.25, which means that 20 to 25 per cent. more plant would have been required to meet the supplies if there had not been diversity between the hourly humps and hollows on the shape of the smoothed curves of the individual supplies. This factor, being obtained from smoothed curves only, eliminates the very much greater amount of diversity which must exist between the short-time fluctuations on the charts obtained from curve drawing watt-meters. Such short-time fluctuations of the individual supplies are almost entirely due to the winders and haulages, and there are so many of these that very complete diversity takes place between them. The following table is interesting in this connection:—

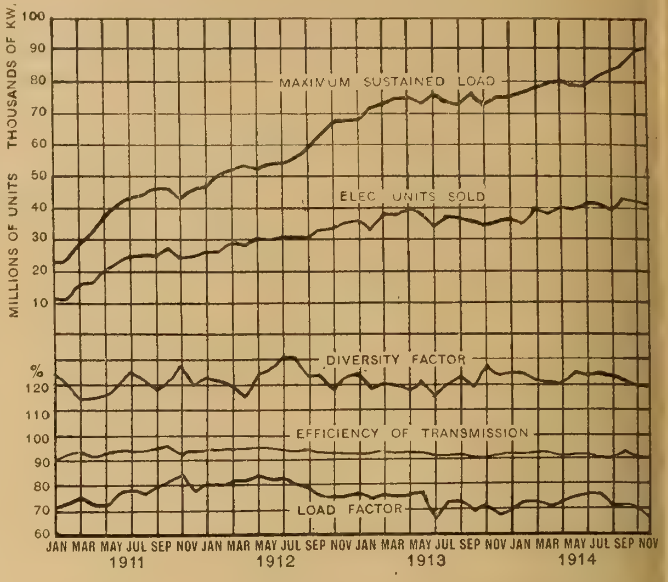


FIG. 4.—STATISTICAL CURVES, POWER CO.'S SYSTEM.

PARTICULARS OF WINDERS CONNECTED TO THE POWER COMPANIES' SYSTEM.

Type of winder.	No. of winders.	Total installed capacity at continuous rating. H.P.	Average size at continuous rating. H P.
Underground winding—			
A.C. winding motors ...	62	17,600	284
Surface winding—			
A.C. geared hoists	52	21,300	430
A.C. direct coupled hoists ...	10	12,700	1,270
Ward Leonard hoists ...	19	21,400	1,130
Totals	143	74,000	517

Continuous rating of largest Ward Leonard hoist about 5,000 H.P

Present momentary peak demand for ditto ... ... 9,000 H.P

Continuous rating of largest A C. hoist ... ... 1,600 H.P

The above figures are specification ratings.

It will be noted that the system supplies no less than 143 winders (exclusive of haulages) aggregating 55,000 KW. at continuous rating. I do not think there is another scheme in the world which is supplying such a large capacity of this class of load. An intermittent supply of this type, involving as it does a very heavy momentary peak, which is often taken at relatively low power factor, is generally considered an unfavourable type of supply from the power companies' point of view, but this is only partially true. The reduction in power factor is undoubtedly most objectionable, but whereas a small number of such loads connected to a relatively small system would necessitate an increase in both the kilowatt and K.V.A. capacity of the momentary system plant for the sole purpose of meeting the momentary demand caused by synchronisation of the individual peaks; and whereas such loads would prejudicially effect the voltage and speed regulation of the system, a large number of such supplies connected to a large system, diversify very fully and have no prejudicial effect other than the reduction in power factor.

It may, in fact, be said that having once connected a few winders to a large system, it is beneficial so far as the diversity and regulation of the system is concerned, to add as many as possible. Under the conditions obtaining on the power companies' system to-day, the addition of a new large winder has no more effect upon the load curve of the system than the addition of a load having a smoothed curve similar to that of the winder. In fig. 5 an attempt has been made to show how the power companies' system load curve is built up. To do this accurately would involve the collection of an enormous amount of data; in fact, it would be necessary to obtain the actual smoothed load curve of each section of each component supply. A sufficiently close approximation can, however, be obtained by assuming certain diversity factors for the several components and by calculating the maximum demand from particulars of the total installed capacity of each class of plant on consumers' premises. Certain assumptions have also been made with regard to the shape of the load curves of individual sections of the supply, but I think the following conclusions may be safely drawn from this diagram: (1) If it were not for the load taken by compressors and winders the system load curve would be very nearly flat and would probably have a week-day load factor of over 90 per cent. As a corollary the miscellaneous load on the surface and underground has a relatively high load factor. (2) There is a pronounced valley in the system load curve between the two shifts on the mines, that is at about 6 a.m. and 6 p.m. The relatively small rise in the load after 6 p.m. and until 6 a.m., as compared with the large rise between 6 a.m. and 6 p.m., shows that a large majority of the mines now work single-shift. This point is brought out very clearly when comparison is made between the week-day load curves shown on the right-hand side of fig. 3 for 1912 and 1915. In January, 1912, the height of the night peak (taken from the mean of the bottom of the two valleys) is about 65 per cent. of the height of the day peak taken from the same point, whereas in 1915, three years later, the percentage had fallen to about 25 per cent.

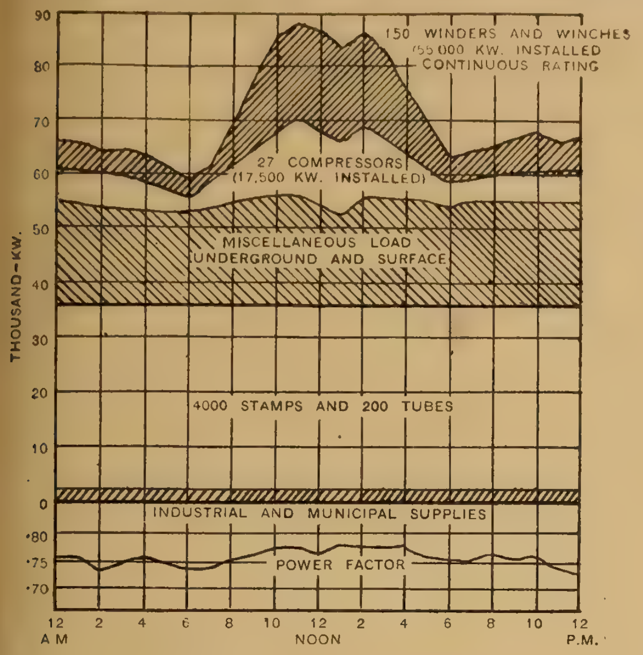


Fig. 5.—Composite Load Curves.

This increase in the proportion of day peak to night peak is largely due to many mines changing from double to single-shift since 1912.

It has been mentioned that the load factor of a combination of supplies may depend upon both the load factor and the diversity factor of the components. Fig. 5 shows this; each supply to stamps and tube mills has a week-day load factor of close on 100 per cent., due to the high load factor of each individual mill and tube mill motor. In this instance diversity plays practically no part. The winders and compressors, on the other hand, have a relatively low load factor, but as their smoothed load curves are similar and overlap, the diversity is confined to "general diversity," and this is, therefore, a case where some benefit, but not much, is derived from diversity. The remainder of the load, however, is made up of a multiplicity of miscellaneous loads underground and on the surface, the operation of which in many cases is not governed by any particular schedule. No doubt some of the loads have high load factors individually, but, on the other hand, a large number have very low load factors and diversify greatly on account of the fact that the consumer's business is in progress night and day, rendering it possible for intermittent work to be spread over the twenty-four hours. It must be borne in mind, nevertheless, that the major portion of this diversity takes place between motors on a given mine, and there will not, therefore, be very much diversity between the smoothed load curves of the miscellaneous supplies of different mines.

The week-day load factor of the system for January, 1915, as calculated from the six days' average curve in fig. 3, is 80.6 per cent., and it will be observed that the monthly load factor as shown in fig. 4 now varies between 70 and 75 per cent., depending largely on the proportion which the number of Sundays bears to the number of week-days in the month. In January, 1912, the week-day load factor calculated from the curve in fig. 3 is 90 per cent., and the monthly load factor at that date as shown in fig. 4 was about 80 per cent.

If the load factor had remained at this figure of 80 per cent. instead of falling to the present average of 72.5 per cent., the plant capacity required on the power companies' system would to-day be reduced by about 8,500 kw., together with a corresponding reduction in the margin of spare plant of 2,100 kw., making a total reduction of 10,600 kw., so that one large generating set could have been dispensed with, and this shows, roughly, the effect of the adoption of single-shift working on the power companies' electric business.

The position as regards load factor and diversity factor may, therefore, be summed up by saying that the load factor of the power companies' system is high because each and every consumer has a relatively high load factor. As compared with most schemes, diversity plays a very minor part.

Fig. 5 also shows the variation in the power factor of the total electric load on the system during a typical week-day, including the supply to the electrically-driven compressors at Robinson Central.

The motors which drive these compressors are of the synchronous type, and are over-excited to take leading current.

The power factor shown on the curve does not, therefore, represent that due solely to the loads demanded by consumers, but it will be observed that under the conditions obtaining, the figures average about 77 to 78 per cent. during the peak.

The third curve in fig. 4 shows the variation in the efficiency of transmission and distribution during the last four years.

The factor is the ratio which the total number of h.t. units delivered to sub-stations bears to the total number of units sent out from generating stations during each month.

Although the units taken by consumers are measured at the l.t. bus-bars in the sub-station, 2 per cent. is allowed to the power companies in the case of mining consumers to cover transformer losses and the overall efficiency down to the l.t. meters in sub-stations is, therefore, about 2 per cent. less than the figures shown on this curve. The efficiency has fallen off slightly, and now averages about 92 per cent. (about 90 per cent. on the l.t. bus-bars). This is due to the increasing output generated at the distant station at Vereeniging; the fluctuations are accounted for by changes in relative loading of the stations, and consequently in the distribution of load over the transmission system.

The loss of only 10 per cent. in efficiency is evidence of the distribution at relatively high pressure over relatively short distances.

Fig. 4 also shows the growth of the maximum sustained load and of the total output of the system since January 1st, 1911. The maximum sustained load means the maximum number of units sent out from all generating stations during the successive hours of the month, or, in other words, the maximum hourly average load.

This now exceeds 90,000 kw., and including the compressor supply at Robinson Central reaches well over 100,000 kw.

An interesting comparison can be drawn between the power companies' business and that of the Chicago, New York, Johannesburg and Randfontein systems, for which fig. 6 shows the smoothed load curves for a single week-day, prorated to that of the power company.

In this the curve for each scheme is proportioned up or down, so that it may have the same summit as the power companies' curve. It will be seen that the load factor of the latter is higher than that of either of the three systems which supply a miscellaneous collection of different types of consumers, whilst the load factor at Randfontein is higher than that of the power companies' system.

The Randfontein curve is, however, not strictly representative as abnormal conditions prevailed at the time. The week-day load factors calculated from these curves are approximately as follows:—Chicago, 56; New York, 44; Johannesburg, 47.5; Power Companies, 79.5; Randfontein, 91.5. The period of duration of the upper portion of the peak on the power companies' curve, namely, from 9 a.m. to 3 p.m., does not overlap the peak of any of the other curves excepting that of the neighbouring system at Randfontein, which latter also deals solely with supply to the gold mining industry.

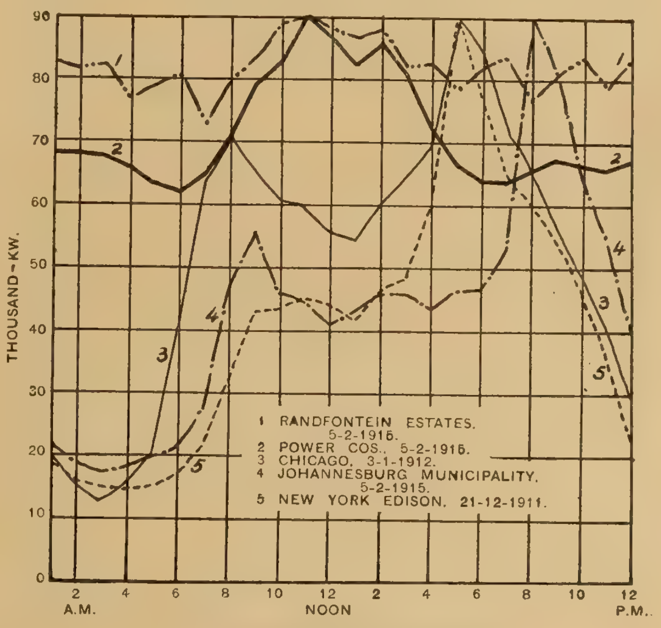


Fig. 6.—Prorated Load Curves.

Taking first the New York Edison curve, it will be observed that this is typical of power and lighting supply to a large city; the Johannesburg curve is similar in shape, except that there is a minor traction peak in the morning, and the evening peak occurs at a different time, it being a summer day in

Africa and a winter day in America. The Chicago curve shows clearly the benefit which that concern is securing from a railway load. The morning peak is more pronounced, and the average load during the day is a large proportion of the evening peak. The Randfontein curve shows the same period of peak as the power companies' curve, but flatter.

The characteristics of the power companies' load may be compared with that of, say, Chicago on another basis, namely, by taking the number of hours of use of various percentages of the full amount of plant in service during the peak.

These curves, which may be termed "load duration curves," are shown in fig. 7.

It will be observed that the power companies use 90 per cent. of the peak capacity of plant for 1,000 hours per annum, as against less than 100 hours for Chicago, and that 50 per cent. of the plant is used for about 8,400 hours and 2,700 hours respectively.

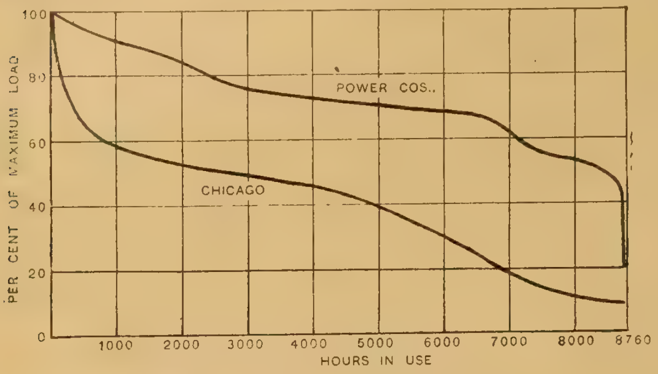


FIG. 7.—LOAD DURATION CURVES.

It will be clear from these comparisons that conditions here on the Witwatersrand are unique. The present method of operating the mines results in a load curve having a peak of considerable duration, but this peak occurs at an unusual time, and would not overlap the peaks on the curves of a traction or a city lighting and power supply if these latter were added to the power companies' system. As engineers, we desire to get the best possible results out of our work; as business men, we want to supply the greatest possible amount of service at the lowest possible cost to the consumer, and the greatest possible profit to our own particular concern; but whether we be engineers or business men, or both, we all desire to avoid unnecessary waste of capital and the world's' resources. Mr. Ferranti, when addressing the Home Institution in 1910, boldly outlined a scheme for the generation and distribution of electric power for the whole of Great Britain, and showed the enormous saving in capital and in fuel which would result if electricity were to become the universal medium for supplying all heating, lighting, and power requirements. I, personally, believe that some day this vision will materialise in a broad form, if not in detail, and that even in the more sparsely populated continent of Africa the conservation of the country's resources by the aid of electric power will be deemed to be matters of national import. The difficulty is that changes of this order can only mature gradually, and small advances do not permit the large economies which would be secured if it were possible for the ideal scheme to be laid out from the beginning. There is, nevertheless, a vast field for conservation within immediate grasp. The power problem in London is an outstanding instance, and it is gratifying to see that there is at least some prospect of a combination of interests in that important field. America is already leading the way, as witness the rapid development of the Chicago Edison Co. during recent years. The strong position to which that vast concern has attained and the resulting benefits to consumers is the outcome of the concentration of various types of supply in one large system, under the enterprising and far-sighted guidance of Mr. Samuel Insull. Here on the Rand, it may be said that the field is a relatively restricted one, but its possibilities have not yet been exhausted. The eastern portion of the Rand promises well, and it is reasonable to hope that a further extension of this vast gold-bearing area will some day be discovered.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

10,785. "Rumblers and the like for electrolytic purposes." C. J. Lane and D. L. Honeyman. July 26th. (Complete.)

10,803. "Vacuum drying and impregnating device, more especially suitable for treatment of the coils of electrical machinery and apparatus." E. Haefely & Co., Akt. Ges. July 26th. (Convention date, July 24th, 1914, Switzerland.) (Complete.)

10,837. "Flexible electric conductors." A. J. Downes. July 26th.

10,845. "Electric ignition devices." A. L. Kavanagh. July 27th

10,851. "Joint or intersection boxes and means for connecting electric cables thereto." J. Coates & G. J. Jones. July 27th.

10,901. "Manufacture of electric apparatus." M. Segre. July 27th. (Complete.)

10,938. "Electric switch controlling devices." A. W. House. July 28th.

10,957. "Electric railway systems." The Rt. Hon. H. L. Samuel, W. Slingo, H. C. Gunton, & C. H. Douglas. July 28th. (Addition to 14,984/14.) (Complete.)

10,958. "Electric railway systems." The Rt. Hon. H. L. Samuel, W. Slingo, H. C. Gunton, W. H. Powell, & J. R. Kingston. July 28th. (Addition to 15,539/14.) (Complete.)

10,959. "Electrical dry and wet heating pad and bandage and the like." W. E. Siday. July 28th.

11,011. "Process for electrolytically depositing a strongly adherent and malleable layer of tin on iron and other metallic surfaces." P. Marino. July 29th. (Complete.)

11,013. "Electric switch plugs." A. E. Rule and Feld Bros. & Co., Ltd. July 29th.

11,033. "Magnetos." M. A. Codd. July 29th. (Complete.)

11,050. "Perpetual magnetic power wheel." H. M. Gloyne. July 30th.

11,072. "Identification of electric cables." B. J. Kat and Callender's Cable & Construction Co., Ltd. July 30th.

11,074. "Electrodes." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) (July 30th.)

11,088. "Process and apparatus for the separation of suspended bodies from electrical insulating fluids, more particularly gaseous fluid." E. Moller. July 30th. (Convention date, July 31st, 1914, Germany.) (Complete.)

11,123. "Sparking-plugs and the manufacture of the same." T. Crossbee and Sons, Ltd., and W. J. Spicer. July 31st.

11,139. "Switch device for car-light and like dynamos." Albion Motor Car Co., Ltd., and B. Murray. July 31st. (Complete.)

11,144. "Electric heaters." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co., United States). July 31st. (Complete.)

11,157. "Wireless telegraphy." J. Longman. July 31st.

11,158. "Telephonic receiving apparatus." J. Longman. July 31st.

PUBLISHED SPECIFICATIONS.

1913.

27,059. Method of and Apparatus for Separating Dust Particles from Gases or Air by means of High-tension Current. G. A. Krause. November 24th. (November 25th, 1912.)

27,060. Method of Separating Suspended Particles from Gases by means of High-tension Electricity. G. A. Krause. November 24th. (November 25th, 1912.)

27,157. Supports for Electric Incandescent Lamp Filaments and the material for the same. G. Ludecke and Brimsdown Lamp Works, Ltd. November 25th.

27,426. Electric Vacuum-light Apparatus. Moore-Licht Akt. Ges. November 28th. (November 28th, 1912. Addition to 1,218/13.)

27,473. Ampere Meter and Volt Meter for Vehicles and the like. Schoeller & Co. November 28th. (February 10th, 1913.)

27,515. Control of Electro-mechanical Switches for Telephone Exchanges. H. Baron (F. Aldendorff). November 29th.

27,590. Cramp Belts adaptable as Electrode Contact Cramps and Holders and for other purposes. J. S. Romanes. December 1st.

28,291. Electro-mechanical Switching Systems for Interconnecting Telephone Lines. H. Baron (F. Aldendorff). December 8th.

28,362. Switching Systems and Apparatus for Interconnecting Telephone Lines. F. Aldendorff. December 9th.

28,502. Switching Apparatus for Interconnecting Telephone Lines by Electro-mechanically-controlled Switches. F. Aldendorff. December 10th.

28,833. Method of Interconnecting Lines by Electro-mechanically-controlled Switches. H. Baron (F. Aldendorff). December 13th.

29,946. Transmitting Arrangements for High-frequency Wireless Telegraphy and Telephony. G. G. Con Arco & A. Meissner. December 30th.

1914.

284. Anode of Hard-lead for Electrolytical Purposes. E. C. R. Marks (Siemens & Halske Akt. Ges). January 5th.

299. Devices for Braking Alternating-current Commutator Motors. Siemens Schuckertwerke Ges. January 5th. (January 4th, 1913.)

450. Semi-automatic or Automatic Graded Service Telephone Systems. H. Baron (G. Heimann). January 7th. (Addition to 11,888/13.)

452. Transmitter for Distant Controlling-apparatus for Ordnance. R. Girardelli. January 7th. (Convention date not granted.)

459. Number Impulse Instrument for Automatic of Sem-automatic Telephone Systems. Siemens & Halske Akt. Ges. January 7th. (April 17th, 1913.)

742. Electrode Furnaces which have an Arrangement for Automatically Mixing up the Charge. Fried Krupp Akt. Ges. January 10th. (January 17th, 1913.)

828. Thermostatic Regulating Devices. W. C. Heraeus Ges. January 12th. (January 29th, 1913.)

900. Self-locking Electric Lampholder. F. Cacha. January 13th.

963. Electrically-driven Vehicles. K. Von Kando. January 13th.

3,318. Trolley Head for Electric Tramcars, Locomotives, Rope Railways, and the like. L. Johnston & G. W. Green. February 9th.

9,289. Controlling Switches for Electrically-actuated Lifts. G. Dirks. April 14th. (April 14th, 1913.)

9,444. Sparking Plugs or Igniters for Internal-combustion Engines. P. H. Tismer. April 16th. (October 16th, 1912. Divided application on 23,185/13, October 14th.)

13,933. Electric Cables and Cable Systems and Joints for use therein. E. G. Walters and Callender's Cable & Construction Co., Ltd. June 9th, (Cognate application, 14,946/14.)

14,294. Electric Controllers. A. West. June 15th.

16,111. Gloves for Preventing Electric Shocks. J. G. Conway. July 6th.

16,149. Holders for Electric Incandescent Lamps. F. Smith & T. J. Loach. July 7th.

16,411. Automatic Telephone Systems. Relay Automatic Telephone Co. (formerly known as Betulander Automatic Telephone Co., Ltd.), G. H. Bryant and F. M. Ward. July 9th.

16,583. Apparatus for Electrically Transmitting Patterns and Pictures in Textile Machines. Osterreichische Siemens Schuckertwerke and Regal Patente Ges. July 11th. (July 12th, 1913.)

16,595. Electric Alarms. J. Banneyer. July 11th.

16,869. Electric Meters. British Thomson-Houston Co., Ltd. (General Electric Co., United States). July 15th.

16,986. Cooling of Dynamo-electric Machinery. Hon. Sir C. A. Parsons. July 17th.

17,037. System for the Operation of Electric Winding Motors and the like. S. H. Eckmann. July 17th.

17,089. Process and Apparatus for the Electrolysis of Halogen Alkalies. Siemens & Halske Akt. Ges. July 18th. (July 26th, 1913. Addition to 18,102/13.)

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Vol. LXXVII.] CONTENTS: August 20, 1915. [No. 1,969.

Page
German Industry and the War 225
Lead 226
Lamp and Lighting Developments in the Near Past and Future, by L. Crouch 227
The Selling Side of Electricity Supply.—III. 228
Electricity Supply in Melbourne... 229
A New Printing Telegraph System (*illus.*) 230
Two American Electric Furnaces (*illus.*) 233
Comparative Costs of Various Types of Pit Locomotives ... 234
New Electrical Devices, Fittings and Plant (*illus.*) 234
Correspondence—
Staff Engineers and Labour Exchanges 236
Units from Refuse 236
The Late Mr. Robert Hammond 236
War Items 236
Legal... 237
Business Notes 237
Reviews 241
Hints to Applicants for Situations, by Ernest C. McKinnon 243
Notes 244
City Notes 246
Stocks and Shares 247
Share List of Electrical Companies 248
Market Quotations... 248
Exports and Imports of Electrical Goods during July, 1915 249
Alternating-Current Cable Telegraphy, by Edward Raymond-Barker (*illus.*) 250
Some Wrinkles on the Operation of Alternators, by E. B. Pausey 252
A New Battery Signalling Bell, by W. M. Thornton (*illus.*)... 252
Trade Statistics of Italy 254
Foreign and Colonial Tariffs on Electrical Goods 255
New Patents Applied for, 1915 256
Abstracts of Published Specifications 256
Contractors' Column ... ... Advertisement page xviii

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GERMAN INDUSTRY AND THE WAR.

MUCH attention has been given of late by our French Allies to the past and future relations between their industries and those of Germany, and an intense desire to free themselves from the fetters which their enemies have forged about them has been manifested. Every effort is to be made to enable France, by her own resources and those of her Allies, to become independent of imported German products, and if possible to exclude them altogether. To this end the Société d'Encouragement pour l'Industrie Nationale has organised a series of lectures by specialists upon the means to be adopted in the industrial war which will inevitably follow the military struggle, and seeing that we have to face a similar problem, the views expressed are of interest to ourselves. One of these lectures was delivered by M. Henri Hauser, professor of the University of Dijon, who demonstrated that the war was not due, as commonly held, solely to the ambition of the military party in Germany, but mainly to the excessive and too rapid development of German industry and commerce, which rendered war, if not a necessity, at any rate so tempting a proposition, even to financiers and business men, that it could not be resisted. Germany is by no means over-populated and in need of room for expansion, although she may have laboured under that hallucination; in point of fact, emigration from her shores fell from 200,000 a year in the eighties to a tenth of that number of late, while some three-quarters of a million of foreign workmen enter her bounds each year.

The evolution of German industry, which in 40 years has raised the Empire from commercial obscurity to the second place in the ranks of industrial nations, beaten only by Great Britain herself, is to M. Hauser a most remarkable phenomenon; it has been achieved not by spasmodic efforts, but by patient, tenacious, methodical labour, never relaxed. Germany possesses a genius for organisation, for utilising men and drawing from each the maximum output, and if she apparently has lost the talent for making great new discoveries, she is expert in the art of applying the discoveries of science to industry; her prosperity is due to the union of the laboratory and the workshop. The rapid rise of German industry deprived it of the long and slow preparation which characterised that of Great Britain, and had the gravest effects upon the internal economy of the country, foremost amongst which were the migration of the rural population to the towns, and the abrupt cessation of emigration to foreign shores. An agricultural state is independent and self-contained; but the industrial state which thus took the place of the agricultural had totally different wants, including imported food and raw materials, capital, and clients; thus it was no longer self-sufficient, and the "World-policy" was forced upon it, with its subsidies, cartels and external "dumping."

In addition to the open and above-board methods of pursuing this policy, M. Hauser describes how the German "tentacles" have laid hold of French industries, under disguise—and not only French, but also Russian, Turkish, Italian, Swiss; not only do they control the industries, but by holding the shares in the pseudo-native companies they convert the financial system into a veritable pump, sucking wealth in Italy or Switzerland, and discharging into Germany. They suborn the Press, and corrupt political life in the countries that they infest. Above all, Great Britain was the most prominent competitor with Germany, and it was necessary to bring about her downfall. By degrees the idea of a necessary, almost desirable, war grew upon the industrial classes, and the extent of its hold is proved by a study of German literature, from which a warning could have been derived had it been heeded, for years ago it plainly outlined the future trend of German policy and the inevitableness of war.

The Germans, in their dreams of the future, look forward to an industrial victory—to the triumph of the business man. That dream has proved illusory: "Time does not spare that which is made without it." But none the less, when vanquished by the Allies, Germany will patiently and obstinately resume her labours, and those who would not be crushed must *now* mobilise their forces for this new war.

In a note published in the *Bulletin* of the same Society, M. Henry Le Chatelier criticises the tendency of many industrials to take too narrow a view of the situation, limiting their proposals to the establishment of new tariffs, the extension of working hours, the demand for the banks to support French industries more effectively—all proposals which require no effort on their own part but involve increased cost to consumers. He also attacks the suggestion that scientists should be called upon to place their services at the disposal of industrials, pointing out that the former cannot dip into this or that subject at random, unless they either charge fees out of proportion to the services rendered, or accept a remuneration equally inadequate to compensate them for their work. The scientist is not an Admirable Crichton, able to pronounce a valuable opinion on every subject under the sun; his value lies in the *scientific method* on which he works, and the proper course is for the industrial to give continuous employment to engineers and chemists at adequate salaries. In Germany every works has its own laboratory. In addition to these private laboratories, there should be syndicated laboratories working for all the firms in a particular industry, to prevent waste of effort by overlapping and retraversing the same ground; and above all these should be the great State laboratories, such as our National Physical Laboratory, collaborating with the lesser ones. This system is largely responsible for the success of German industry. On the other hand, it entails the gradual disappearance of the small factories, and requires the possession of knowledge of laboratory practice on the part of the technical directors of works. The small works cannot afford the cost of maintaining a laboratory, or of the technical and commercial organisation which is indispensable to low cost of production, high quality of products, and an assured outlet for them.

Unless the technical director is familiar with laboratory practice, he will be incapable of utilising a laboratory to advantage; he will not know what problems to entrust to it, or how to define them, and his laboratory will be a white elephant. M. Chatelier deplores the exaggerated importance attached to mathematics and abstract science in France, whereas the urgent need is the study of the experimental sciences, upon which all industry is based; provision must be made to fill this want.

To meet the German competition it is useless to attempt to erect insuperable barriers; it is necessary to adopt their methods of working. The process involves a somersault of opinion on the part both of the Government and of the industrial world. Our Goverment has already executed that feat, and shows every indication of earnestness and sincerity in carrying out the new policy; but without the concurrence of our industrials the effort will be in vain.

It is useless to place fine tools in the hands of unskilled labourers, and that will be the effect of training young physicists and chemists for research work if they are to be subordinate to men who are incapable of utilising their abilities to the best advantage.

Lead.

Lead has had a sharp depreciation in prices since last writing, but the decline has probably proceeded about far enough, and there have been intervals, indeed, when the market has assumed a decidedly more healthy appearance. The wholly fictitious level of values, which has been brought about largely by excessive speculation both in America and on the London market, has been followed by the usual aftermath of liquidation, and the past fortnight or so has seen a thorough weeding out of the overbuilt fabric of "bull" commitments. There is no doubt that the original speculation in the United States, which put up the price of lead on this side momentarily to £30 a ton, was intimately connected with share considerations, and had little or nothing whatever to do with the position of the metal. The upward swing in America, of course, brought in a lot of rag-tag buying here, and this has been the source of trouble ever since, because those who bought lead as a speculation being, as is too often the case, unwilling to cut their loss, have held on, and disastrously. The existence of this unhealthy element in the situation was, of course, perfectly well known in the market, but it has by now been practically all eliminated, and to this extent the technical position is undoubtedly much better than it has been for quite a time. Considered from a purely statistical point of view, the price of lead should certainly be quite high enough, as will be seen from the following details, showing the United Kingdom imports of pig lead and sheet lead during recent months:—

	July.		Jan.-July.		
From	1914.	1915.	1914.	1915.	
Spain	7,082	10,140	49,371	61,903	tons.
U.S.A.	2,846	1,760	13,296	38,877	"
Mexico	233	—	1,595	250	"
Australia ...	5,940	10,059	45,370	46,455	"
Other countries ...	1,653	1,961	18,226	11,158	"
Total ...	17,754	23,920	127,858	158,643	"

The excess of supplies this year over last, as will be seen, exceeds 30,000 tons, the most remarkable increase being in connection with the United States, which country has increased its contribution by about 200 per cent., while Spain is more than 25 per cent. up. There is practically no alteration in the amount coming forward from Australia, while in respect to other countries there is a falling-off. All accounts agree that the actual amount of business being done by the general consuming trade shows a very distinct reduction compared with the pre-war period. On the other hand, it must be remembered that the consumption of lead for munitions purposes is on a wholly unprecedented scale, and that huge requirements in this connection are inevitable until the war is actually over. Large demands for pig-lead continue to reach the London market from Russia, and considerable quantities of lead are being dispatched from here to our Northern Ally, the total shipments of English and foreign lead from British ports during last month being about 4,000 tons. Further permits for shipment continue to be issued, and this tends to wipe out the excess quantities of metal arriving here. Production has been greatly stimulated by the prevailing high range of prices, and when this point is given the prominence which is due to it, the tendency is rather to take a rather conservative view of price movements in the near future, though there are always, of course, speculative elements to be considered.

LAMP AND LIGHTING DEVELOPMENTS IN THE NEAR PAST AND FUTURE.

By L. CROUCH.

Artificial lighting is largely out of season just now, partly by reason of the long hours of daylight, but chiefly owing to the real and supposed military exigencies—to which one accedes, but not without mental reservation of many kinds concerning the necessity and *rationale* of certain regulations ! Nevertheless, the present seems a more favourable opportunity than has existed for many years past for taking stock of the means of lighting at our disposal, and in particular for examining whether the lines along which lighting has been developing during recent years, are desirable and suitable for further pursuit when peace again reigns, and provision, rather than obliteration without extinction, of artificial lighting again becomes a practical problem. In resuming possession of home trade, and in extending our lamp and lighting activities abroad, it is very desirable that we should follow the best lines compatible with local conditions and demands. Both in lamps and fittings we are engaging on a good deal of new work, and at the time of taking this up, and during the temporary suspension in many more or less established lines of activity, there is an opportunity which will not recur to set our old furniture in order, and see that our new ventures are well started.

Devoting first a few words to the most obvious phase of present public lighting—its absence—there are some useful lessons which have been and may yet be learned from this. The circumstances of wholesale reduction of lighting were so urgent and unprecedented that no doubt the first means adopted were far from the best. When it became obvious that dim lighting would be required for a considerable period, numerous efforts were made to improve the results, while still conforming to the requirements of the authorities. Guided by experience gained from the first crude methods, a considerable measure of success was secured, showing that abnormal and temporary as the present conditions may be, they are capable of yielding permanently beneficial results. Taken all in all, the inconvenience of reduced lighting (as *now* reduced) is far less than could ever have been anticipated. Except in isolated cases there is little difficulty—at any rate in the writer's experience—in seeing kerbs, pedestrians and vehicular traffic, though he must confess to frequent anxiety as to whether the drivers of 'buses and taxis can pick him out before they run into him. In the more dimly lighted streets, instances of almost complete invisibility by a sort of natural protection or light-and-shade matching, are often to be observed. No doubt the Purkinje effect is frequently operative ; for instance, it is often impossible to see the scarlet armlet of the National Guard.

Through all the dimming of street lamps the object in view—or which ought to have been in view—was to give as satisfactory traffic illumination as possible and as little light as possible directed upwards, whether directly or by reflection, diffusion and haze forming. Such an end is, broadly, desirable in peacetime as well as when unwelcome aerial visitors are expected, and it will be a great pity if advantage is not taken of the present opportunity to investigate completely the question of the best polar distribution for street lighting—particularly with regard to the use of new types of globes and reflectors. The public have become accustomed to a state of affairs very different to the hitherto accepted standard, and before reverting to the old and often crude system of street lighting, steps should certainly be taken to see if permanent good cannot be brought out of the present evil. It is not likely that ever again so good an opportunity will be found for conducting street lighting experiments on a large scale, and with variations from accustomed systems which could hardly be tested after the old order of things had been even temporarily restored. The result of improvements in this direction would naturally be more effective lighting at reduced cost.

At the other end of the scale to the street lighting now provided in our cities, lie the "White Ways" of America. Many of these are very fine in appearance, but others are literally glaring atrocities. Still, whether good or bad as judged by us, "White Ways" undoubtedly appeal to the American temperament, and effectively "boost" a street or town (again to Americans). To that extent they justify their existence, and by the same argument they are hardly likely to find favour in their most aggressive form in this country. Our own display lighting is relatively unobtrusive, the American style being generally reserved for fair grounds.

We might very well imitate America, however, in dealing with street lighting problems more lavishly. For instance, very large scale comparisons have been made in Chicago between half-watt tungsten and arc lamps for street lighting, and as a result of these tests it was decided to utilise the former as a standard in place of the latter, which were adopted two years ago, some 10,000 being in use. Imagine the amazed consternation (and uncompromising disapproval) with which the British anything-but-electrical Electricity Committee would receive such a suggestion ! The Chicago tests were probably the most complete yet made as between half-watt and arc lamps, and it is interesting to note that they decided in favour of the newer lamp which has, of course, lower nominal efficiency than any arc lamp. The arcs to be replaced are 450-watt units, yielding 1,100-1,200 maximum c.p. at 30° below horizontal. This candle-power is subjected to 8 per cent. absorption loss by a new inner globe, and to nearly 50 per cent. loss after the globe has been in use for a time, owing to deposits and etching, which brushing will not remove. Even washing the globe restores only three-fourths the original efficiency, so that practically the same working illumination is obtained from 300-watt filament lamps giving 600 maximum c.p. and provided with prismatic, refracting globes to obtain improved lateral, long-distance distribution. Maintenance costs are estimated to be the same at present for arcs and half-watt lamps, and will be less for the latter when longer life than 1,000 hours can be guaranteed (actually, it is already often obtained). The first cost of the tungsten equipment is half that of the arcs.

Even more important than the elimination of former defects in public street lighting after the war is the proper control of privately-owned lamps and signs on the exterior of buildings. What is needed in the electric sign field in particular is fewer restrictions and more control. During recent years the restrictions in most cities in this country have practically prevented the development and use of really effective electric signs, but they utterly failed to suppress many which are an eyesore by day and a nuisance by night. In this respect, again, it must be admitted that the States are far ahead of us. Of electric signs as they are understood in the States, we have here no examples. Where our signs are not hopelessly prosaic, they generally suffer from one or more of the defects of unsuitable lighting, erection and operation. The average man will look longer and with more interest at a sign which is really artistic and interesting than at one which is simply a startling jump and glare. It is difficult to see any difference in principle between a badly-designed, placed and operated advertising sign and a man who shouts out of his window or commits other nuisance to attract attention. One of the most elementary measures which might be taken to improve matters is to insist upon architects making some provision for the harmonious accommodation of electric signs when designing buildings on which it is certain such will be used.

Whether the illumination of the exteriors of buildings as a whole is desirable, or would appeal to people in this country, is a very moot point, but in this as in their best electric signs, American engineers employ surprising amounts of energy and obtain very effective results. The illumination of the outside of the Woolworth building, for instance, absorbs 175 kw. (approximately the maximum station load in such towns as Grangemouth, Cromer, Berwick, Carnarvon, Dorking or Bray). Six hundred 250-watt nitrogen-tungsten lamp projectors are used, in addition to 24 1-kw. lamps in the tower. Some of the projectors shine upwards and some downwards along the face of the building, which is bathed in light without the source of the latter being obvious or in any way annoying. The *motif* of this scheme is, again, a matter of national temperament, but from the illuminating standpoint it is unquestionably a triumph. To descend to a much humbler but perhaps more utilitarian plane, similar methods might very well be adopted here in the illumination of poster hoardings. As ordinary mortals we would gladly see every hoarding swept off the face of the earth, but as advertisers are hardly likely to agree to such a proposal, electrical manufacturers and central station engineers should take active measures to point out that a properly lighted hoarding is more effective and pleasing by night than by day. There is still room for much improvement in the means of lighting extensive vertical surfaces and in determining the most effective nature and amount of light. By using a number of differently coloured lights in turn (with an intermediate and longer exposure to white light), considerable attention could be attracted by the weird colour distortion produced; during the illumination by white light, the watcher "takes the medicine!"

Agreed as we all are on the desirability of low intrinsic brilliancy in luminous sources, it is curious that we seem ever to get further away from our ideal. The reason is, of course, that we employ almost exclusively lighting by *incandescence*, so that every improvement in efficiency depends on higher working temperature and increased intrinsic brilliancy. The effect of the latter is to increase the importance of fittings (reflectors, refractors and diffusers) which alone produce tolerable results from an intolerable source and distribute light which is generated economically but very locally, in an economical and suitable manner. The use of appropriate fittings is practically inevitable with all high efficiency lamps, and though this frequently involves considerable loss of efficiency in some directions, the fitting often does much to pay for its absorption losses by recovering and applying rays which would otherwise be wasted.

Though the view may be very heretical, the writer is strongly of the opinion that in many directions "scientific" precepts have been carried too far in illuminating work; too much importance being attached to the almighty foot-candle and the power expenditure necessary to provide it. Illuminating engineering itself is anything but an exact science, and there are so many variables and so many empirical factors concerned, that it is difficult to see that the "design" of illuminating schemes can ever be much more than the application of glorified "rule of thumb." It must be admitted, at least, that many of the rules and methods advanced encourage a false sense of security, and are apt to give very disappointing results when applied by "illuminating engineers" of limited experience and great faith.

Just as the managers of commercial and manufacturing undertakings are coming to realise that the total cost of lighting is a trivial fraction of their total operating expenses, whilst the extra cost of good as compared with bad lighting, is yet more negligible, so the ordinary householder is realising that the total cost of lighting is not a serious item if modern electric equipment be used, and that it is worth paying a few pence a week for a more pleasing effect with a little less efficiency. Those fittings which give the highest efficiency always look, somehow or other, as though they were doing it. There seems always an air of cold virtue and severity about them and their illumination, which contrasts unfavourably with the cheery and somewhat *mechant* air of fittings which are less particular about a few per cent. absorption and misdirection. The writer would not for a moment suggest that inefficiency is desirable *per se*, but simply that the most pleasing effects seem always to be obtained with equipment which is not of the highest possible efficiency, and there is no doubt that psychological effect is an increasingly important factor in determining the commercial success of lighting equipment.

It is no use telling or even proving to a man that a certain lighting scheme is the most economical available for his home. The argument may prevail outwardly, but if the "effect" of the lighting scheme is not right, that scheme is not, and never will be, satisfactory. Foot-candles and distribution may be perfect as judged by the most voluminous tables and formulæ in the illuminating engineers' pocket book, but if the room does not *look* right to plain Mr. Smith directly he enters, the probabilities are that it is *not* right. There are elements in illuminating engineering which cannot be expressed by figures and factors—prejudices, if you will—which cannot be overcome by "educating the public."

(*To be continued.*)

THE SELLING SIDE OF ELECTRICITY SUPPLY.—III.

The internal arrangement of showrooms offers scope for a great deal of ingenuity. In giving play to this, however, one must not lose sight of the demands of good salesmanship. Having through the effect inspired by the window display induced the prospective customer to walk in for a further inspection, everything must be done to turn that first curiosity into something more concrete; therefore no less attention and care is required inside than is bestowed on the front. Size and shape must determine the general lay-out. The ceilings and walls are naturally claimed by fittings. With regard to these, although their sale is not regarded as the main objective, it is usually an important branch of showroom business; properly equipped it will be a convenience to many contractors who are without extensive showrooms of their own. A sufficiently large turnover must be obtained therefore, to secure the over-riding or factors' discount that will enable you to sell to the trade; for the contractors who come to you will naturally expect the full discounts to which they are accustomed.

A great many shops are oblong in shape, and where this is the case it lends itself very well to breaking up, so as to display panels of fittings. One of this nature recently inspected had been arranged with a considerable amount of skill and taste. The ceiling had been divided into four sections by three rows of corona dining-room pendants. There were four of these in a row, at both ends of each row two 2-light bedroom counterweight fittings were fixed, and, closer still to each wall, two hall lanterns. They had thus a display of one dozen dining-room fittings, one dozen bedroom slide fittings, and a dozen lanterns, which showed up very well without any appearance of crowding. The spaces between the rows were filled with various cord and chain suspension fittings, mostly of the three and five-light variety. At the extreme ends were rows of single-light drop pendants. Coinciding with the spaces broken by the rows of dining-room pendants, the side walls were divided off into four panels on each side. These panels were fitted up with a large number of various types of brackets, several panels being reserved for period styles. Round the showroom three narrow benches were fitted forming three steps up from the floor. These were filled with appliances, radiators, etc., broken here and there by standard lamps. The general effect was excellent, the pretty coloured silk flounces of the dining-room pendants and the shades of the standard lamps making it quite a fairy-land, and no doubt many visitors were induced to look in on that account.

An ambitious showroom assistant should familiarise himself with the principal styles of architecture and interior decorations; a superficial knowledge at any rate should be acquired. By superficial, I mean something more than *Aristide Pujol's memoria technica* for the instant recognition, by the vulgar, of the three orders in architecture, "cabbages, Corinthian; horns, Ionic; anything else Doric."

He should have some acquaintance with the principal French, English, and Dutch period styles, which should extend to some detailed knowledge of the dainty work of Adams Bros., Chippendale's choice frets, Sheraton's chaste designs, etc. Many people are very undecided and helpless in selecting fittings and welcome the assistance of the salesman if he impresses them as a man of good taste. One is often asked to suggest a suitable fitting for a room furnished and decorated in some special style. Some help can be had by studying the catalogues of leading manufacturers, as sections will usually be found devoted to the subject. Care is required, however, as frequently the classification is open to dispute, and some of the fittings have incorrect detail, giving bizarre effects.

Flemish and French, particularly Louis Seize candelabra, are very strong sellers, and are worthy of a good deal of space if the class of district in any way warrants it. A disadvantage (from the consumer's point of view) of candelabra is that considerably more current is required for illuminating a room than in the case of ordinary direct fittings. My experience of indirect and semi-indirect fittings is that these have not sold very well when mixed up with direct types. When shown in a room by themselves, however, they sold very well indeed, even with a display of only 40 pieces; the semi-indirect type appear to meet with the greatest favour.

There is a lot to be said for the semi-indirect fittings; from the station point of view the fact that about 50 per cent. more candle-power is required than with the direct style is a recommendation in these days of high-efficiency lamps. From the consumer's side they have the advantage that less wiring is required than for several bracket points, and one large lamp is cheaper to buy than several smaller lamps, and also much stronger. Then the well-balanced soft light, with a complete absence of eye-strain, alone provides a fund of argument for the fitting and for electric lighting.

ELECTRICITY SUPPLY IN MELBOURNE.

In the course of his presidential address to the Victorian Section of the Electrical Association of Australia, Mr. W. H. Alabaster compared the output of electric supply undertakings in Melbourne during the years 1904 and 1914. The number of units disposed of and the average price obtained for them during those years were summarised as follows:—

—	Units consumed.			Average price obtained (pence).		
	1904.	1914.	% increase.	1904.	1914.	% decrease.
Light	3,302,973	12 739,742	285·7	4·46	3·57	19·95
Power and heat	986,189	14,776,853	1,398·0	2·19	1·46	33·3
Public lighting	1,440,151	1 985.915	37·9	2·52	1·25	50·4
Traction ...	—	5,102,015	—	—	1·10	—
Bulk supply ...	—	1,395,251	—	—	1·49	—
Total	5,729,313	35,999,776	528·0	3·58	2·14	40·2
No. of consumers	2,256	29,316	1,200			

This comparison, he said, denoted substantial progress made in so short a period, but the possibilities ahead of them were still greater. Increased sale of current, provided that the increase did not adversely affect the existing load factor, had the effect of decreasing practically every item of expenditure, which made materially for lower selling rates.

The average price of electric light in Melbourne compared favourably with that obtaining in the old world. It was not until recently that sufficient inducement was held out to the large manufacturer to relinquish his existing motive power in favour of a supply from the power station. Suitable modifications of the tariffs had now been introduced, and it was certain that the consumption for this purpose would be greatly increased.

The average price obtained per unit for private lighting had decreased 20 per cent., and the increased efficiency of metal filament over carbon lamps might be taken at 200 per cent., so that for equal lighting the consumer now paid about 27 per cent. of what he paid in 1904. A half-watt lamp would, of course, greatly improve upon these figures; from what he had seen of these lamps, they had a very large future before them. Taking the average life of a 130-watt ordinary tungsten lamp as being 1,200 hours, the higher efficiency of the half-watt lamp would pay for its additional cost during a life of 450 hours when current was charged at 3½d. per unit.

The consumption of energy for power and heating purposes showed a wonderful advance during the period under review, and there was every indication of the rate of increase being not only maintained, but accelerated. The supply of energy for refrigerating purposes had been responsible for a considerable portion of the power load recently obtained, and this supply, with its load factor in the region of 100 per cent., was very welcome to the supply undertaking.

In the near future, units supplied for cooking and water heating would be in demand on every day in the year and at any time of the day or night. With a view to obtaining the fullest information, he had so equipped his kitchen that the whole of the cooking and water heating (except bath water) was being carried out electrically, and during the last 16 months he had tried various types of apparatus. The consumption of current during that time (including current used for ironing) had averaged 32.6 units per week for a household of three adults and one child. He was convinced that reliable apparatus was obtainable, and that faults were more likely due to the manner in which the apparatus was installed and to unsuitable flexible cords, etc. Meat or pastry cooked in an electric oven was infinitely preferable to that cooked in a gas oven. There was, however, room for improvement in the appliances designed for boiling, as the cost of vessels with self-contained elements did not permit of the same range of vessels generally associated with the gas ring, and hot plates at present were too slow. The latter difficulty would probably be shortly overcome either by the hot plate with oil-immersed element or by the radiant type of plate. One of the latter type showed an overall efficiency of 53.7 per cent. when raising three pints of water to boiling point, which was equal to the best results obtained with existing types of hot plate. This efficiency was increased to 67 per cent. by roughening the bottom of the kettle and to 75 per cent. by blackening it. The rapid heating of large quantities of water, such as were required for a bath, was not practicable at present; a much more satisfactory arrangement was to provide a well lagged cistern, and to heat the water by means of a small quantity of energy, supplied over a long period. He had had one of these cisterns in his kitchen during the past four months, and it had been found very useful in supplying all the warm water required in the kitchen, and also for a child's bath. Such apparatus, with its high efficiency and load factor, could easily compete with the heating of water by other means.

Perhaps the greatest obstacle to the advance of electric cooking was the first cost of the appliances and of their installation, but this was largely due to the very small demand. In order to introduce it satisfactorily, it would be necessary for some responsible body to obtain complete outfits in large quantities and to dispose of them by means of some system of hire purchase.

Suppliers of cooking apparatus stated that the present inadequate tariffs were responsible for the small demand and consequent high cost of apparatus, whilst undertakers replied by questioning the use of a special tariff for so small a number of consumers. He thought the supply authorities should take the first step, and by introducing a suitable and payable tariff, they would very soon increase the demand.

The individual load factor of an average consumer was undoubtedly very poor, but he reckoned that the average annual load factor of a number of such consumers would be equal to about 25 per cent. He estimated that from 1,000 to 2,000 cooking outfits could be connected without increasing the maximum demand upon the generating station.

For the tariff, he preferred a system wherein a fixed monthly charge (depending upon the size of installation or probable m.d.) was made, and a secondary charge for every unit consumed. The present was a very opportune time for the adoption of such a tariff, as it would tend to guarantee a definite annual revenue to cover the fixed charges, which were now met by the higher rate charged for lighting.

With regard to public lighting, the advance had been at least as marked as in any other of the spheres of electric supply; here also, reduced cost per unit had been combined with greater efficiency in lamps used.

Ten years ago they had no electric traction in Melbourne, but now there were some 56 miles of single track in successful operation, with 46 miles in course of erection. These were all additional lines erected to meet the great demand for this form of transportation, and the electrification of their tramways, which must be commenced shortly, would greatly increase these figures. The electrification of their suburban railways was one of the biggest projects of the kind ever undertaken, and would greatly widen the field of the electrical industry in Victoria during the next few years.

Recent years had seen electricity supply extended to the majority of their suburbs, and although extension by any means was preferable to none, it was obvious that some of the modes employed were not the most economical and efficient. A number of the local councils, desirous of running their own systems, purchased current in bulk, and retailed it themselves; this might give fairly satisfactory results, but when matters were further complicated by such a council re-selling in bulk for distribution by a third party, the proceeding was manifestly inefficient.

The units disposed of by Melbourne supply undertakings during the year 1914 amounted to 36 millions, and it was estimated that in five years' time this figure would be augmented as follows:—

Private supply for light and power	35 million units.
Electrification of cable tramways	24 ,, ,,
Additional tramways	10 ,, ,,
Total increase	69 ,, ,,

This gave an estimated output of over 100 million units per annum, which, added to 129 million units, estimated to be generated for the suburban railways, would make a total output of 229 million units for Melbourne and suburbs.

The rapid extension of the undertakings had materially affected the systems of generation and distribution of energy.

Ten years ago (as at present) the major portion of the energy was generated by two stations, the centre of the city being supplied with D.C. at 460 volts, and the suburbs with single-phase A.C. supplied through 2,000-volt overhead feeders and house transformers. To overcome the unreliability, danger, and inefficiency of the latter system, underground mains had been laid to sub-stations, where the current was converted from 4,000 to 400 volts to supply local networks of bare hard-drawn copper. The size of generating units during the period under review had increased from 350 KW. to 5,000 KW. Owing to the difficulty experienced in obtaining reliable direct-current generators of sufficient size, it was deemed advisable to install three-phase generators at the supply station and obtain D.C. by means of converters. Most of these converters had been placed in a sub-station near the centre of that half of the D.C. area which was farther from the works, thus tending, not only to minimise the units lost in mains, but to increase materially the capacity of feeders already laid.

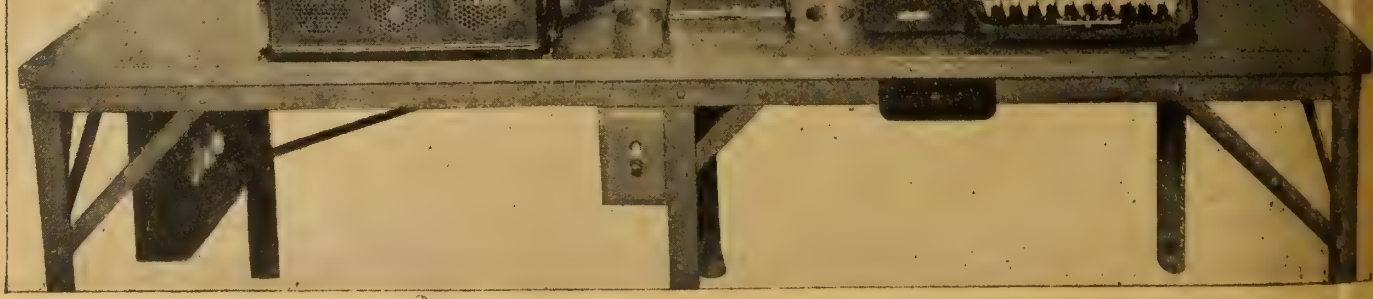
Three-phase supply was being given to some of the neighbouring municipalities, and it was intended ultimately that the existing single-phase system should be supplied from the three-phase generators by means of two sets of auto-transformers placed across the outers, so that eventually the whole of the generation in the city station might be carried out by the three-phase plant.

When the existing stations were designed, the huge outputs which he had forecasted were not anticipated, and in a few years the sites would become inadequate. When this time arrived, it would probably be advisable to select a site with access to fuel by land and water, and with an ample supply of water for condensing purposes. High-tension three-phase current would be supplied to the existing undertakings for the necessary transformation; and as the plant in existing stations became obsolete, or relatively inefficient, the load would be taken up by this new station.

A NEW PRINTING TELEGRAPH SYSTEM.

THE excellent work done by Mr. Donald Murray in developing first the automatic printing telegraph system, which we described in our issues of March 13th-April 3rd, 1903, and later the Murray multiplex system, described by the inventor in a paper before the Institution of Electrical Engineers (abstracted in the ELECTRICAL REVIEW, May 19th, 1911), is well known to our readers, and the latter has been extensively adopted by British and foreign administrations. In 1912, Mr. Murray sold his U.S. patent rights in the multiplex system to the Western Union Telegraph Co., and the latter entered into collaboration with the Western Electric Co., of Chicago, with a view to the development of the invention; a detailed description of the apparatus as manufactured by the latter company was recently given by Mr. PAUL M. RAINEY in the *Electrical World*, from which we extract the following particulars:—

Some of the various methods of operation which have been standardised are as follows:—



RECEIVER. TRANSMITTER. PERFORATOR.

FIG. 1.—COMPLETE TRANSMITTING AND PERFORATING EQUIPMENT.

1. *One-Way Method of Operation.*—This method provides one traffic channel, which may be used in either direction at the rate of 45 words per minute. This system is intended for short-haul traffic over lines comparatively free from inductive disturbance and not exceeding the equivalent of 30 miles of underground cable.

2. *Two-Way Method of Operation.*—This method of operation provides one traffic channel in each direction simultaneously without involving the use of duplex balancing apparatus. Its traffic-carrying capacity is equal to, roughly, 45 words per minute in each direction, or a total of 90 words per minute for the line. This system is operative over any length of line not requiring the use of repeaters. For economic reasons it would ordinarily not be used for lines longer than 500 miles.

3. *Double-Duplex Method of Operation.*—This method of operation provides two traffic channels in each direction. Simultaneous transmission in each direction is obtained by means of the duplex balance. The traffic-carrying capacity of the circuit is, roughly, 45 words per minute per channel, 90 words per minute in each direction, and a total for the line of 180 words per minute.

4. *Triple-Duplex Method of Operation.*—This method of operation provides three channels in each direction, simultaneous transmission in two directions being obtained by means of the duplex balance. The traffic-carrying capacity is, roughly, 45 words per channel, 135 words per minute in each direction, or a total of 270 words per minute for the line.

5. *Quadruple-Duplex Method of Operation.*—This method of operation provides four channels in each direction, the simultaneous transmission in two directions being obtained by means of the duplex balance. The traffic-carrying capacity is, roughly, 45 words per channel, 180 words in each direction, or a total of 360 words per minute for the line.

The methods of operation described above by no means represent the limit of flexibility of the system, for if line conditions will permit, the number of channels may be further increased. Moreover, the working speed per channel is not limited by the apparatus, but rather by economical operating conditions. Forty-five words per minute is thought to be an economical working speed. Satisfactory operation of the apparatus has been had at 52 words per minute per channel on a quadruple-duplex, thus making a total of 416 words per minute for the line.

In the case of the quadruple-duplex, triple-duplex, double-duplex, and two-way services, the messages are first prepared on tape by an operator using a keyboard perforator, as shown at the right of fig. 1. When each key of the perforator is depressed, several holes are punched in the tape, and their arrangement determines the combination of positive and negative currents which will be sent to line when the tape is fed through a transmitter (fig. 1) working in conjunction with a distributer (fig. 6). The impulses thus transmitted over the line operate a polarised line relay at the receiving station, which, in conjunction with another distributer, passes the impulses along to a receiving printer (fig. 1, left), which translates them into the predetermined letter or figure and prints them in column form, so that when a message is completed it may be torn off and is ready for delivery. If so desired, the message may also be received in the form of a perforated tape. This is accomplished by means of a reperforator which works in conjunction with the printer. The tape thus prepared may be used for retransmission on another line operated by any of the methods described above.

Ordinarily, for one-way service, keyboard transmission is adopted, instead of tape transmission. In either case the home printer may or may not be used to provide a record of all traffic passing over the circuit. However, when desired, use may be made of tape transmission for this class of service, which possesses the advantage of affording a simple and efficient storage of signals, thus keeping the speed of transmission constant. This is of particular advantage in operating over a difficult circuit; for example, a line which would easily permit of a fair average speed, but which would not be capable of transmitting the signals at the maximum speed of the operator.

The code used in this system is an equal-letter five-unit code; that is, each signal consists of five units or current impulses, and all signals require the same amount of line time for their transmission. This is generally known as the Baudot code, because of its use in the Baudot system, which has been extensively used throughout Europe, particularly in France, for upward of 30 years. In a five-unit code, assuming that each unit is represented by a pulse of positive or negative current, there are available 31 combinations which are sufficient for all the letters of the alphabet and the functions—carriage return, line feed, letter shift, figure shift, and space. The various figures and additional functions are obtained by preceding these signals by the figure-shift signal. Before returning to letters, it will then be necessary to send the letter-shift signal. In addition, the column printing feature requires signals to lift the paper vertically and return the carriage for a new line. The transmission of these extra signals over the line occupies line time, and this loss of time has been found to average about 10 per cent. of the working time, for ordinary telegraph traffic. In other words, the code employed in this system may be considered to average 5.5 units per character so far as line transmission is concerned. As regards the economy of line time, the five-unit code has an advantage over the Continental Morse code as 5.5 is to 9.08, an advantage of 65 per cent.

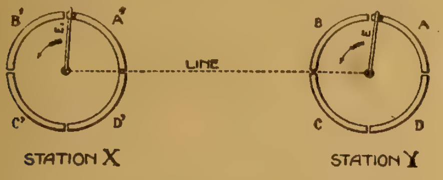


Fig. 2.—Diagram of Multiplex Operation.

The equal-letter code permits of the use of the multiplex principle, which is employed in the quadruple-duplex, triple-duplex, double-duplex and two-way methods of operation. Fig. 2 shows diagrammatically the method employed to secure multiplex operation. If each of two metal rings, one at each station, X and Y, is divided into four quadrants, A, B, C and D, at Station Y, and A′, B′, C′, and D′, at Station X, and rotating brushes E and E_1, are connected to the line as indicated, and if the contact brushes start from the same relative position and sweep over the contact segments with the same uniform angular velocity, quadrant A will be connected through the line with quadrant A′, quadrant B with quadrant B′, quadrant C with quadrant C′, and quadrant D with quadrant D′, once per revolution, the interval of each of these four connections being equal to the time of one-quarter of a revolution of the rotating brushes. If each signal consisted of one pulse of current, it would then be possible to send one signal per quadrant per revolution. If, instead of having solid quadrants, each is divided into five segments, it will be possible to use the five segments of one quadrant at one end for the transmission of five current impulses, which constitute the signal for a given letter or figure in the code just described, and the five segments at the other end may be used for receiving these impulses and distributing them in such a manner that they may be used to select the letter determined by the combination of impulses. In fig. 3 the quadrants are shown thus divided; each quarter of the circumference consists of five segments, each segment of quadrant A, station Y, being connected to a contact lever so arranged as to connect this particular segment with the ground circuit or battery, depending upon its position between the fixed contacts, while the segments of quadrant A at station X are connected to the relays as shown. Normally all of the levers 1, 2, 3, 4 and 5 are in engagement with contacts connected to ground. If, now, any lever is moved over to engage its battery contact during the quarter of a revolution in which the rotating brush E moves over the quadrant A, a current impulse will be transmitted to the line through the rotating brush E, and since the rotating brush E_1 is synchronously wiping over the segments 1′, 2′, 3′, 4′ and 5′ at the same time that the rotating brush E wipes over its contacts 1 to 5, the corresponding relay at station X will be momentarily energised. If provision can be made to change the combination of levers during the time that the brush sweeps over the other three quadrants, it will be seen that during each revolution a different signal can be sent from quadrant A to quadrant A′. What has been said regarding quadrants A and A′ applies equally to the other quadrants. Thus it will be seen that the multiplex principle permits us to send and receive four character signals per revolution. In actual operation the functions of the levers at the sending end, station Y, will be performed by the transmitter, and the operation of the five relays 1′, 2′, 3′. 4′ and 5′ is utilised in the printer to select the predetermined letter or figure. It will also be understood that by dividing the ring into a different number of segments it might be possible to send and receive a greater or lesser number of signals per revolution. What has been described above constitutes multiplex operation. If the line is worked duplex, the same can be accomplished in both directions at the same time. An essential requirement of such a system is that the rotating contact brushes at the two ends must be made to rotate in synchronism. This has been accomplished in the system herein described, the means employed being briefly as follows:—

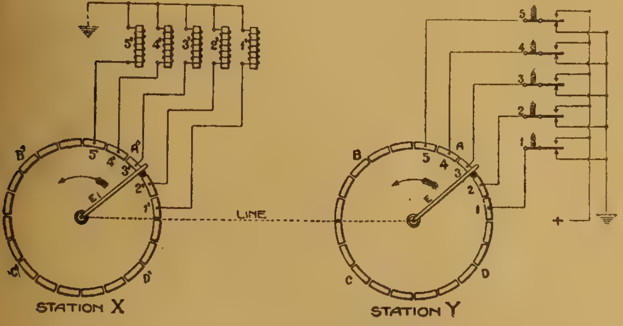


Fig. 3.—Arrangement of Five-part Quadrants.

Referring to fig. 4, it will be noted that segments 1 to 5 station at Y are connected to levers 1, 2, 3, 4 and 5, so arranged that they may send to the line positive or negative current, depending upon their position. The brush E connects these segments consecutively with the solid ring which is connected to the line. At station X the line is connected to ground through the windings 1, 2, 3, and 4 of a polarised relay. The tongue T of this relay is connected to the solid receiving ring R_8. The marking contact M of this relay is connected to a grounded battery, and when negative current from the distant end is passing through the relay the tongue rests on the spacing contact S. As the brush E rotates it connects the solid receiving ring R_8 with the receiving segments 1′, 2′, 3′, 4′ and 5′ of F_1 consecutively. The receiving segments are made shorter than the sending segments, so that the receiving brush E_1 picks out only the centre portion of each current impulse, or of each repeated current impulse, since the signals sent over the line are repeated by means of the polarised relay. Assuming perfect synchronism between the sending brush E and the receiving brush E_1 the receiving brush should be at the point C_1 midway between receiving segments 1′ and 2′ when the sending brush passes from segment 1 to segment 2, and at C_2 midway between receiving segments 2′ and 3′ when the sending brush passes from segment 2 to segment 3, and so on. Thus it will be seen that for a change of polarity, which can take place only when brush E passes from one segment to another, the receiving brush E_1 should be at some point in the circumference midway between two receiving segments. The receiving distributor is therefore provided with additional rings R_2 and R_4, called correcting rings. R_4 is a solid ring connected consecutively to the segments in R_2 by the brush E_2. These segments are half the length of the sending segments, and are, therefore, double in number. They are connected into two groups—*a* and *b*, as indicated. The brushes are so arranged that when the receiving brush E_1 is midway between any two receiving segments, say at O_1, the correcting brush E_2 is just about to engage one of the *a* segments, say at d_1. Circuit provisions are made so

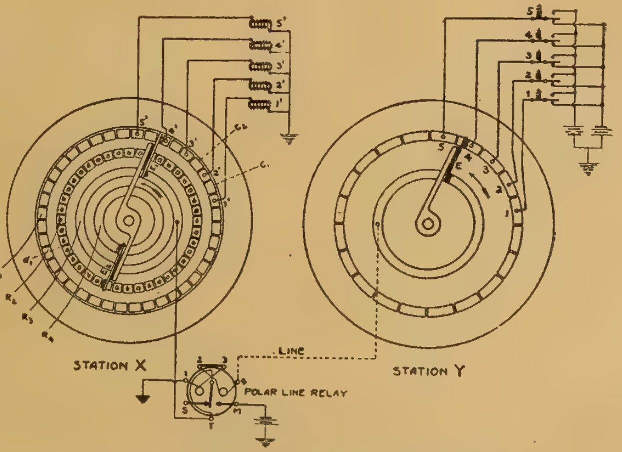


Fig. 4.—Connections to Synchronisers.

that a short pulse of current is generated locally at each reversal of the line current. When this reversal finds the correcting brush E_2 on an *a* segment it causes the operation of a mechanism which automatically sets back both brushes E_1 and E_2. Now, if the motor driving the receiving distributor is arranged to run slightly faster than the motor driving the sending distributor, the tendency will be for brushes E_1 and E_2 to be gaining, and the intermittent stepping back, as already described, will result in maintaining the receiving brush E_1 in the proper phase with the sending brush E at the other end of the line. It will thus be seen that at each reversal of the line current the position of the correcting brush on the segmented correcting ring determines whether a correction of phase relation shall be made. Since the motor at the receiving end is running faster than the one at the sending end, sooner or later it will engage an *a* segment at the time of a current reversal. This causes the brushes to be stepped back through a small angle, so that the current reversals take place only while the correcting brush is on *b* segments. Thus the signalling impulses are made to provide correcting impulses, which are used to maintain synchronism.

The shortening of the receiving segments to one-half the length of the sending segments provides an ample angle for this purpose. It also possesses the advantage that only the centre portion of the signal is utilised for signalling purposes, and the system is less subject to the effect of inductive disturbances. Diagram A, fig. 5, shows the form of signals sent to the line by the distributor. When the signals are received at the distant end, they are more or less distorted. Diagram B, fig. 5, illustrates this distortion. It is near the point of reversal at the time the line current is weak that inductive disturbances are able to affect or further distort the signals. If any advantage were to be gained, the segments could be shortened still further, since the relays operated from them are connected in local circuit and require a very short impulse for their operation. It will be appreciated, then, that the shortening of the receiving segments is not a sacrifice in any sense of the word. In actual practice the line is worked duplex and the sending and receiving distributors are combined and run by one motor, means for maintaining synchronism being used at only one end.

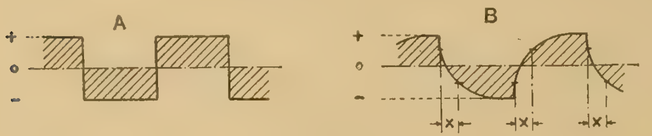


Fig. 5.—Distortion of Signals.

Fig. 6 shows the distributor face with the brushes. It will be noted that this is somewhat more complex than the diagrams which have been explained. The outside ring, No. 1, of this distributor is the receiving ring, only alternate segments being used for selecting purposes. The intermediate segments in each quadrant, however, are used for a specific signalling purpose, as will be described later in connection with the printer. The second ring from the outside, No. 2, is the correcting ring and corresponds to ring R_2 of fig. 4. The third ring, No. 3, is the sending ring and corresponds to the sending ring at station Y, fig. 4. The fourth ring, No. 4, is called the local ring and performs a very important function, which will be understood from what follows. Referring back to fig. 3, it will be remembered that while the brush is travelling over quadrants B, C and D, the combination of the levers 1, 2, 3, 4 and 5 should be changed to the combination of the next letter. Likewise, while the brush travels over quadrants C, D and A, the transmitting apparatus connected to quadrant B should change its combination to the signal of the next letter, and so on. At station X the printer connected to quadrant A′ receives a letter during one-fourth of the revolution, while the brush E_1 is passing over the segments of quadrant A′; but while the brush is passing over the remaining quadrants, B′, C′ and D′, the printer has time to complete its printing operation, move the paper and clear out, so as to be in readiness to receive another signal. The segments in this local ring, No. 4, are used to perform these functions; that is, certain segments are used to change the signal combinations set up in the different quadrants. Likewise, they are used to start the printing mechanism after selection has been made, so that it may be able to complete the printing operation in time to receive the signal for another letter. It will be noted that the brushes connect these various segmented rings with solid rings 5, 6, 7 and 8. Each brush holder is insulated from the spider, and the individual brushes are made up of a number of strands of small hard-copper wires.

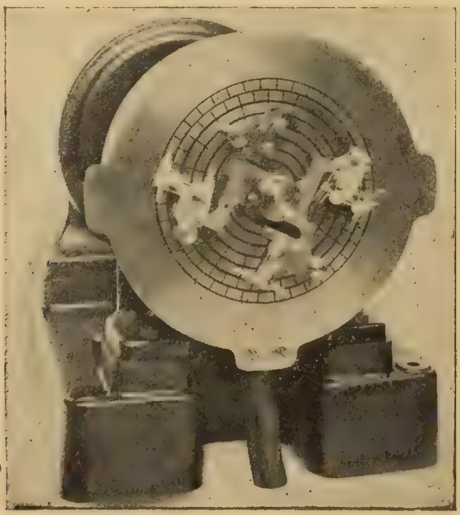


Fig. 6.—Distributor.

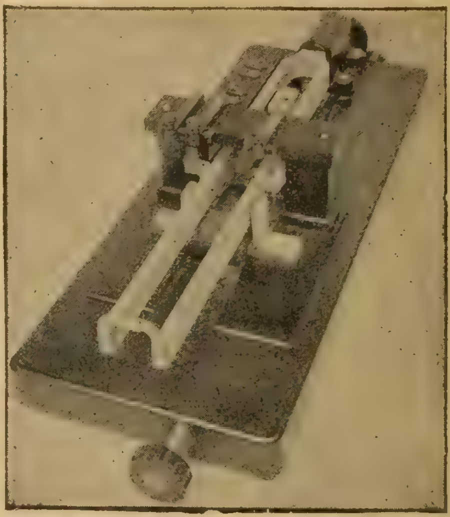


Fig. 7.—Electrically Driven Tuning Fork.

The motors used to drive the distributors are of the well-known phonic wheel type and are driven by impulses from an electrically driven tuning fork. This assures a constant rate of vibration, since the frequency of a tuning fork varies by only about 0.01 per cent. per deg. C., and is little affected by changes in voltage applied to the driving magnet. Fig. 7 shows the fork used, while the motor distributor and mechanical corrector are shown in fig. 8. The mechanical corrector, which is shown mounted between the distributor and the motor, is the mechanism which is arranged to step back mechanically the brushes when they have advanced too far, as already explained. The speed of the motor is determined by the rate of vibration of the fork. Large changes in the rate of vibration of the fork are accomplished by adding weights to the two prongs, a set of weights being provided with each fork. Small changes in the speed of the motor (a fraction of a revolution per minute) are obtained by turning the handle at the front of the fork, which, by means of gears and a screw, moves a small fork forward and backward. The shutters on the end of the prongs are used for stroboscopic observation and are not essentially a part of the system.

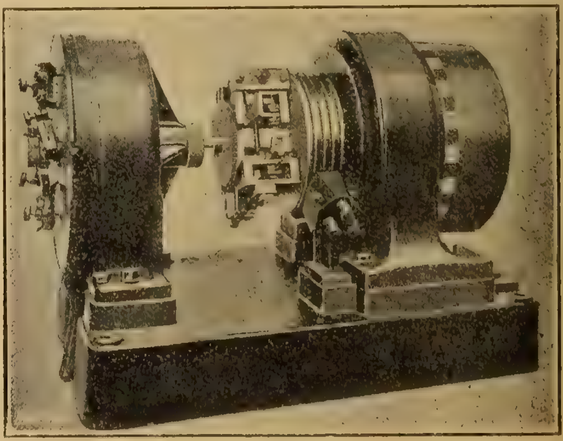


Fig. 8.—Distributor and Corrector.

(To be concluded.)

TWO AMERICAN ELECTRIC FURNACES.

Amongst the ever-widening uses to which electricity is now being put, none promises a greater sphere of usefulness than its application to furnace heating and for melting purposes. The electric furnace may be said to have gone a long way towards solving the fuel difficulty in those countries where solid fuel is costly and water power plentiful, and it is in localities where such conditions prevail that the greatest progress in electrical furnace practice may be expected. In the refining of steel in particular, the electric furnace is now playing an important part, as due to the greater accuracy of control and improved conditions of operation, a much superior product can be ensured, than under pre-electric conditions, and there are at the present time over 70 electric steel furnaces in use in Europe and America.

In a paper read at the San Francisco Convention of the National Electric Light Association, Mr. W. M. McKnight described the first Stassano arc furnace to be installed in the States. This furnace was at the Warman Steel Casting Co.'s works at Redondo, Cal., its introduction being due to the costliness of the crucible process on the Pacific coast.

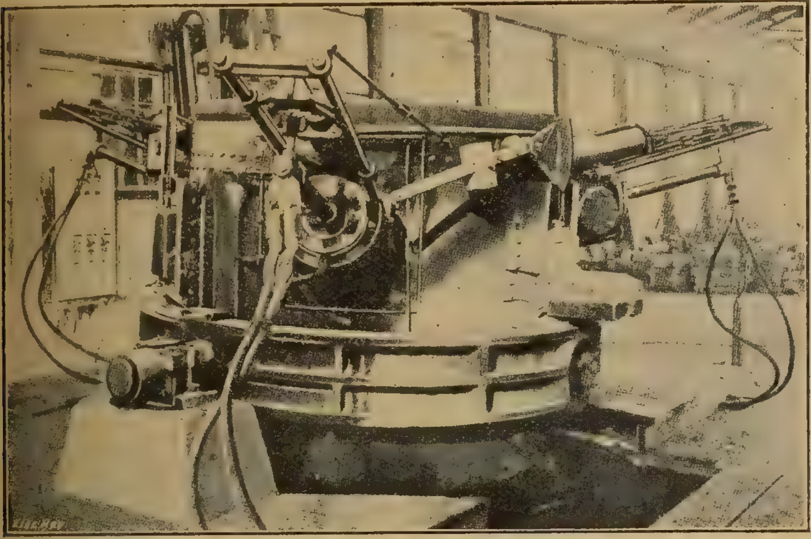


Fig. 1.—Stassano Furnace, Warman Steel Plant, U.S.A.

The Stassano furnace, which has now been in continuous use in these works since November, 1913, except for relining intervals, has a capacity of 1 ton, and six heats can be operated daily; deducting time taken in relining, there are 24 full operating days of 24 hours each per month. It requires two days three times a month to reline the furnace, magnesite bricks being used, the cost being $225 per lining, including labour and material, no cement being required.

The furnace turns out steel castings of up to 1,600-lb. weight for automobile fittings, gears, water-wheel buckets, and where great strength is required. Its primary features are a completely closed melting chamber, and a three-phase electric arc above the metal, preventing the carbon and other electrode impurities from entering the metal, and allowing a thorough mixing during any desired time. The metal reaches approximately 3,000° F. before being poured.

The furnace is suspended in trunnions and tilted for skimming and pouring the metal by means of gearing. The three electrodes dip towards the centre of the furnace at an angle of about 15°, converging to a point about 2 to 3 in. above the metal. The average arc is about 10 in. long, although at times an 18 in. arc is drawn.

While the original furnace was closed at the top, the Warman Co. has altered it so that the roof is removable and additional furnaces to be installed shortly will embody this improvement.

The carbon electrodes are 3½ in. in diameter and 6 ft. long and burn down to stubs about 18 in. long. The electrodes enter the furnace through a water jacket and are fed individually by hydraulic pressure regulated from control valves at an operator's stand, the water being circulated by a 2-H.P. motor-driven pump through a cooling tower to a tank which supplies the water jackets and the hydraulic control, under a 20-ft. head.

The current consumption of the furnace is from 800 to 2,000 amperes per terminal on a three-phase 150-volt circuit. Current is supplied through flexible cables connected to three single-pole double-throw and one three-pole double-throw knife switches, connecting the transformer secondaries in either interconnected star or delta, at pressures of 150 and 100 volts respectively, with the furnace.

To keep the balance a ground connection is tapped through an oil switch and overload release to the middle point of the Y on the main circuit. Heavy copper bus-bars lead from the switches to the secondary terminals of three 100-K.V.A. Westinghouse transformers, which are specially designed, oil cooled and wound for 10,000 volts primary and 110 to 150 volts secondary.

The entire consumption for the installation is registered by a primary meter, which together with the transformers is placed in a galvanised iron sub-station, and controlled by a 10,000-volt oil switch with overload trip coils; the service is protected by a fused pole-top switch operated from the ground.

The double transmission line is fed from two near-by substations, each having an approximate capacity of 2,000 KW.; these sub-stations are supplied from the Southern California Edison Co.'s 10,000-volt and 33,000-volt transmission lines.

Aside from steel, ferro silicon, ferro-manganese and anthracite coal having 90 per cent. of fixed carbon, are ingredients necessary to the finished product.

There is very little variation in load from day to day, as shown by graphic chart, the average demand being about 225 KW. The fluctuation of the load, which is non-inductive, scarcely affects the regulation of the 10,000-volt line.

Another American furnace described by Mr. W. P. Lass in the *Mining and Engineering World*, is one used by the Alaska-Treadwell Gold Mining Co. for treating by-products; this by-product, consisting of 2 tons of slag, 300 lb. of matte, 500 lb. of refinery refuse, flue dust, &c., was formerly treated in a 24-in. water-jacketted blast furnace, but in 1914 a single-phase electric furnace was substituted.

The furnace was constructed from an old steel acid drum, in the bottom of which a cable of bare copper strands was introduced, the strands being spread fan shape, and embedded in powdered graphite to form the lower electrode.

The furnace sides were built up of firebrick, leaving a chamber 14 in. in diameter and 20 in. high. The upper electrode is of graphite or carbon rod 3 in. in diameter, arranged to joint to new lengths without shutting down or wasting stubs. The arrangement of the furnace is shown in fig. 3. Three openings in the cover provide for feeding the charge, for gas escape and for the centre electrode, the latter being large enough to allow of charging round the electrode; escaping gases are extracted by a fan, the furnace being operated on a lighting circuit through a 50-KW., 60-cycle, 110-volt transformer.

A water rheostat is provided to lower the voltage when starting or when there is a bath of metal in the bottom of the furnace, which would otherwise allow too much current to pass. The material to be treated in the furnace is mixed in certain proportions, the material added during the melt being 8,507 lb., of which 5,870 lb. is by-product material—old slag, the residue from burning old mill launders, sweepings, &c., of the following percentage compositions:—SiO_2 40·1, Fe 16·0, CaO 16·1, Cu 5·9, Pb 3·0, Zn 5·7, Al_2O_3 2·0, S 3·6, moisture 4·0, gold $1,096·6 per ton. Coke is added to the charge as a reducing agent.

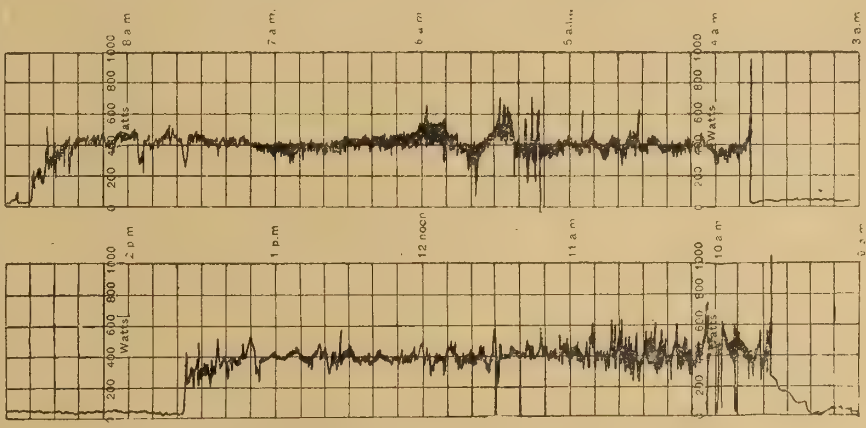


Fig. 2—Chart showing Load Variations, Stassano Furnace.

In starting, the furnace operates as an arc furnace until thoroughly hot, when the charge is added, the electrodes being raised as the current increases until the chamber is filled with the charges and the upper electrode extends into the melt a foot As the charge continues to melt, the electrode is moved, keeping the amperage nearly constant. At this stage the furnace has automatically transformed itself into a resistance type furnace, the molten charge acting as a resistant.

After the charge is in quiet fusion (about 2 hours 10 min.) power is turned off, and the charge allowed to settle before tapping.

Both graphite and carbon electrodes are used, the former costing $2.95 each, and the latter $1.20; power cost is less than 1 c. per KW.-hour.

The labour required for the operation of the furnace, including charging and tapping, is one half one man's time, when melting 1 ton in 24 hours. The following data is given :—

Running time, 128 hours 40 minutes.
Average weight, charge added, 160·5 lb.
Average fusion time of charge, 2 hours 25 minutes.
Total number charges, 53.
Graphite electrodes used, 1 per 24 hours.
Total power used, 4,440 KW.-hours.
Power per lb. material fed, ·52 KW.-hour.

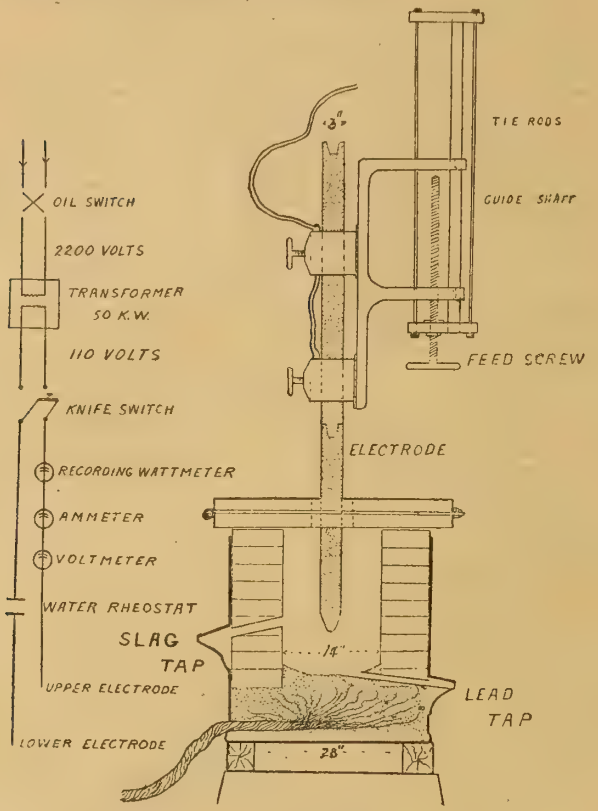


FIG 3.—SECTIONAL DIAGRAM, ELECTRIC BY-PRODUCT FURNACE.

The electric furnace shows a saving in mechanical loss of gold in flue dust; results in a lower grade slag, allows of fine temperature regulation, and benefits the health of the operators (who are not specially trained in its use).

COMPARATIVE COSTS OF VARIOUS TYPES OF PIT LOCOMOTIVES.

ALTHOUGH pit locomotives are very little, if at all, used in this country, the following data, referring to tests carried out under as similar conditions as possible in a number of German coal mines, are of interest as indicating Continental practice and experience; complete details of the installations and trials appeared in *Gluckauf*. The object of the present tests was to compare the costs of compressed air, accumulator, D.C. trolley and single-phase pit locomotives. The track and load conditions in the several cases examined are shown in Table I.

TABLE I.

Type of locomotive.	H.P.	Average gradient (parts in 1,000).	Length of route (metres)	No of laden trucks.	Weight of laden train (kg.)	Performance per 7-hour shift. Total t km.	Useful t. km.
Compressed air...	35	3 33	1,290	35	32 800	615	325
Accumulator ...	16	1·25	1,100	25	25,300	446	226
D.C. trolley ...	30	2·78	1,300	30	31,040	765	423
One-phase—A ...	30	3·45	1,500	30	29,150	815	392
—B ...	40	3·45	1,500	40	39,000	900	420
—C ...	30	+ 4·35; − 2·86; + 1·6	1,250	35	40,865	962	430

The battery locomotive installation was supplied from a 3,250-volt three-phase line through a rotary converter at the pit bottom, feeding a charging station in-bye. The overall efficiency from generator to battery was about 42 per cent., that of the battery alone being 65 per cent. The station output averaged 0·12 per total and 0·23 KW.-hour per useful (coal) ton-km.

The D.C. trolley installation was supplied through motor-generators from a 1,000-volt three-phase network, and the overall efficiency, allowing for light-load losses and 2 per cent. loss in the H.T. conductors, was 53·2 per cent. In this case, the station output was 0·08 and 0·15 KW.-hour per total and per useful ton-km. respectively.

Three types of single-phase locomotive were tested, supply being taken from 1,000-volt three-phase mains through track transformers supplying overhead trolley wires. The overall efficiency of this scheme was found to be 74·5 per cent., and the station output averaged 0·16-0·17 KW.-hour per useful ton-km.

The average total cost data as shown in Table II assume the cost of energy to be 0·35d. per KW.-hour, and allow 4s.-5s. wages per man per shift and 300 working days, each of two shifts, per annum: 5 per cent. interest is charged and 25 per cent. depreciation is reckoned on locomotives, 10 per cent. being allowed on H.T. equipments, converters, buildings, reserve plant, &c. The capital cost of the type of accumulator locomotive tested was £670, that of the D.C. trolley locomotive, £355, and that of the single-phase locomotives from £345 to £420. Part 1 of Table II assumes the locomotives to be worked to their full capacity; there is little difference between the total costs of the D.C. and single-phase trolley installations, but these are considerably cheaper than compressed-air locomotives and still cheaper as compared with accumulator locomotives. If the equipment is not worked to its full capacity, but is idle for, say, 1·5 hours in each 7-hour shift, it will usually be possible to refill air tanks or change accumulators during these intervals, and, by thus avoiding interruption of service for these operations, the specific cost of working air or accumulator locomotives rises more slowly than that of trolley locomotives, as is shown by part 2 of Table II. Where yet longer idle intervals occur in working, the specific cost of all the systems considered rises in about the same proportion.

TABLE II.

Total costs. Pence per		Accumulator.	Compressed air.	D.C. trolley.	Single-phase.
(1) Total t. km.	...	0·530	0·435	0·294	0 247
Useful t. km.	...	1·120	·822	·517	·494
(2) Total t. km.	...	0·587	0·435	0·340	0·305
Useful t. km.	...	1·150	·822	·646	·611

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electrically-propelled Chairs.

The expositions now in progress on the Pacific coast offer visitors the novelty and comfort of riding about the broad intramural avenues in silent, easy-going electric roller chairs. More than 200 such chairs are in use at the San Francisco fair, and a lesser number are in service at San Diego, where the accompanying photograph was taken.

Each chair carries two persons, one of whom steers and controls the chair. The average speed is about 3 miles per hour. Some of the chairs are equipped with extending bumpers which are connected with the control apparatus and brakes. If such a chair runs into an obstruction of any kind the pressure on the bumper instantly throws off the power and sets the brakes, bringing the car to a stop within a few inches. The battery equipment averages ten 150 ampere-hour cells, which are capable of operating the 0·5 H.P. motor about eight hours on one charge.—*Electrical World*.

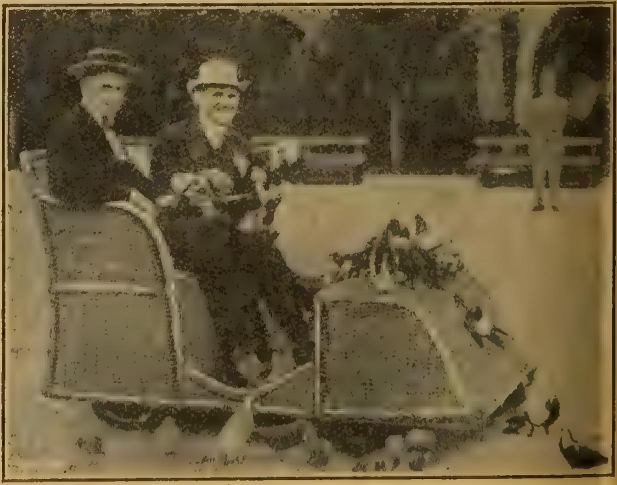


FIG. 1.—ELECTRICALLY-PROPELLED CHAIR.

Domestic Water Heating.

In order to get over the difficulty of water heating where consumers are substituting electric for coal ranges, the WASHINGTON WATER POWER CO., of Spokane, has developed an electric water heater, to be connected with the ordinary domestic hot-water tank, and operated when the customer's electric range is not in operation.

The heater consists of a brass tube about 3 ft. long, and having an internal diameter of 1·75 in. Around the tube is wound double spiral of square copper wire about 0·125 in. wide and spaced 0·125 in. apart. High-resistance wire is wound in the grooves on asbestos seats, and the entire unit is treated with three coats of enamel and then baked. To minimise heat radiation the unit is insulated with a covering of magnesia.

Tests made with this heater in actual use indicate the following results:—Starting with cold water in the tank, hot water was available in 15 minutes. By permitting the heater to operate during the entire night preceding washday, sufficient hot water was obtained for an ordinary family washing. From February 12th to April 1st, a meter on the tank showed a consumption of 636 KW.-hours, or 13·5 KW.-hours a day. An analysis of the earnings from 12 2-KW. ranges over a period of 100 range-months showed that they consumed on the average about 780 KW.-hours a year each, or 2·1 KW.-hours a day.—*Electrical World.*

Electric Supply in a Ball-Bearing Factory.

In the well-known Hoffmann ball-bearing factory at Chelmsford power is supplied for driving the machinery at 110 volts; the generators are driven by Diesel engines, and the first installation comprised two 220-KW. "Witton" generators coupled to three-cylinder Diesel engines, having cylinder dimensions of 450 mm. diameter × 660 mm. stroke. A recent addition to the plant took the form of a 700-KW. "Witton" generator driven by a four-cylinder Diesel engine, with cylinder dimensions of 510 mm. diameter × 660 mm. stroke. This engine has water-cooled pistons and cylinders. At the low speed of 187 R.P.M. the machine had large dimensions, and the problems involved in its construction can be realised by the fact that the full load current of the generator is 6,400 amperes. Special care was taken in the design and construction of the commutator and brush gear, a split commutator being adopted to carry the heavy current. An interesting feature of the installation is the fact that the machines are equipped with "Hoffmann" roller bearings.

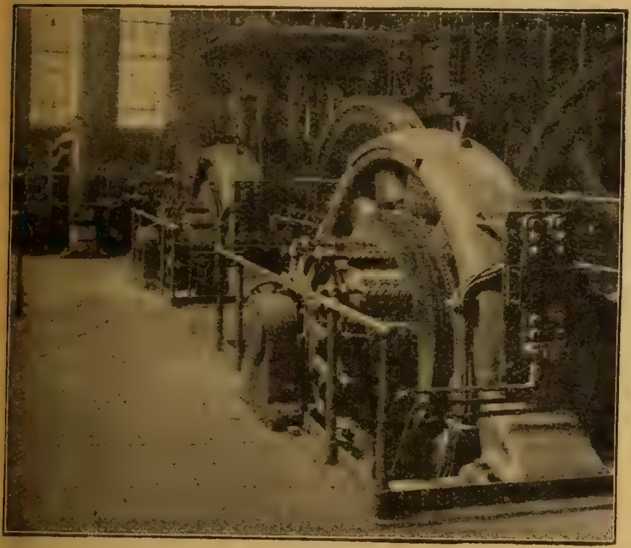


FIG. 2.—GENERAL VIEW OF THE TWO 220-KW. AND ONE 700-KW. "WITTON" GENERATOR IN THE BALL-BEARING FACTORY OF THE HOFFMANN CO.

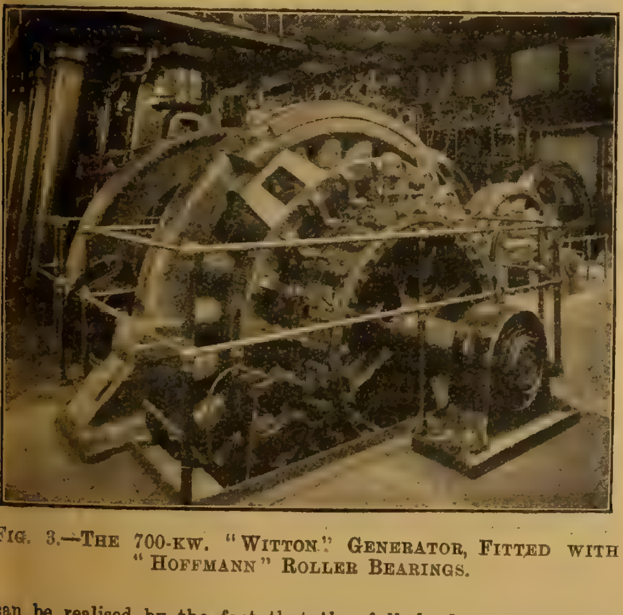


FIG. 3.—THE 700-KW. "WITTON" GENERATOR, FITTED WITH "HOFFMANN" ROLLER BEARINGS.

The generators for this installation were supplied by the GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C.

Helsby Patent Condensers.

The growing importance of improving the power factor in A.C. systems, together with successive improvements in the construction of condensers, has had the natural result; "power" type condensers are now made by the BRITISH INSULATED AND HELSBY CABLES, LTD., of Helsby, who have just issued a descriptive pamphlet on the subject. The Helsby patent "Power" type condensers are of the Mansbridge self-sealing type, and are either "oil-immersed" or "solid impregnated," the former type being recommended in cases where the working pressure exceeds 250 volts A.C., and the condensers are continuously in circuit. They may be employed for improving power factor, suppressing arcing at contact-breakers and in switches, for reducing the current or voltage on electromagnets and other electrical devices in high-pressure circuits, for wireless telegraphy, and for other purposes. The Mansbridge system of construction has been fully described in our pages; it consists essentially in the use of paper coated on one side with metal, two such sheets being rolled up together so as to form a cylinder.

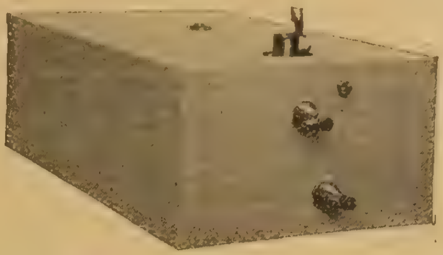


FIG. 4.—BOX OF 50 1-MFD. HELSBY PATENT CONDENSERS.

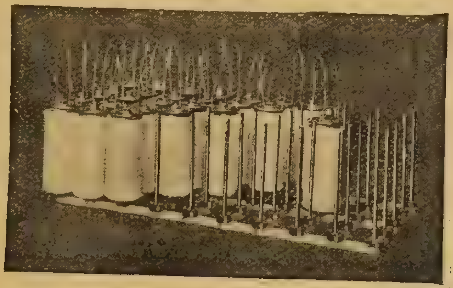


FIG. 5.—METHOD OF MOUNTING CONDENSER UNITS OF 1 MFD. EACH.

Amongst other advantages, this method of construction possesses that of being self-sealing; if a pin-hole in the paper permits of a short circuit, the spark volatilises the thin coating of metal in the neighbourhood of the defect and the insulation is restored. The dielectric losses are very small, the efficiency at ordinary frequencies and temperatures being over 99·5 per cent.; and the temperature rise of large capacities at rated voltage and 50 cycles does not exceed 20° F. The condensers are manufactured in units of about 1 MFD., and are suitable for working pressures up to 550 volts A.C.; the units are assembled in strong sealed metal cases in such numbers as may be required, but preferably not exceeding 50 MFD. in one case. These cases are further

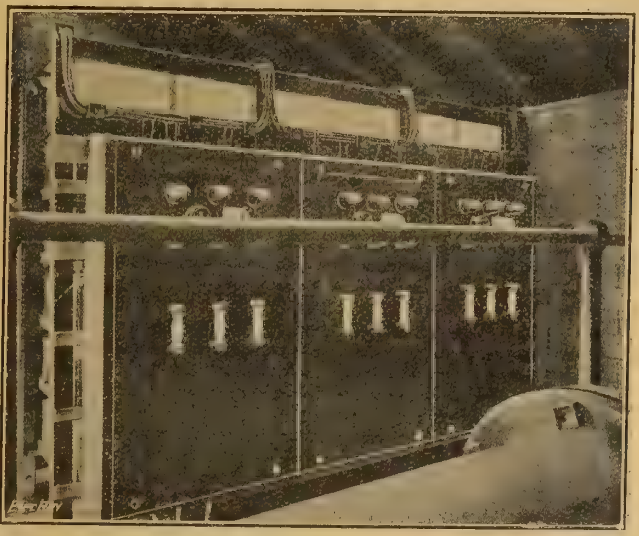


FIG. 6.—HELSBY OIL-IMMERSED THREE-PHASE CONDENSER OF 165 K.V.A.

assembled in strong wrought-iron frames or cast-iron cases, and provided with suitable switch and fuse gear. Fig. 4 shows such a 50-MFD. case, measuring 10 × 11 × 7½ in. and weighing 75 lb.; and fig. 5 shows the method of mounting the units. Fig. 6 is a view of an oil-immersed three-phase condenser of 1,740-MFD. capacity, installed in a colliery generating station; the output is 165 K.V.A. at 550 volts, 50 cycles per second. Such a condenser used in conjunction with a generating set supplying 460 K.V.A. at a power factor of 0·6 would reduce the K.V.A. to 350, and improve the power factor to 0·85, thus enabling the generator to deal with an increased load of 30 per cent.

The pamphlet points out the advantages of condensers over running machinery for improving power factor, including the convenience of connecting a condenser directly to each machine that has a low power factor, and thus providing the compensation at the precise place where it is needed. The principles of power factor improvement are also explained, with examples showing how to ascertain the amount of capacity required. As a rule, it is sufficient to correct the power factor to 0·95, as the amount of capacity required to raise it to unity is much greater in proportion than at lower power factors.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Staff Engineers and Labour Exchanges.

With regard to the present regulations requiring all applicants for positions to make their applications through the Labour Exchanges, I think it advisable to call attention to possible abuses which are in danger of being overlooked.

The officials of these places are accustomed to inquiring as to an applicant's character, &c., from his last employer. Presumably they will do so in the present circumstances, whether the applicant be a workman out of work or a staff engineer applying for another post. It has always been accepted that applications for staff positions are treated as confidential by the advertiser, to avoid any trouble between employé and employer. There now seems to be a possibility of the introduction of the Exchanges breaking down this most desirable understanding. In many cases doubt as to this point has prevented many men applying for positions for which they are well qualified.

Again, what is there to prevent an unscrupulous employer stating, irrespective of its truth, when such an inquiry is made, that the employé in question is on war work, thus blocking the way to his advancement for selfish ends, and enabling himself to retain the man without increase of salary?

In addition, cases have occurred where men, who have obtained a post elsewhere, have been told that under the new Act they could not leave their present work, even where these men could not, with any truth, be said to be engaged on munitions (as at present defined).

As in these ways men willing to serve their country have been held, and as there is still likelihood of similar acts against the spirit of the Munitions Act to the men's detriment, as well as the country's, a statement from some authority as to the position seems to be required.

Alcor.

Units from Refuse.

In reply to Mr. Morgan, of course we all know that the refuse in his part of the country and around London is generally very poor stuff, but after all it is a very small portion of the United Kingdom to which this does apply, and even in such places refuse is worth using. As Mr. Morgan shows, the existing stations where fuel is very expensive are naturally equipped to burn coal economically, and therefore they can do likewise with refuse as a fuel.

I must not pretend to know as much about the conditions at Horsham as Mr. Morgan, but I should be interested to know whether he has gone into the matter of buying washery dust instead of coal and mixing it with his refuse, so that his destructor would carry him through both his day and evening shifts. In other words, why should not the Horsham refuse be brought up to the same calorific value as the Aberdare refuse by means of very cheap washery dust stored in a hopper above the refuse bin, and a little let down every time refuse is tipped? It will come as a surprise to Mr. Morgan (as it did to me when I arrived here) to learn that coal in Aberdare is not even "fairly cheap," and especially does this apply to house coal. The larger pits around here sell the best *steam* coal in the world in very large quantities, and do not trouble themselves by small local sales. I find in normal times that house coal from Lancashire is cheaper than in Aberdare, taking railway carriage and cartage into consideration.

The only criticism of Mr. Morgan's plant that I make is that the combustion chamber—like mine—appears to be away from the boiler tubes, and that he does not therefore get anything like the full benefit of the heat.

A. J. Abraham, *General Manager,*

Electricity and Tramways Department, Aberdare.
August 16th, 1915.

The Late Mr. Robert Hammond.

I have read with very much interest your obituary notice of the late Mr. Robert Hammond, of whom too much good could not be said. I was associated with him for years at 110, Cannon Street, and well remember his bluff manner and "bronze" laugh, as it was called.

The tales I could tell about the "Brush" 40-lighters, their 2,000 volts and bare copper conductors, would be unbelievable nowadays.

He loved a joke—often at his own expense—and the book you refer to, entitled "The Electric Light in Our Homes," in the production of which I had the honour of assisting, produced endless fun. I have a copy somewhere. It was written in conjunction with a tour round the principal towns of England to demonstrate the advantages of *the* light.

The travelling "properties" comprised a portable drawing-room, about 15 ft. square, a set of 24 large accumulators (fully charged), and other things. The railway charges for accumulators in those days were wicked, and when I called Mr. Hammond's attention to them (to Exeter £1 each—£24), and explained that it was because they were "full," he said return them as "empty"; and I did so ever after. I suppose the railway people won't stand that now.

One thing I think deserves mention, and it, curiously enough, relates to one of that select company still with us, but of whom so many have gone. I refer to Mr. Ferranti, who about 1882 or 1883 came along with his A.C. machine. No one would look at him (in a business sense) until Mr. Hammond did, and the firm of Ferranti, Thomson & Ince, of Appold Street, resulted.

The Lowrie-Hall development came after this, and was really engineered by Fowler's, of Leeds, but it was owing to Mr. Hammond's insistence—backed with money—that electric lighting, so far as the development of the alternating current is concerned, has much to be thankful for.

Harry South.

London, W., *August 16th,* 1915.

WAR ITEMS.

War Relief Funds, &c.—The employés of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., have, since September last, been contributing to the National Relief Fund, British Red Cross Society and Belgian Relief Fund, and last week the total reached £1,002. £500 has been sent to the first-named fund, £250 to the Red Cross Society, and £225 to the Belgians, leaving a balance in hand of £27. This, it will be agreed, is an admirable record, and an excellent example to other works.

The Board of Education has issued an appeal for books for the 4,000 British civilian prisoners of war now interned at Ruhleben, in Germany. These books are needed for use in the educational classes in connection with the "Camp Education Department," which has recently been formed for the benefit of these civilian prisoners, and a list of the works specially required can be obtained from Mr. Alfred T. Davies, Board of Education, Whitehall, London, S.W., to whom all communications on the subject should be addressed. It will be noted that ordinary books, novels, &c., are not required; no books should be sent but those named in the list.

Germans in Russia.—The public subscription of 500,000 roubles to support victims of the war has, says the *Novoye Vremya*, led to a discovery showing the ramifications of German operations in Russia, even at the present time of war. Among the subscribers was the firm of Bogan & Co., of Moscow, whose nationality, when attention was drawn to the firm's name, was speedily shown to be German; two of the partners, named Mark, had, indeed, become naturalised immediately on the declaration of war. Moreover, a syndicate was formed at Petrograd under the style of the Union of Cable Manufacturers, partners in which were the firm of Bogan & Co., and the firm of Felten & Guilleaume, of Mannheim. This syndicate now dictates the price of copper in Russia, as it is part owner of the works at Bielaretz, Kolchurgin, and other places, practically controlling the output of copper goods. The firm of Bogan having interests also in the copper mines in the Caucasus and the Ural, disposes of immense stocks of copper, and some idea may be formed of the profits earned by the syndicate from the rise in prices of from 50 to 100 per cent. in copper, and from 75 to 100 per cent. in copper goods.

Patriotic Tramway Men.—The Manchester Corporation Tramways Department has just compiled another roll of honour, giving the names and addresses of the employés who have joined the Colours. The list contains the names of more than 2,000 men and youths who have responded to their country's call.

Women Munition Makers' Wages.—The wages to be paid to women engaged in Manchester engineering shops which are turning out munitions have given rise to a dispute. It appears that a conference took place a few days ago at which the employers were represented by Messrs. W. Collinwood, A. P. Wood, and F. G. Goodbehere, and the workpeople by Messrs. J. Binns (A.S.E.), R. H. Coates (U.M.W.), and J. Rowan (Electrical Trades). A proposal was put forward for a £1 a week minimum for all women over 18 years old engaged on munitions, but the employers declined to pledge themselves to the proposal, and it is now probable that the matter will be taken to arbitration. Mr. Rowan, of the Electrical Trades Union, stated in an interview that employers showed a strong inclination to employ women in the making of shell parts. In quite a number of shops they were at work on capstan lathes and the like. In seeking to secure a minimum of £1 a week for the women the Trade Unions, in his opinion, were making a reasonable claim.

LEGAL.

Electric Accessories Dispute.

In the City of London Court, on August 12th, before his Honour Judge Rentoul, K.C., a claim was made by Mr. George Braulik, electrical engineer, 8, Lambeth Hill, against Mr. G. H. Banning, Criterion Works, 33, Hurst Street, Birmingham, electrical engineer, for £3 14s. 8d. for Eclipse electric lamps and other accessories supplied. Defendant paid £1 11d. into Court for discount which had been deducted, but disputed the balance. He said he had returned some of the lamps because the voltage was marked on them in ink, and his customers would not have them so marked. They were returned for the voltage to be engraved, and the plaintiff had not since sent them to him. Other lamps sent to him were defective.

Mr. Mayers, plaintiff's salesman, said that the lamps were sent to the defendant in proper condition, and they were returned broken. There was no mechanical defect in the lamps. All lamps were tested before they were sent out.

Judge Rentoul found for the defendant, with costs, and said the plaintiff ought not to have sued a Birmingham man in London for £3 14s. 8d. There was probably the expectation on the part of the plaintiff that the defendant would rather pay the amount than come to London and defend the action.

Theft of Copper.

At Salford, on the 11th inst., Phillip Hawkley (36), of 13, Fern Street, Salford, and Wm. Brookes (53), Hayfield Street, Pendleton, were charged with stealing 1 cwt. of scrap copper, value £5, the property of the British Westinghouse Electric and Manufacturing Co., Ltd. Wm. Dobson (51), 18, Hayfield Street, Pendleton, was charged with receiving the copper, knowing it to have been stolen; and Thos. Wilson (37), broker and coal dealer, of Railway Street, Pendleton, and his brother, Matthew Wilson (31), 2, Peter Street, Pendleton, agent for lamps and fittings, were charged with receiving the property from Dobson, knowing it to have been stolen. Brookes was an outside labourer employed by the Westinghouse Co., and Hawkley was employed in the firm's copper department. All the prisoners were committed for trial at the Salford Sessions, bail being allowed.

There were two other charges against the two Wilsons, and they were committed to the Sessions on these also.

Electrical Work and Council's Test.

A case involving an interesting point to electrical contractors was heard on Thursday last week at the Watford County Court by his Honour Judge Scully. The point at issue was whether payment for electrical work could be withheld until the passing of such work by the local authority, though such testing was not included in the terms of the contract. The action was one in which the plaintiff, Mr. J. W. Russell, electrical engineer, of Loates Lane, Watford, claimed £41 17s. for work done at the residence of Mrs. Charlotte Hunter, of Rothesay, The Avenue, Bushey.

Mr. K. Preedy appeared for the plaintiff, and Mr. Samuel J Duncan for the defendant.

Mr. Preedy said that the plaintiff wired the defendant's house. The important point in the case was that the work had to pass the rules of the Watford Urban District Council's electrical department. The work was completed and the account sent in in April. Defendant sent a letter promising payment, and then wrote stating that as the work had not passed the test of the Council the installation was not complete, and payment would not be made until the test was passed.

The Plaintiff, sworn, said that the Council would not pass the job until the pendants and fittings were all fixed.

Cross-examined: The work was done to the requirements of the Council's rules, but had not been passed. He told the defendant he could not get the work passed until the fittings were fixed. He had not applied to the Council to pass the work, because defendant would not get her fittings out of store. It was not his job to put up any fittings. The complete installation included the fittings, and none had been fixed.

The Chief Electrical Engineer to the Watford U.D.C. said that a cable was laid to defendant's house ready to connect. The installation was not complete until the fittings were up and the light ready to be used. When he inspected the work he found it was work that could be passed.

Cross-examined: The work was done according to the Council's rules, but it had not been passed because the installation was not complete. It had not been tested with the lights on. The work would not be passed until the whole of the fittings in the house were finished.

Mr. Duncan submitted that the whole house was a unit, and the work should be tested and passed by the Urban Council before payment. That was a condition of receiving payment, and unless the test was passed defendant was justified in withholding payment.

Mr. Preedy said it was never a condition of contract that plaintiff should get the installation passed. All plaintiff had to do was to get the work done in accordance with the Council's rules.

His Honour: I think that is so. He has performed his contract so far as it could be done.

A verdict was given for the amount claimed, with costs.

BUSINESS NOTES.

Consular Notes.—HONG-KONG.—The American Consul reports that the matter of extending trade in the Hong-Kong field and in the Far East generally at the present time hinges more upon the results of the war in Europe than on any change in the normal relations of the United States to China, Japan, Indo-China, or any other portion of the Hong-Kong field. American opportunities depend largely upon the resumption of normal conditions in China. With the advent of normal demand for foreign goods for use in China, there will be a demand for American goods in many lines for the reason that the United States at the present time is almost the only country in a position to supply such goods. Japanese manufacturers are already in the field with Japanese substitutes for nearly all lines of German goods. While British manufacturers are suffering many disadvantages becauses of the war, they are still getting not only nearly all the business they have had heretofore which is now to be had, but also a large proportion of that business heretofore belonging to countries at war with Great Britain which is now available. In some respects attention should be paid more to the future than to the present, for trade at present is in comparatively small tune.

CHINA.—The American Consul at Hong-Kong reports that the question of the construction of a tramway system in Canton is being taken up anew by the provincial authorities, and plans for a line connecting the stations of the Canton and Hankow Railway and the Kowloon-Canton Railway, and running through a populous portion of the city, have been drawn up and have been forwarded to the authorities in Peking for approval.

The proposed line is projected by Gen. Lung, military governor of Kwangtung Province, in connection with Chinese capitalists in Hong-Kong, and the plans call for the construction of a little less than six miles of street railway along a route which will permit of the use of a considerable portion of the old wall of Canton. It is proposed to construct the line by means of a company for which the provincial government will furnish half the funds.

Plans for the rolling stock are not yet complete, but the general idea seems to be to buy motors and steel parts of cars abroad, completing the cars in Canton or Hong-Kong, present high freight rates rendering the purchase of complete cars abroad at this time a matter of difficulty. It is thought that the line as projected can be started with an initial outlay of about $100,000 gold. The practical management of the enterprise at present is in the control of Mr. Chin Gee Hee, president the Sunning Railway Co., who is working upon it in consultation with Gen. Lung.

The American Commercial Attaché at Peking reports that he recently had an interview with Mr. Chow Wan Pang, Director of Posts and Telegraphs in the Ministry of Communications, and was informed, relative to the contemplated telephone system for the Wuhan cities (Wuchang, Hankow and Hanyang), that the specifications have been completed, and that after their inspection by expert authorities tenders will be called for in the Peking and Shanghai papers. It seems that arrangements will undoubtedly be perfected whereby the telephone systems for the various foreign concessions in Hankow will be taken over by the Chinese Telephone Administration, as well as the German system now in use in Hankow city, and the general system substituted therefor. Although it has not been definitely decided how many telephones the new system will provide for, 2,000 or 3,000 will probably be called for, and arrangements will be made whereby the system will allow of an expansion up to 10,000 instruments. Hankow is a very important centre in China, and will probably occupy a position in that country analogous to that of Chicago in the United States. The combined population of the three Wuhan cities is conservatively estimated at 1,000,000. It appears that the main consideration in regard to this installation is the question of credit; hence it would be well for manufacturers to be prepared to make overtures in this direction with any bid for the business.

RUSSIA.—The American Consul at Moscow reports that American electrical works are in a position to make very favourable propositions in electrical supplies, of which there is a great scarcity on the Russian market. The only difficulty consists in the size of the order, the minimum stated by the American manufacturers being so large that the Russian purchasers are unable to distribute the amount.

Catalogues and Lists.—E. H. Freeman Electric Co., Trenton, N.J., U.S.A.—Price list of "guaranteed wiring devices" as used in the United States.

Trenton Porcelain Co., Trenton, N J.—Price list of standard porcelain insulators, knobs, cleats, switch bases, &c.

Graphite Lubricating Co., Bound Brook, N.J., U.S A.—Booklet describing oil-less bearings with graphite lining, trolley-wheel bushings, &c.

British Insulated & Helsby Cables, Ltd., Helsby.—Pamphlet describing the Helsby patent "Power" type condensers for use on A.C. power circuits, and explaining their use for the improvement of power factor.

Frank W. Morse, Boston, Mass., U.S.A.—Price list of electric lighting appliances, fittings, reflectors, connectors, &c.

Messrs. Ferranti, Ltd., Central House, Kingsway, London, W.C.—Binder containing autumn catalogues of electric heating and cooking appliances, including the electric fire cone and cone fires, bar fires, cooking disks, boiling plates, grills, breakfast cookers, ovens, &c.

The British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.—Folder describing oil-immersed drum-type starters.

Messrs. Fredk. Hodgson & Co., 24, Queen Victoria Street, E.C.—Price list of electric fans, D.C. and A.C., with oscillating movement, ceiling fans, portable fans, and a special line of cheap desk fans.

Dissolutions and Liquidations.—Adnil Electric Co., Ltd., Adnil Building, Artillery Lane, London, E.C.—A provisional order for the winding up of the above company was made upon the petition of a creditor, following on the decision of the Court of Appeal that, owing to the constitution and control of the company—the directors being resident, and the bulk of its share capital being held, in Germany—it can no longer effectively carry on its business. This order does not imply that the company will not be able to pay all its creditors in full, but the step was necessary in order to protect the assets. Under the order, Mr. J. H. Stephens has been appointed special manager pending the meeting of creditors, which will be held when the Courts re-open after the Long Vacation, and in this capacity he is carrying on the business for the beneficial realisation of the assets. He is retaining the services of Mr. Leach to assist him in the management of the business.

The business recently carried on in the name of Messrs. Marples & Leach, at 26-30, Artillery Lane, E.C., has been determined as from July 31st, 1915. Mr. Marples has joined the Swedish General Electric, Ltd., of Norfolk House, Cannon Street, E.C., where communications to him should be addressed. Mr. Leach is continuing in business at the above address until further notice.

Book Notices.—The *Wileroid* is the title of the first issue of a new magazine produced by members of the Switchboard Department of the British Thomson-Houston Co., Ltd., Willesden; it contains a variety of articles and notes, rhymes, sketches, and other interesting items, which do credit to the literary and artistic abilities of the authors. A whole page is occupied by the Roll of Honour, containing the names of men who have left Willesden to join the Colours, about 150 in number. Naturally, there is an under-current of war affairs running through the contents. A view of the annual staff outing at Sunbury shows that the party enjoyed fine weather (it was in June). A search through the magazine has failed to elucidate the derivation of its cryptic title.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXXI, Part 4. July, 1915. Newcastle-on-Tyne. The Institution.

Trade Announcement. — Messrs. J. W. Buck and Co. have started business in wholesale electrical supplies at 39, Victoria Street, London, S.W. They hold an agency for the Stella Conduit Co., Ltd., of Bilston. 'Phone: "Victoria 344."

France.—An agent wishes to represent a United Kingdom manufacturer of electrical apparatus; name and address can be obtained from the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Bankruptcy Proceedings. — J. G. M. Hilton, electrical engineer, Birmingham.—Trustee (A. S. Cully, Official Receiver, 191, Corporation Street, Birmingham) released July 15th, 1915.

For Sale.—The City and South London Railway Co. invite tenders for purchase of the generating and sub-station plant now at the Angel and London Bridge stations. Particulars are given in our advertisement pages.

LIGHTING and POWER NOTES.

Aberystwyth.—Restricted Lighting.—The T.C. has accepted from the E.L. Co. a rebate of £80 from the public lighting accounts for five months, owing to restricted lighting.

Argentina.—Recently Messrs. A. Rafael Langone & Co. made an offer to the municipality of Buenos Ayres to undertake the entire electric lighting of the city at 20 per cent. less than the present prices of the service, utilising a new secret system of their own, the nature of which they would not reveal. They offered to contract for the lighting service for a period of 12 years, making over all their installations to the municipality on the expiry of the period. Before taking the proposal into consideration, the municipal authorities required the proposers to present their application on stamped paper (value $500 m/a.) in terms of the regulations governing such matters. The proposers protested that this requirement did not apply to their case. The legal advisers of the city consider that the municipality is not in a legal position to consider the proposal referred to, having regard to its existing lighting contracts.

The Municipal authorities of Campana and the administrators of the local electric lighting company are in conflict. The Municipality refused to pay its June lighting bill unless the company (Compania Industrial Holando-Americano) first paid a sum of $3,000 claimed by the Municipality as fines. The manager of the company announced that unless the Municipality paid, the light would be cut off, and when this took place the Mayor took possession of the power station, at the head of the local police, and found electricians who were able to turn on the supply after half-an-hour's delay.

The Electrical Department of the Government of the Province of Buenos Ayres has reported favourably upon the application recently made by Senor Marcelino S. Romero for the electrical concession at Punta Alta (Bahia Blanca).—*Review of the River Plate.*

Ashton-under-Lyne.—The Electricity Committee has decided that as soon as the existing shop lantern agreements terminate, the charge per lamp be as follows:—£2 per annum for the upkeep and 1d. per hour burning for current.

Australia.—The Auburn Municipal Council has decided to light the municipality by electricity. After conferences with adjoining Councils and the Sydney city electrical engineer, the Council has adopted an agreement which provides for a term of 10 years, with the option of renewal. The Lidcombe and Granville Councils are also considering the question of electric lighting.—*Sydney Evening News.*

The Premier, in outlining the Metropolitan Council (Greater Melbourne) Bill (second reading) in the Legislative Assembly, stated that the electricity supply was practically confined to the City Council, which supplies three other Municipal Councils, the Melbourne Electric Supply Co., and the North Melbourne Electric Tramway and Lighting Co. The new Council was eventually to be the sole electrical supplier in the metropolis, and would have power to take over all concerns now operating. The amount of compensation, if not agreed, would be settled by arbitration.

Aylesbury. — Hospital Lighting. — The U.D.C. has decided to supply current to the Royal Bucks Hospital, which has its own battery, on a special rate.

The Electricity Committee has been asked to consider the possibility of terminating the agreement with the consulting engineers in view of the compulsory area having been cabled.

Barnsley. — Loan Sanction. — The L.G.B. has sanctioned the Council's application for a loan of £15,220 for extensions of plant at the electricity works.

Basingstoke.—The T.C. has decided to extend the area of supply to various parts of the town where there are prospective customers.

Burnley.—Price Increase.—The Corporation has decided that following the increased price of coal, the charges for electricity will be:—In the borough: for lighting, 3½d. per unit; heating, 1½d. per unit; power, the present prices, plus 5 per cent. In Reedley Hallows: For lighting, 4½d. per unit; heating, 2½d.; power, the present prices, plus 5 per cent., with the usual discount for prompt payments.

Callan (Co. Kilkenny).—Workhouse Lighting.—The Callan Co-operative E.L. Society has offered to light the workhouse electrically at a cost of about £60. The yearly cost of the light is estimated at £45, with electricity supplied at 6d. per unit for lighting, and 2d. for power and heating. The B. of G. is to consider the matter at a future meeting.

Canada.—According to the *Electrical World* the Ontario Hydro-Electric Commission will submit to the Ontario Government plans providing for the development at Niagara Falls and from the spillways of the New Welland Canal of 250,000 H.P., and for an immediate development of 100,000 H.P., a work that will entail a capital expenditure of approximately $10,000,000 and require three years to complete.

Under the treaty between Great Britain and the United States governing the amount of water that can be taken at Niagara Falls, there remain about 6,600 cb. ft. of water per second available on the Canadian side. The plans of the engineers of the Hydro-Electric Commission contemplate the use of this water. It is understood that the Commission will erect a plant at Chippawa Creek that will enable power to be developed on both the Niagara River and the Welland Canal spillways. The Commission also purposes to go to the Minister of Railways and Canals and ask for the water-powers that were promised on the Trent Canal, from which can be developed from 15,000 H.P. to 20,000 H.P., unless satisfactory arrangements can be made with the interests now controlling the power in the Trent Valley.

Dundee.—It was announced at a recent meeting of the Committee that the electricity department is not in a position to undertake new lighting or power installations at the present moment unless for Government work.

Easington (Co. Durham).—Proposed Refuse Destructor.—The R.D.C. has decided to obtain information regarding the provision of a refuse destructor, with a view to one being installed in the district after the war.

Glasgow.—Year's Working.—With further reference to the annual report on the year's working of the electricity department, of which some financial particulars were given on page 141, the total output generated was 104,227,424 units, from Port Dundas, Pollokshaws, Kelvinside, Govan, and Partick stations, and the figures include over a million units purchased from the tramways department. The total quantity sold was 88,834,270 units, as against 77,020,871 units in the previous year, and included 19,849,725 units for private lighting, 65,718,795 units for power and heating, 2,756,400 units for public lighting, and 359,075 contract units. The consumers numbered 32,030, and the public lamps 1,440 arc and 390 metal-filament lamps. The total number of motors in use, on the mains, was 10,681, of 77,305 h.p., taking 64¾ million units; the previous year's figures were 9,638 motors, of 66,947 h.p., consuming 53¼ million units. The total connected consumers' load to May 31st last was 101,048 kw.; the maximum station load was 39,750 kw.; and the units consumed by private customers per lamp fixed averaged out month by month was 26·7. The plant capacity of the Port Dundas, Pollokshaws, Govan and Partick stations was 72,000 h.p. A Maclaurin gas producer is being erected at Port Dundas station, to test the gas firing of boilers and to experiment with a view to obtaining a smokeless fuel as a by-product of the gas process. A 1,000 kw. rotary converter is now in use at Govan station, where another small engine-driven set has been disposed of. A 1,000-kw. rotary is also being installed at Partick; at this station the burning of street refuse has been discontinued and the crushing plant is now dealing successfully with this problem; 300 kw. of steam plant and the storage battery have been sold during the year. A second 500-kw. rotary converter is to be installed at Kelvinside station. Consumers' sub-stations now number 27; the largest addition was in the Fairfield Co.'s premises, where the plant capacity is 4,200 kw., the change-over to the Corporation's supply being almost complete. There are now four sub-stations at Messrs. Beardmore's Parkhead Works; when all the plant is running in these consumers' sub-stations it will amount to 15,000 kw. At the new Dalmarnock station, the foundations are nearly completed, but nothing further will be done until after the war.

Gravesend.—The T.C. has authorised a Sub-Committee to complete negotiations with Henley's Telegraph Works Co., Ltd., and the Empire Portland Cement Co. for supplies of current for power purposes. No future contracts for power supply are to be entered into without a clause making the price of current dependent upon the rise and fall in the price of coal.

Hetton-le-Hole.—Street Lighting.—The U.D.C. has accepted the offer of the Tramways Co. to undertake the public lighting of the district by electricity for another year as an experiment, with a view to a permanent agreement being entered into. Owing to the reduced number of lamps used to comply with the lighting order, the company's price is to be increased by 3s. per lamp.

Hitchin.—Street Lighting.—The U.D.C. has accepted the offer of the Electric Supply Corporation, Ltd., for two electric lamps on trial for public lighting, at 2d. per unit for the all-night lamp, and 2½d. per unit for the lamp alight until 11.30 p.m.

Hong-Kong.—The China Light and Power Co., Ltd., Kowloon, has decided to adopt a more progressive policy than formerly, and a very serious effort is to be made to develop the outlying districts and capture the rapidly increasing power demand. With this object in view the company is being reorganised and the station extended and modernised. The manager's salary is being considerably increased. Mr. C. N. M. Hamilton (manager) has resigned, and the company is in negotiation with a well-known engineer to fill his position.

Hove.—Year's Working.—The first accounts of the electricity undertaking, which has now been in the Council's possession for a year, since being taken over, show a net profit of £3,023, which is considerably in excess of the expected surplus. Reductions in price and meter rents represented in the aggregate some £1,157 for the year. The Aldrington undertaking made a net deficit of £148; this undertaking has now been merged into the Hove supply.

Ipswich.—Loan Application.—The T.C. has applied to the L.G.B. for an additional loan of £8,760, to cover the cost of sub-stations and materials, the Board having intimated that it would sanction the amount on receipt of a formal resolution of the Council, when the actual cost was ascertained.

Kingston-on-Thames.—Year's Working.—During the last financial year the Corporation electricity department sold 1,162,000 units, as compared with 1,242,000 units in the previous year; the consumers numbered 1,789, an increase of 113. The total revenue was £15,273, as compared with £15,416 in 1913-14, and the gross profit £6,684, about £50 in excess of the previous year, despite the falling off in revenue. A decrease in works costs resulted from the more extended use of the Diesel plant, the steam plant being only run on the peak loads. Steam plant generated 306,200 units with a fuel cost of 1·8d. per unit, as compared with 855,801 units by Diesel plant, at a cost of ·424d. per unit. Unfortunately, extra expenditure was incurred during the year in interest, repayments of loans, income-tax, &c., totalling £1,072, and after meeting all charges, the deficit on the year's working was £1,295, as against a deficit of £721 in the previous year.

The Council has decided on a further increase in prices all round. The report led to a critical discussion by the Council, in the course of which Councillar Hall moved a resolution, which another Councillor declared to be tantamount to a vote of censure on the electrical engineer and the Lighting Committee, and, despite a warm defence by Alderman Lyne, this was carried by 13 votes to 11; the Alderman remarking that after such a resolution, which was a serious reflection on the Lighting Committee, he could not carry on. The minutes of the E.L. Committee and report were approved.

London.—Marylebone.—At a recent meeting of the B.C. the annual report of the electricity department was presented. From this it appears that for the first time a decreased output occurred on the year's working, 15,926,167 units being sold, as against 17,038,516 in the preceding year; the gross income shows a corresponding decrease, from £176,716 to £168,854; this set-back is entirely due to lighting restrictions. Altogether, it was considered that the net revenue had suffered, through circumstances beyond the Committee's control, to the extent of £15,400. As a final result, a debit balance of £7,057 occurred on the year, as against a profit of £4,525 in the previous year. Ald. Duncan Watson, chairman of the E.S. Committee, in moving the adoption of the report, pointed out that when he took up his position after the commencement of the war, it was obvious that there must be a deficit on the year's working. He outlined the difficulties met with, including a proposed increase in assessment, which had fallen through, pointing out that had it not been for loss of revenue, increased expenses, &c., even assuming no increase over 1913-14, intead of a debit of £7,057, they would have had a credit balance amounting to £12,617. After a discussion, in which it was mentioned that the undertaking was now paying £15,000 a year in rates and taxes, the report, &c., was adopted.

Market Drayton.—Street Lighting.—The U.D.C. has accepted the offer from the E.L. Co. for connecting the street lamp standards with the mains, and fitting with bracket, service boxes, cable jointing, trenching and re-instatement, at £2 10s. per lamp.

Meltham.—Proposed E.L.—The Council has appointed a deputation to wait upon the Electricity Committee of the Huddersfield Corporation with a view to securing a supply of electricity to the Meltham area.

Navan.—Workhouse Lighting.—At a recent meeting of the B. of G. it was stated that, as compared with gas lighting, £75 had been saved in five years by adopting electric light.

Nottingham.—According to the *Nottingham Daily Express*, negotiations have been taking place between the Corporation and Messrs. Cammell, Laird & Co., with a view to the latter erecting works on a 12-acre site. Apparently these have resulted successfully, and it is stated that the Corporation has undertaken, on behalf of the firm, to construct a special electrical station on the site.

Plymouth.—The Electricity Committee has recommended that the borough electrical engineer be instructed to report upon the reorganisation of the staffs of the electricity undertakings, consequent upon the resignation of the engineer of the Newport Street works.

Southend.—The Electric Lighting Committee has decided to defer the laying of a branch main to the Eastern Valley sewage pumping station.

In view of the postponement of the erection of the Thorpe Bay sub-station, the town clerk has been directed to negotiate for the retention of the site already agreed upon for this purpose.

Street.—Street Lighting.—The U.D.C. has been informed that the public lighting scheme will be completed early in September.

Stretford.—Price Increase.—The Trafford Power and Light Supply (1902), Ltd., has informed the U.D.C. that the charges for electricity are to be raised 10 per cent. in the case of current for lighting, and 15 per cent. in the case of current for power purposes.

Surbiton.—E.L. Transfer.—The U.D.C. has completed the agreement for the transfer of the electricity undertaking to Messrs. Callender's Cable and Construction Co., Ltd.; the clerk has been instructed to take steps to obtain the sanction of the B. of T. to the transfer.

Tunbridge Wells.—Annual Report.—The report of the borough electrical engineer, on the year's working to March last, shows that greater progress was made than in the previous year. The revenue was £18,613, and the gross profit £9,629, while the net profit was £3,157, as compared with £2,165 in 1914 and £1,111 in 1913. The units sold numbered 1,334,729 as against 1,126,622 in 1914; the load factor was 16·8 per cent., maximum load 907 kw., generating plant capacity 1,600 kw., and connected load 3,484 kw. During the year a 300-kw. turbine plant was installed, which carries the day load, the steam consumption according to test figures having dropped from 28 to 21 lb. per kw.-hour. The full benefit of this turbine will be felt in the present year. Underfeed stokers have been introduced on three boilers, the coal bunkers extended and, in particular, a large new coal store and wharf at the Medway sidings has been opened, in which some 700 tons of coal have been stored. Over 1,500 consumers are now connected to the mains.

U.S.A.—Electricity in Sheep Farming.—According to the *Electrical World*, the great sheep ranches in the stock-raising regions of Oregon are large consumers of electricity for light and power. Central station energy is used for pumping in the irrigation districts and for chopping grain for stock feed in the winter. In one of the large stock-raising farms electricity has been put to a novel use for the winter fattening of sheep. The sheep pens are wired and the electric light is turned on during the winter months from 4 p.m. to 9 p.m. Under this artificial illumination the sheep continue to feed until the lights are extinguished. At 4 a m. the lamps are then again turned on and burn until daylight, and again the sheep feed. In this way the sheep are made to feed during the equivalent of a long summer day, and thus, despite the winter season, are brought quickly to the condition for marketing.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Proposed Tramway Purchase.—After considering the question of the purchase of the suburban tramway system, the Corporation Tramways Committee decided to ask Mr. Dalrymple, manager of the Glasgow Corporation Tramways, to visit the city to consult with the Advisory Committee.

Accrington.—At a meeting of the T.C. last week, Alderman T. E. Higham said the Tramways and Electricity Committee had resorted to the employment of female tram conductors because it could not get men who were not of military age to fill the positions. They were receiving exactly the same remuneration for the same work that the men had.

Australia.—In his second reading speech on the Greater Melbourne Bill, before the Legislative Assembly, the Premier indicated that the Council would assume control of all tramways in the enlarged area. Undertakings controlled by municipal trusts would simply be taken over as going concerns; the lease of the Melbourne Tramway and Omnibus Co., which controls all the lines terminating in or running through the city, expires on July 1st, 1916, and the Council would be empowered to acquire by agreement, or compulsorily, the undertaking, so that the company would go out of business after that date. Power will be given to shorten the life of the Melbourne Tramways Trust, if desirable.

Birtley. — Suggested Tramway Extension. — The Parish Council has decided to ask the Gateshead and District Tramways Co. to extend its tramways from Low Fell to Birtley, as large permanent engineering works are to be erected in the town.

Hove.—Railless Traction.—The T.C. has decided to dismantle the electrical overhead equipment which was installed in part of the main thoroughfare about a year ago as an experiment, to determine the system to be adopted in establishing the joint service of electric railless 'buses to be put on the roads in Brighton and Hove. In thus removing the posts and wires, the local authorities of Hove will have to pay about £600 to the company which contracted to erect the plant, but this payment will be taken into account should circumstances in the future permit of a revival of the scheme. The two towns have mutually agreed to defer any further progress with the undertaking until "six months after the war."—*Daily Telegraph.*

L. & S.W. Railway Electrification.—According to the daily Press, the current is to be switched on to the Kingston loop line in a few days' time. This line includes all the stations between Waterloo, Clapham Junction and Kingston *viâ* Wimbledon, and back to the Junction *viâ* Richmond and Barnes. Various other sections will be completed in quick succession, to Twickenham, Shepperton, Hampton Court and Claygate, and, in all, 140 single track miles will be electrified. The trains will consist of three-coach units, run singly or in duplicate, according to traffic requirements.

Oldham.—War Bonus.—The local Tramway Workers' Union has again asked the Tramways Committee to consider an application for a war bonus for its members. A previous application was allowed to drop after the men's representatives had interviewed the general manager, and also in consequence of the manner in which the Corporation was treating employés who had gone on active service. The renewal of the demand is due to the fact that the General Labourers' Union is making a demand for a war bonus on the Gas Committee; the Tramways Committee has decided to leave the matter with the Special Committee that is dealing with the labourers' application.

Sheffield.—Female Labour.—It was stated at the last meeting of the City Council that about 180 women conductors were now employed on the tramcars. It was not the general policy of the Tramway Committee to employ married women, but a number of wives of soldiers serving at the Front had been engaged

TELEGRAPH and TELEPHONE NOTES.

Chorley.—The Buildings Sub-Committee of the Chorley Board of Guardians has been authorised to prepare a scheme for the installation of intercommunication telephones to link up the various departments, and to consult an expert electrician.

Eccles.—An outbreak of fire occurred last week at the Eccles Telephone Exchange in Monton Road, and the Corporation fire brigade was called out. The damage caused was only slight.

Italy.—The police have seized at Milan, a wireless apparatus belonging to Signor Olivi, an engineer, and have lodged information against him and his three assistants.

Japan.—It is reported from Tokio that on July 7th wireless communication was successfully inaugurated between the new station at Funabashi, near Yokohama, and the Hawaiian Islands. Messages by wireless telegraphy between Japan and the United States will be regularly accepted in the near future. The distance between Funabashi and Honolulu is about 4,000 miles.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Adelaide.—September 1st. Condensers, testing sets, rheostats, Morse sounders, and Wheatstone transmitters, for the P.M.G. See "Official Notices" July 23rd.

Brisbane.—October 6th. Tinned-copper wire, porcelain pothead insulators, for the P.M.G. See "Official Notices" to-day.

Perth.—September 29th. Telephone switchboard parts, for the P.M.G. See "Official Notices" July 30th.

Sydney.—September 13th. Council. A.C. and D.C. electric motors. Specification (10s. 6d.) from E.L. Department, Town Hall.*

September 6th. Metropolitan Board of Water Supply and Sewerage. Centrifugal pumps and electric motors at Richmond pumping station.* Acting Secretary, 341, Pitt Street, Sydney.

September 23rd. Condensers, galvanometers, relays, and sounders, also incandescent electric lamps, for the P.M.G.'s Dept. See "Official Notices" August 13th.

October 25th. Six electrically-operated wharf capstans, for the Sydney Harbour Trust. Forms of tender from the Engineer-in-Chief, Harbour Trust Offices, Circular Quay.*

October 25th. For the Commonwealth Department of Defence (Navy Office). Supply, delivery and erection of power-station plant and equipment for the Commonwealth Naval Dockyard, Sydney.*

Melbourne.—September 8th. Transformers and relays for point indication for automatic signalling (Contract No. 28,918), and electric point and lock detectors (Contract No. 28,951), for a period of five years, for the Victorian Railway Commissioners.

September 29th. Fuse blocks (complete and spare porcelain bases and fuse clips), for the Victorian Railway Commissioners. Particulars at the Contractors' Room, Spencer Street.

Hawthorn.—November 30th. Refuse destructor plant, for the Hawthorn-Malvern-Camberwell and Kew Destructor Trust. Specification from the Trust Engineer's Office, Town Hall.

Aylesbury.—Electric light installation, Town Hall, for the U.D.C. Mr. W. A. Turnbull, electricity works (returnable deposit of 10s.).

Bristol.—August 23rd. Corporation. One 6,000-kw. three-phase steam turbo-alternator with condensing plant. See "Official Notices" July 23rd.

London. — H.M. Office of Works. — August 20th. Enamelled electric conduit and fittings. See "Official Notices" August 13th.

L.C.C.—August 23rd. Installation (74 wiring points, 93 lighting points) at Winchester Street Elementary School, Pentonvill Road, N. See "Official Notices" August 13th.

New Zealand.—September 1st. Public Service Store Tender Board. Supply and delivery of (1) 92 miles of air-space paper insulated, lead-covered telephone cable, and (2) 100 miles o insulated and braided wire. Controller of Stores, Post and Telegraph Department, Wellington.*

Portsmouth.—August 31st. Corporation. Six months supply of stores, for the Tramway Committee. See "Officia Notices" to-day.

Rochdale.—Electricity Committee. Supply and deliver of static transformers for a period of 12 months. Mr. C. Atchison, electricity works, Dane Street.

Shanghai.—September 24th. Municipal Council. On turbo-generator, 5,000 kw., and one or two of 10,000 kw., complet with condensing plant, &c. See "Official Notices" to-day.

South Africa.—Johannesburg.—September 25th. F the T.C. Two turbo-alternator sets, condensing plant, switchgea

&c. Specification, &c., on deposit of £2 2s., from Mr. J. H. Dobson, General Manager.*

West Ham.—September 2nd. Three months' supply of electrical fittings, for the B. of G. of the West Ham Union. Forms of tender from the Clerk, Union Road, Leytonstone, N.E.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Government Contracts.—List of new contracts for July, 1915:—

War Office.

Asbestos.—Bell's United Asbestos Co., Ltd.
Cables and wire.—B.I. & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; W. T. Glover & Co., Ltd.; A. Green, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; Liverpool Electric Cable Co., Ltd.; Midland Electric Wire Co., Ltd.; Siemens Bros. & Co., Ltd.; Ward and Goldstone.
Generating sets (parts).—Austin Motor Co. (1914), Ltd.
Electric lamps.—Cryselco, Ltd.; General Electric Co., Ltd.; Pope's Elec. Lamp Co., Ltd.; Yorkshire Incandescent Electric Lamp Co., Ltd.
Telephone sets.—Western Electric Co., Ltd.
Brass and copper wire.—T. Bolton & Sons, Ltd.; C. Clifford & Sons, Ltd.; R. Johnson & Nephew, Ltd.; D. F. Taylor & Co., Ltd.
Works services.—Electric light installation, St. Anthony: Drake and Gorham, Ltd. Electric light installation, Devonport: Henley's Telegraph Works Co., Ltd. Electric wiring at Salisbury Camp: Edmundson's Electricity Corporation, Ltd.; A. V. Gifkins & Co. Electric lifts, Whalley: W. J. Furse & Co., Ltd. Electric light and power, Park Royal, Acton: Mann, Egerton & Co., Ltd.

Crown Agents for the Colonies.

Submarine cables.—Siemens Bros. & Co., Ltd.

India Office Store Department.

Aeroplane transmitters.—Marconi's Wireless Telegraph Co.
Cells.—Siemens Bros. & Co.
Copper wire.—F. Smith & Co.; Shropshire Iron Co.
Insulator cups.—Taylor, Tunnicliff & Co.; Bullers, Ltd.
Wire.—Callender's Cable & Construction Co.

H.M. Office of Works.

Electrical work, Eastcote Alien Camp.—Pinching & Walton.

Post Office.

Telegraphic apparatus.—Creed, Bille & Co., Ltd.; Gell's Telegraphic Appliances Syndicate, Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; B.I. & Helsby Cables, Ltd.; Peel-Conner Telephone Works, Ltd.
Telephone cable.—Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.
Telephone lamps.—A. C. Cosser, Ltd.
Copper.—F. Smith & Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.).
Alterations to batteries, Central Telephone Exchange, London, E.C.—The Chloride Electrical Storage Co., Ltd.

Heywood.—The T.C. has accepted the tender of Messrs. Blakeley & Wild for a temporary superstructure building at the electricity works.

Sunderland.—The T.C. has accepted the following tenders on behalf of the Electricity and Lighting Committee:—

Babcock and Wilcox.—Links for chain-grate stoker.
India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.—Brush-holders for motor-generator.
W. G. Farrow & Co.—Street box frames and covers.
Steel & Co.—Cast-iron box frames and covers, gun-metal clamping blocks, mild steel bolts and cubicle covers.
B.I. & Helsby Cables, Ltd.—Cable racks and wood cleats.
South Durham Steel & Iron Co.—288 ft. mild-steel angle bar.

REVIEWS.

Wiring of Finished Buildings. By Terrell Croft. London: Hill Publishing Co. Price 8s. 4d. net.

This book is American—written by an American principally for Americans. The statement implies that it has limitations when viewed from the English standpoint, as will be mentioned later, but it also means that it has a refreshing liveliness which is not usually found in English technical books.

In its general arrangement the book leaves little to be desired. Every paragraph, table and illustration is numbered, and references are given fully and accurately. The explanations, once the differences between American descriptions and ours have been appreciated, are clear and concise, and the illustrations are particularly good. Every one appears to have been made specially for the book, and there are none of the irritating reproductions of stock catalogue illustrations that are usually found in similar English books. Also, no space is occupied in valueless reprints of standard wiring rules.

The result of all this is that in well under 300 pages Mr. Croft has managed to compress what might well have formed the basis of two or three books.

The first portion of the book—about the first six chapters, occupying some 100 pages—deals with the business of the supply authority in obtaining new customers, and the details given by Mr. Croft of American efforts in this direction would surely make many of our publicity experts ashamed of their past records. He treats of all sides of the subject. For example, the relative value of different forms of advertising—posters, circulars, shop window displays, "soliciting" (American for canvassing), and so forth—is discussed fully, and actual results obtained in various towns are scheduled out in detail. Mr. Croft is evidently a believer (and he produces plenty of evidence in support) in the value of an advertisement offering to install wiring on special terms for a limited period on some system of free wiring or of gradual payment. He is, however, emphatic that it is best to carry out the work through a contractor. To quote one paragraph only:—

"It appears to be the general opinion among those best informed that the most effective system of handling finished-building wiring is (1) for the central station to agree, with the local contractors' association or with a group of contractors, upon a standardised price schedule (see par. 75) for wiring; (2) the central station solicits the wiring business on the basis of the standardised schedule assuming all solicitation and advertising expense; (3) the central station apportions equitably the business thus obtained among the contractors, with whom it is co-operating; (4) the central station pays the contractor the standardised price upon the completion and acceptance of the job; and (5) the central station assumes the account, as hereinbefore explained, and receives the payments for it on the instalment plan, if the consumer so desires. Experience has shown that business can be obtained at prices that are sufficiently high as to allow a fair profit for the contractor."

The same general view is repeated in many other places, and the policy of various supply authorities is quoted time after time to the same effect. This is decidedly interesting in comparison with the efforts of the municipal supply authorities on this side to carry out such work themselves.

In this section, also, the question of cost is discussed very fully, and various systems of charging for free wiring installations are investigated. The actual figures are difficult to check as conditions are so different; it would appear that the American wireman gets about twice the rate per hour paid to the English wireman, but he also appears to get through a very much greater amount of work—which one can easily believe to be possible.

The next chapter, of between 40 and 50 pages, contains about the same amount of information as most English books on wiring work in houses, if allowance is made for the mass of unnecessary detail usually repeated in such books which would certainly be known to anyone who would read them. The subject is considered from the American standpoint, which is evidently very different to ours. There is a large amount of information useful to wiremen here, but, on the other hand, much attention is given to such systems as wiring in flexible metallic conduit and "knob and tube" wiring (or, in English, wiring on porcelain insulators), which are scarcely used here at all for house wiring. Wiring on insulators between floors in wood-frame buildings appears to be a regular practice in America, but there are evidently carefully considered regulations (the National Code) that are enforced strictly by the Board of Underwriters. One cannot help a mental comparison with the system in force here which allows ridiculously bad work to go into house after house due to the entire absence of any supervision of cheap wiring work. The only jobs supervised here appear to be those where supervision is least likely to be required.

The remaining chapters of the book are mainly concerned with the actual carrying out of the wiring work, and might, again, easily form a separate book. Indeed, a reprint of certain sections of these chapters would form a most valuable book for wiremen which many firms would be glad to distribute to their men if it were available in a cheap form. The hints on making special tools for certain work, on fishing for wires through ceilings and down walls, on removing floor boards and base boards (skirtings) with a minimum of damage, and so forth, would be of extreme interest to many workmen to whom the earlier part of the book would scarcely appeal at all. Such a reprint might perhaps be re-written for English workmen, as a few sections would not interest them, but only very little alteration would need to be made. This side of the subject also is treated very exhaustively as, in addition to the suggestions as to tools, etc., already referred to, the general layout of typical installations is discussed, including such points as the adoption of roundabout routes to avoid damage or to get the advantages of an easier run for the wires.

Altogether, the book is full of valuable matter, and would be found of great interest, in whole or in part, to very many sections of the electrical industry, though principally, of course, it appeals to central station men, to contractors, and to wiremen of all grades.

Constant-Voltage Transmission. By H. B. Dwight. London: Chapman & Hall, Ltd. Price 5s. 6d. net.

The disadvantages of a varying power factor in connection with long-distance transmission lines are fairly generally recognised. The objectionable features are, of course, considerable voltage variation at the receiving end of the line, and also the limitation of the amount of the energy current by the idle or so-called wattless current.

The purpose of the book under review is to urge that more synchronous motors be installed in alternating-current systems and that dependence be placed on them to secure the desirable result of controlling the line voltage at the opposite end to that of usual practice. The effect of synchronous condensers is so marked that in many cases they can be run idle and yet save several times their cost. A considerable amount of this apparatus is necessary and the excitation of the machines must be continually changed, and by thus varying the power factor the voltage drop in the transmission line is held at a constant value.

The first chapter is merely introductory to the subject, and the second one deals broadly with alternating-current transmission. We are pleased to see that the limiting of the transmitting voltage by the extraordinarily rapid increase in cost of the terminal apparatus is pointed out.

In Chapter III the synchronous motor is briefly described, while power factor control is treated in the succeeding chapter. Both are very short, but quite clear.

The history of this method of voltage control and its disadvantages as well as its advantages are set forth in succeeding chapters, which call for no remark except that they appear to be quite fair.

In Chapter XII we have what, in the opinion of the reviewer, is the most valuable part of the book—working methods of calculation. These are a combination of the use of imaginaries with graphics, and are practical and accurate. For engineering calculations, the results to be calculated should be selected because they are of the greatest commercial value, and not because they are the most easy to obtain. Numerical illustrations of the methods are given.

At the end of the book there is a collection of formulæ for transmission lines and an appendix giving the reactance of stranded conductors.

The impression left on the reviewer, after careful perusal, is that there is nothing very new about the book as a whole, but that it is an impartial and thoughtful attempt to show the benefits of this method of voltage control. The price appears to be rather high for a small-sized book of 115 pages only.—H.G.S.

The Year-book of Wireless Telegraphy and Telephony, 1915. London: Wireless Press, Ltd. Price 3s. 6d. net.

At this time, when wireless telegraphy is perforce in such eclipse so far as the private investigator is concerned, it gives us special pleasure to welcome the third edition of this monumental work as being something of live interest to be perused and criticised. The thickness of the volume has been quite considerably reduced, but not by reducing the matter presented, for, actually, 40 pages have been added to last year's total, and by careful editing the subjects dealt with have been increased, and the information already given revised and amplified. At the same time, it will be noticed that the price of the year-book has been slightly increased, at which no one can cavil.

All the regular features, on which we have now come to rely in this publication, are retained and brought up-to-date. The record of development in wireless telegraphy during 1914, which began with sufficient promise, naturally stops abruptly with the outbreak of war. It is, indeed, to be hoped that the many important developments thus dramatically interrupted may soon be continued. Wireless telegraphy laws and regulations, the international radiotelegraphic convention, and the section on safety of life at sea remain practically as in the last edition, and are sections of proven utility to all practical workers. So, too, are the laws and regulations of all countries, which occupy over 200 pages in their expression, and include the fateful orders which paralysed private wireless work last August.

The invaluable tables of land and ship stations occupy about thirty pages more than in last year's edition, and they have evidently been revised and amplified as fully as possible under the old headings (name, geographical position, call signal, range, company or ship, wave length, nature and hours of service and tariffs). We would again suggest, however, that it is wholly desirable to include, wherever possible, a note of the system employed and the sending power used.

Articles by specialists on various topics form a valuable feature of this as of previous issues, and of particular topical, as well as broader, interest are the papers on "Wireless and War at Sea," by A. Hurd; and on the "Influence of Wireless Telegraphy on Modern Strategy," by Col. F. N. Maude. In the former article, Mr. Hurd lays emphasis on the great changes wrought by improved systems of communicating intelligence and by steam power on naval warfare; he sketches the extraordinary development of wireless, but of the extent to which wireless telegraphy is actually used in modern naval warfare, and concerning its grave defect in disclosing the presence of ships to enemies in the neighbourhood, he says nothing. On the one point he could, naturally, say nothing even were he acquainted with the facts; but in the other matter, we fear Mr. Hurd has "let himself go" on the romantic possibilities of wireless without pointing out that its use was undoubtedly responsible for certain disasters in the Russo-Japanese war, and for many vessels falling victims to the *Emden* in the present campaign. We believe that time will show wireless telegraphy to have been used very cautiously by the winning side in this war. The fact that signalling is proceeding cannot be concealed, the direction of the signals can be located, at least, approximately, and codes are of very dubious value. In a peculiarly fascinating article on the effect of wireless on land strategy, Col. Maude justifies the surprising statement that it has no appreciable effect whatever!

A report is included of Prof. Fleming's address to the Wireless Society of London on the function of the earth in radiotelegraphy. This cannot be termed a "popular" exposition, and we are glad to note that the policy has been adopted of including some quite popular and some quite technical articles. It is disastrous to attempt to make every article appeal to layman and expert alike. Mr. H. J. Round writes on the Tyk system of wireless telephony, which was giving such promising results at the moment its development was interrupted by the war; and Dr. Eccles says about all that can be said concerning international wireless research in 1914. Articles of more popular interest are included on long-distance wireless services and wireless newspapers at sea, and a series of consecutive interest is formed by Mr. A. H. Morse on "Some Applications of Wireless Telegraphy"; Mr. R. C. K. Lempfert on "Application of Wireless Telegraphy to Meteorology"; and Mr. A. R. Hinks on "Wireless Telegraphy in Survey." Small additions have been made to the section on international time and weather signals, and the collection of formulæ and equations, glossary, dictionary, tables and data, list of patents and companies, biographical notices, and other miscellaneous information have been retained and brought up-to-date where necessary. By the care with which it is revised, by the wholesale substitution of fresh "current" material, and by its excellence throughout, this year-book is justly entitled to the high esteem in which it is now held by all associated with, or interested in, wireless telegraphy.

A School Electricity. By C. J. L. Wagstaff, M.A. Cambridge University Press. Price 5s. net.

It is very seldom that a "School Electricity" is sufficiently interesting to make it a pleasure to read it. Most school textbooks are boring rather than interesting, and the writer who sets out to make such a book interesting by dint of joking and telling "funny stories" generally writes as boring a book as any of the rest. Mr. Wagstaff has, however, given us something in the nature of an oasis in the desert; he has written an interesting school text-book on electricity.

The author's success in this direction may be very largely attributed to the simplicity and clearness of his English diction. It is no exaggeration to say that the book is a good electricity book because it is written in good English. The same things have been said dozens of times before in the usual dry-as-dust text-book style; Mr. Wagstaff has taken these commonplace facts of electricity and magnetism and, by careful arrangement and choice of words, has endowed them with a freshness and attractiveness that cannot fail to appeal to every schoolboy who uses his book.

The book is based on a course of lessons given at Oundle School. These lessons were essentially practical and the experiments described were actually done, some in the laboratory by the boys, some in the class-room. The author believes very strongly in the early use of instruments (*e.g.*, ammeters and voltmeters) which give direct readings, in addition to those which only compare, and by a preliminary treatment of work and horse-power in the mechanics lessons he considers that it ought to be possible to talk about volts and watts quite early in the study of electricity. As a matter of fact, a boy would need very little preliminary teaching in mechanics to enable him to obtain a perfectly clear understanding of electrical pressure and energy from the chapter in this book on "The Volt," a chapter which is a unique example of the author's mastery over his subject and equal mastery over his phrases.

The order of treatment is much the same as in other elementary text-books. An introductory chapter on magnetism, followed by chapters on the ampere, the volt, and Ohm's law; then detailed treatment of resistance, primary cells and galvanometers. There is a short, but extremely good, chapter on temperature effects, and then the author passes on to consider the magnetic and electromagnetic effects leading up to the study of the dynamo and motor. Five chapters are then devoted to a fuller and quantitative treatment of magnetism, and the last five chapters to a similar treatment of electrostatics. The mathematical theorems of electrostatics are dealt with in two chapters—"Lines of Force" and "Mathematics of Electrostatics"—both of which are so extremely well written that few students will find any difficulty in mastering even this most difficult portion of the subject.

Each chapter is followed by a set of examples to which answers are given, and there is a set of miscellaneous examples at the end of the book, together with a number of photographs of filings diagrams. The book is splendidly printed and serviceably bound, and is the best school electricity that we know of.—P.H.S.K.

Engineers Wanted.—Professional men who have practical experience in the engineering trades, and are anxious to place their services at the disposal of the Government, are invited by the Board of Trade to consider the possibility of undertaking manual work in connection with the production of munitions of war. The great need of the moment, the Board says, is for skilled mechanics (turners, fitters, millwrights, &c.). Men whose training has included engineering workshop experience can now do valuable service by offering to do manual work at the usual rates of payment for such work. They will not displace any skilled workman; they will simply increase the army of those who by work at home help the armies abroad.

Professional men who wish to offer their services to this end should send full particulars of their qualifications to the "Engineers' War Service Register," Queen Anne's Chambers, Westminster, S.W.

HINTS TO APPLICANTS FOR SITUATIONS.

By ERNEST C. McKINNON, A.M.I.E.E.

The writer has frequently had occasion to insert advertisements for assistants in the Electrical Review and other engineering papers, and has always been astonished at the poor quality of the majority of the applications.

One advertisement will sometimes bring replies reaching into hundreds, and it is by no means an overestimate to say that over 75 per cent. of the replies are drawn up so poorly that they are simply a waste of time and money.

It may be that the advertisements are, to some extent, at fault in their wording or ambiguity—probably so in cases where one finds applicants wanting 30s. per week competing for the same vacancy with others asking £250 per annum. But this does not explain away the rambling, irrelevant, badly-written, incomplete letters which come to hand.

Some men appear to apply for practically every vacancy advertised—the writer during the past seven years has invariably observed an application from one man whose writing is weird, and who has another peculiarity, his age (stated) is decreasing.

One of his last applications may very well be taken as a model of how *not* to do it.

The advertisement stipulated that candidates should "state age, experience and salary required." Here was his reply:—

> Dear Sir,—In reference to the Electrical Review advertisement, I beg to offer my services for the requirement. . . . Having been accustomed to electricity works and traction plants, running operations, &c. Also works and &c. Plant experiences, and installation works, etc.; working experiences thereof. Trusting in approval at a fair wage. My age is thirty-two; abstainer.
>
> I remain,
>
> Yours respectfully.

As an example of unnecessary and foolish padding, the following has been taken from an application rescued from the waste paper basket for the purpose of this note:—

> I would prefer you to make an offer as to remuneration when you take up my references. In conclusion, I trust you will not consign my application to the waste-paper basket, but give me a fair chance.

Much may have been written already on the subject, but the waste with its accompanying disappointments still continues, and the writer trusts that the following notes will be helpful to numbers of the younger and less experienced applicants for posts of various classifications appearing each week in the Electrical Review "Wanted" columns.

The Application.

Remember that your application may be one of hundreds. It is almost certain that the employer will not even trouble to read a long rambling application closely written on both sides of the paper, but will give first consideration to those which are clear and concise.

Use paper quarto or foolscap size—avoid note paper, or paper ruled for cash.

Use ink—never write in black lead.

Although type-written applications receive more attention than badly-written ones, for certain positions where the applicant, if engaged, may be required to write daily reports, the employer will take handwriting into consideration.

Handwriting is undoubtedly a good index of character and habits. It may reveal, on the one hand, independence, boldness, assertiveness, self-confidence, physical strength, clearness of thought, intelligence, good education, neatness, and precision; and, on the other hand, weakness, hesitancy, nervousness, indecision, lack of training, irregular habits, slovenliness, irresponsibility, and illiterateness.

Write on one side of the paper only.

Leave a wide margin on the left hand side.

Divide the matter into distinct paragraphs.

Avoid scents, monograms, and letter headings.

Pin all separate sheets together.

For attractiveness the writer recommends that the application be enclosed in a cheap but neat stiff paper binder endorsed:—

Application of ....
For position as
....
Box No. ....Electrical Review.

The first page should commence in letter form thus:—

Gentlemen,
Replying to your advertisement for..............................
in the current number of the Electrical Review, Ref. No......
I beg to tender my application as per particulars below.
Yours respectfully,
(Signed) Ordinary signature.

Then should follow in schedule form these *essential facts*:—

1. Name in full.
2. Address in full.
3. Age.
4. Single or married.
5. If married give details of family, but don't describe your children as encumbrances.
6. Wages or salary required.
7. Education summarised (for full details refer to page 2) *For salaried men only.*
   Elementary. Name of School. Period.
   Secondary do. do. do.
   Technical do. College. do.
   University do. Period. Degrees taken.
8. Experience summarised (for full details refer to page 2 (and 3).
   Give on this page list of previous employers.
   .... (apprenticeship)
   ....
   ....
   .... (present employers)
9. Mention if copy testimonials are attached, and if others can be obtained.
10. If free or engaged.
11. If engaged, what notice is required to present employers.

This may be followed by these *optional* facts—

If member of I.E.E.
Languages, and degree of proficiency.
Length of service with present or last employers, and reasons for leaving.
For Draughtsmen—Knowledge of metric system; use of slide rule.
For Juniors—If attending night classes.

Superfluous matter should be omitted, such as request for further particulars of job before applying, and statements *re* good time-keeping, being strong, willing and active.

Page 2 should be headed, "Application of ....," and should be a chronological record of the applicant's education and experience, giving the inclusive period on the left-hand side, followed by the name of the school, college, or firm.

Detail examination successes, degrees taken, and give a very brief statement of the work engaged upon, and experience gained at the different works and offices.

All subsequent sheets should be numbered consecutively, and headed, "Accompanying Application of.................."

One sheet may be devoted to a list of references.

A separate sheet should be reserved for each copy testimonial.

The filling up of a schedule is often a pitfall to the simple-minded. Readers may have heard of the Irishman who stated in reply to an item in a schedule:—"State age of parents, if living." "Father, 106. Mother, 102." A friend with him pointed out that his parents were dead. "Yes," replied the Irishman, "but that would be their age, if living!"

Just in the same way a little consideration will show that the above schedule is drawn up to cover all sections. It is not *essential* for, say, a wireman to give particulars of his education, not because one does not expect a wireman to have a highly technical training, but because his *experience* would be the main ground for his selection.

The question of "Salary expected" is obviously a difficult one for applicants to decide, but the omission of a figure is liable to cause the summary rejection of the application.

There is the minimum for which you might take the job if details were known, and there is the awful feeling that you may be asking less than the employer is prepared to give.

A safe course would be to quote the "commencing wage or salary" at which you would be *willing* to take the position if engaged, relying on your energy, ability and industry to secure subsequent increases.

In reply to a recent advertisement, one candidate stipulated for the strange figure of £91 per annum.

Applicants should state a *weekly wage* if they expect to be engaged by the week, or a *yearly salary* for monthly or quarterly engagements.

Some people may query the insertion of "Details of family" among the essentials, and suggest that this should be in the "Optional" section; but if the information is not given in the application, it is sure to be asked for at the interview. The employer will prefer a man without family ties for certain posts, but will regard family ties as a likely reason for a man settling down into certain other positions.

The Interview.

If in due course you are lucky enough to be invited to attend at an appointed place at a fixed hour, a few suggestions may help applicants.

Bring with you all certificates and original testimonials.

Be punctual.

Be clean and tidy.

Be polite.

Don't be nervous or incoherent.

Don't be familiar.

Don't be garrulous (talkative).

Don't be disrespectful *re* your past employers.

Attend to Nature's requirements just before the interview.

Little details may attract the notice of the employer to your disadvantage. It is, therefore, wise to keep the appointment with an absence of stubble on cheek or chin, and be provided with clean collar and handkerchief, and possessing clean finger nails and clean teeth.

If a chronic smoker of cigarettes endeavour to remove the stains from your fingers.

If you have a meal just before the appointment avoid onions, kippers or other dishes with a lingering reminiscence.

Don't brace up your courage with stimulants; a belch of beer or a whiff of whisky may hash your chance.

Don't come in chewing a cachou, to sweeten your breath; it creates suspicion.

Avoid perfumes, a waxed moustache and a display of jewelry.

Don't carry a cane, and *do* take your hat off.

This last point is a rock on which many applicants founder.

Familiarity is almost certain to be resented.

Talkativeness will be regarded unfavourably, especially if this takes the form of confidences regarding your grievances, or the shortcomings of your last employers.

Try to avoid fidgetiness, which includes feet-shuffling, playing with your hat, dropping pencils, &c.

Raise your voice to a tone which you can perceive is effective, and talk clearly. If the questions put to you have to be repeated, time is wasted—another man is probably waiting outside—you are therefore losing ground.

Don't let your gaze wander round the room.

Look your future employer in the face while he addresses you, and during your replies.

In anticipation that your railway fare and reasonable expenses incurred by the visit will be refunded to you, come prepared with a slip detailing the items.

NOTES.

Magnetisation by Rotation.—In a letter to *Science*, Prof. S. J. Barnett, of the Ohio State University, says that about six years ago he published in that journal a note in which it was shown that on the modern theory of magnetism any magnetic substance should become magnetised by a sort of molecular gyroscopic process on being set into rotation. Rotation should produce in any substance an intrinsic magnetic intensity parallel to the axis of rotation, proportional to the angular velocity, and (like the magnetisation of the earth) directed oppositely to the magnetic intensity which would be produced by an electric current circulating around the substance in the direction of rotation. If the rotating body were magnetic, magnetisation, proportional to the intensity, should result; otherwise not (except to a very minute extent).

Preliminary experiments mentioned in the note referred to appeared, though doubtfully, to show the effect in question in the case of a large iron rod rotated at a speed of about 90 revolutions per second.

Recently he has made, with Mrs. Barnett's assistance, experiments which have yielded definite and conclusive results. In the final experiments two nearly similar rods of steel shafting were mounted with their axes horizontal and perpendicular to the magnetic meridian, and two similar coils of insulated wire were mounted about their centres. These coils were connected in series with one another and with a Grassot fluxmeter, and were oppositely wound so that any variations in the intensity of the earth's field produced no effect on the fluxmeter. One of the rods remained at rest; while the other, mounted in a region in which the earth's magnetic intensity was compensated by an electric current flowing in a very large coil, was alternately rotated by an air motor and brought to rest, the change of flux for different speeds and different directions of rotation being determined by the fluxmeter. The fluxmeter was compensated for extraneous electromotive forces, and was read by mirror and scale to 0·1 mm. at the scale distance 8 metres. After all suspected sources of systematic error were eliminated, an effect was left corresponding precisely with that predicted by the above theory and inexplicable on any other theory hitherto proposed. The intrinsic magnetic intensity of rotation per unit speed, and the change of flux-density at the centre of the iron rod per unit speed, were found to be $3{\cdot}1 \times 10^{-7}$ gauss/R.P.S. and $1{\cdot}9 \times 10^{5}$ maxwells/cm.^{2} per R.P.S., respectively.

It is not, of course, possible to obtain iron rods entirely free from magnetisation, and observations were always made on changes of residual flux. Together with the change of flux proportionable to the angular velocity, the effect being looked for, another change, proportional to the square of the angular velocity, was found and traced to the radial expansion of the rod produced by rotation.

The intensity of magnetisation per unit speed produced at the centre of the iron rod was about $1{\cdot}5 \times 10^{-6}$, C.G.S. unit per R.P.S. If the rod had been rotated at the speed of the earth, viz., 1/86,400 R.P.S., its intensity of magnetisation would have been about 2×10^{-10} that of the earth, and still less if the shape had been spherical. This, however, does not prove that even a very large part of the earth's magnetisation may not be due to the effect in question, as we are entirely ignorant of the magnetic properties of all substances under the conditions prevailing within almost the whole of the earth. Schuster has pointed out that an effect of this kind may explain both the mean magnetisation of the earth and the secular variation as well. It seems more likely, however, that a large part of terrestrial and solar magnetisation is due to other causes, such as the outward radial displacement of electrons by centrifugal and thermionic action.

Western Electric Co.'s Disaster.—The catastrophe which occurred on July 24th in Chicago, when the steamer *Eastland* capsized in the Chicago River with many thousand excursionists, resulted in a known death roll of Western Electric employés of 446, with 289 employés still missing. The Western Electric Co. made provision for the relief of the stricken families. On January 1st, 1913, a 10-million-dollar fund set aside by the American Telephone and Telegraph Co. for pensions, sick benefits and life insurance for the 175,000 employés of the Bell system became available. Under the plan inaugurated, the beneficiaries of all employés of more than 10 years' standing who die by sickness or accident occurring outside the employment of the Western Electric Co. will receive an amount equal to one year's pay, and beneficiaries of those between five and 10 years' standing will receive one-half of one year's pay, the maximum payment being $2,000. It is also provided that beneficiaries of all employés killed in performance of work for the company are entitled to three years' wages, the total amount not to exceed $5,000. In addition to the fund that is thus made available, Mr. H. B. Thayer, president of the Western Electric Co., announced a further contribution of $100,000 toward the relief fund. While no figures have been compiled regarding the amount of insurance benefits which will be paid out of the company's fund, a conservative estimate places it at $200,000.—*Electrical World.*

Electrical Trades Wages Arbitration.—The award of the Arbitrator, Sir David Harrel, in connection with the recent arbitration proceedings between the Electrical Trades Union and the London Electrical Masters' Association, was issued on Friday last week. It authorises an increase of ¾d. per hour, which, together with the advance of 1d. per hour which was made last year, makes a total increase of 1¾d. per hour for electrical wiremen and fitters in the London district in about 15 months. The award reads as follows:—

On March 9th, 1915, application was made by the London District Secretary of the Electrical Trades Union to the London Electrical Masters' Association for an advance of wages from 10½d. to 1s. per hour, and a reduction of the working hours to 48 per week.

The Employers' Association intimated that they were unable to accede to this request, and these matters were therefore considered at a meeting of the Joint Committee of representatives of the parties on April 30th and at a general meeting of the Electrical Masters' Association on May 10th, but no agreement was arrived at on these questions.

On June 10th application was made to the Chief Industrial Commissioner by the secretary of the men's Union for the appointment of an Arbitrator to decide upon the application for an advance of wages from 10½d. to 1s. per hour for electrical wiremen and fitters with *pro rata* advances to electricians' labourers and assistants, it being subsequently explained that the question of the reduction of hours was unreservedly withdrawn.

After some negotiations, the Employers' Association concurred in the reference of the matter to arbitration, and the Chief Industrial Commissioner having appointed me, David Harrel, to act as arbitrator in the matter, I heard representatives of the parties on August 5th.

After giving careful consideration to the statements and arguments made before me, I hereby award that the existing rate shall be raised from 10½d. to 11¼d. per hour, with *pro rata* advances to electricians' labourers and assistants, such advanced rate to come into operation as from the beginning of the first pay day following the date hereof, and the advance now awarded to be regarded as war wages and recognised as due to, and dependent on, the existence of the abnormal conditions now prevailing in consequence of the war.

Through Business Eyes.—The ill-effects that may attend a sudden cutting down of expenditure on advertisements were discussed last week by Mr. H. E. Morgan, of Messrs. W. H. Smith & Sons. To a London news agency representative he declared that expenditure on advertising in these changing and critical times was a matter requiring the greatest consideration. It was as reckless to apply the brake suddenly as it was to spend unwisely. It was necessary to adjust expenditure to the conditions which might prevail at any given time.

While this was sound business, the complete stoppage of advertising was utterly unsound. Goodwill was an asset, and was only to be kept alive if it was fertilised, and the loss incurred by stopping most kinds of advertising would be greater than the loss, if any, incurred by continuing.

"The manufacture and sale of articles in those huge quantities which make for the most economical production," he asserted, "is only possible in the present day with advertising. Advertising is the cheapest form of distribution. The specially made non-advertised article is really a luxury and is losing ground. Advertising is a national economy, replacing as it does the human salesman. When distribution can be achieved by the use of the printed word, the human salesman can be released for national duties."

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—*Company Orders.*—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week ending August 28th, 1915.

Monday, Wednesday and Friday.—Drills, 6.30 and 7.30 p.m.

Application for Enrolment.—All applications for enrolment should be sent to the Commandant, Marconi House, Strand, from whom all particulars can be obtained.

E. G. FLEMING,
Company Commander and Acting Adjutant.

Good work is being done by the various sections of the Corps, both in drill and in the special technical work under the staff of the London Electrical Engineers (T.F.), for which this Corps has been organised. Arrangements for the use of a miniature rifle range, with rifles and instructor, are being completed, so that members will be able to take rifle practice at any hour of the day most convenient to themselves.

Recruits will be welcome from all those who are willing to fit themselves by training for military engineering work; it is not necessary that they should be members of one of the Engineering Institutions, although the Corps has been organised primarily among the membership of the Institutions, and applications from men with an engineering bent, even if in other occupations, will be entertained. Applications should be addressed to Lieut.-Col. C. B. Clay, Marconi House, Strand.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, August 19th, 1915 :—

Week-end Parades.—Saturday.—The Battalion will parade as strong as possible at Cumberland Gate, Regent's Park, at 2 30 p.m., and proceed by march route to Wembley, *viâ* Gladstone Park. Rucksacks will be carried. Members can use their own discretion as to what they carry in the rucksacks, but the total weight of these articles should not be less than 20 lb.

Sunday, 7 a.m., Réveillé ; 10 a.m., Church Parade ; 10.20 a.m., Parade under Company Commanders ; 2.15 p.m , Battalion Parade.

Musketry.—Bisley Targets.—Sunday, 22nd inst. Men who have sent in their names will report themselves to Sergt. Cotter at the Barrier of No. 9 Platform, Waterloo Station, at 10.45 a.m. Dress : Uniform with Rifle and Sidearms. Men are recommended to take their lunch with them.

There will be no shooting at Bisley on Saturday, 21st inst.

Acton Range.—Saturday, the 21st inst., at 2.30 p.m. Shooting for all Companies. Names to be in by Friday evening. Tuesday next, the 24th inst., at 2.30 p.m. Shooting for all Companies. There will be no shooting at Acton on Thursdays, until further notice.

A. G. JOINER, *Captain and Adjutant.*

Lead.—Reports on the lead market from Messrs. James Forster & Co. show a slight decline in price on the first week, arrivals being heavy. Messrs. G. Cawson advise that American quotations were still above London parity. On the second week there was a considerable fall, the price opening at £23 5s., and being as low as £20 5s. on August 12th. It recovered 10s. by the end of the week. This fall was due to supplies coming in freely, and promoted a good business. The American market is lower, but still 30s. to £2 above London parity. Supplies from Mexico are not looked for at present, the situation being still too unsettled. Improvement in price is anticipated after the heavy selling both by speculators and importers.

Messrs. Robert Hammond & Son.—In a circular letter announcing the death of their senior partner, Mr. Robert Hammond, Messrs. Robert Hammond & Son state that it is the intention of the firm to carry on the practice under the old name and at the same address (64, Victoria Street, Westminster). Pending the return to civil life of the junior partner, Captain R. W. Hammond, now on active service, Messrs. Preece, Cardew, Snell and Rider have kindly undertaken to execute, on behalf of the firm, all work now in hand, and any future work which may be entrusted to the firm.

Appointments Vacant.—Handy man, for overhead trolley line, &c., for Dover Corporation Tramways; pupil for Barnsley Corporation Electricity Works. Particulars are given in our advertisement pages.

Fatality.—In connection with the death from electric shock of a Halifax tramway car cleaner, Archibald Hemingway, to which reference was made last week, the evidence given at the inquest showed that Hemingway was at work on the top of a car, and when found was in a state of collapse, with one hand fast between the trolley standard and the spring bolt, and the other clutching the outer rail of the car. The man was released and artificial respiration tried without success.

Mr. Galloway, tramway engineer, agreed that the conditions indicated a defect in the car, and suggested that when out during the previous night the trolley head had been struck by lightning during a thunderstorm, with the result that the earth-wire and insulation of the standard were destroyed ; under such conditions Hemingway would receive a 500-volt shock when touching the standard and hand-rail at the same time. No such accident had previously occurred at Halifax, and he agreed that the defect would have been detected if the car had been previously examined, which was scarcely practicable. As a precaution, it would be possible to remove the trolley head from the wire and work with the shed lights when cleaning on an open top deck, but the car lights were essential for inside car work. After a lengthy inquiry, the jury returned a verdict of "Accidental death."

Royal Society of Arts.—Mr. R. Le Neve Foster has presented the Society with a donation of £140 for the purpose of founding a prize in commemoration of his father, Mr. Peter Le Neve Foster, who was secretary of the Society from 1853 to 1879, and the Council has determined to offer the prize for a paper on "Zinc, its Production and Industrial Applications." The prize will consist of a sum of £10 and the Society's silver medal. Intending competitors should send in their papers not later than December 31st, 1915, to the Secretary of the Royal Society of Arts, Adelphi, London, W.C.; from whom particulars can be obtained.

Copper.—Stocks in friendly countries continue to increase slowly. Messrs. H. R. Merton & Co.'s statistical report for the fortnight ending August 14th, 1915, shows English stocks 24,389 tons, against 23,959 tons for the end of July, and compared with 16,778 on July 15th, 1914. French stocks are 5,554 tons, and the total European visible supply is 41,716. This, however, includes 3,973 tons, a pre-war figure, allotted to Hamburg and Bremen.

Detailed supplies show arrivals from North America, low ; Spain and Portugal, high ; "other countries," equal to pre-war average ; shipments from Chile just below pre-war average ; and Australian shipments for the fortnight 1,000 tons, against pre-war average 1,655 tons. Total deliveries, if not exceeded in the coming fortnight, will be about equal to those of February, 1915, *i.e.*, a good deal higher than for August, 1914.

The total deliveries for the year completed July 31st, 1915, amounted to 384,749 tons, against 570,969 tons for the preceding year. As the figures in most cases refer to European arrivals, it does not necessarily follow that the decrease is all in friendly countries.

Inquiries.—Makers of Edison, Goliath, and other screw-type lampholders are urgently inquired for. Large orders are to be placed. A machine to compress the graphite and manganese cylinders on the carbons of dry cells is inquired for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. W. BARRY ADAMS has resigned his position with the Barcelona Traction, Light and Power Co., and has joined the staff of the Rio Tinto Co., Ltd. His address in future will be c/o Rio Tinto Co., Huelva, Spain.

MR. F. H. LOWE, shift engineer at the King's Lynn Corporation electricity works, has joined the Forces.

At Holy Trinity Church, Exmouth, on August 8th, the marriage took place of MR. W. J. OXENHAM, engineer and manager to the Launceston and District Electric Supply Co., Ltd., and Miss A. E. Ferris, daughter of the late Mr. E. G. Ferris, of The Strand, Exmouth.

The Greenock Corporation Electricity Committee has recommended an increase of £100 in the salary of the engineer, Mr. Frank H. Whysall. Mr. Whysall was appointed a year ago, and his first financial report shows a surplus of about £10,000.

MR. A. E. WILSON, deputy city electrical engineer, Bristol, having been selected by the War Office for the appointment of Electrical Engineer to the Chief Engineer, Southern Command, has resigned his present appointment and takes up his new duties at Salisbury on the 23rd inst.

Tramway Officials.—INSPECTOR W. F. RICHARDSON, of the Birmingham tramway department, has received a commission in the 18th Service Battalion of the Middlesex Regiment. He was in the Army for some years, and left as a Colour-Sergeant, joining the Tramway. He rejoined last August, and was appointed drill instructor to the 3rd City Battalion at Moseley College.—*Birmingham Daily Post.*

MR. HENRY MATTINSON, one of the chief officials in the Manchester Corporation tramway department, has obtained a commission in the Royal Engineers.

General.—Sergt. James Jackson, of the Berwickshire Territorials, who was electrician to the Earl of Home, at Hirsel, has been wounded in action.

At Illogan (Cornwall) on August 7th, the marriage took place of Mr. J. G. Meneer, late chief electrician at South Crofty mines, and now in the Royal Flying Corps, and Miss Ida Kate Bath, of Trelowith.

Mr. Samuel Lemon, who has warrant rank as a telegraphist on the patrol ship *Alsátian*, the flagship of Rear Admiral de Chier, has been awarded the Distinguished Service Cross. He lives at Fleetwood, and was formerly in the telegraph office at the Fleetwood Railway Station. Later he became a wireless operator, first on the ss. *Viking*, and then on the ss. *Alsatian*.

Captain Herbert Bailey, electrical engineer, who has been wounded in action in the Dardanelles, formerly lived at Blackburn, but on the outbreak of war was in China. He returned to this country and resumed his association with the Territorials, being at once appointed Captain and Adjutant of the 2/4 East Lancashire Regiment. He went out with a draft of men to the Dardanelles about a month ago.

Mr. Walter Langdon-Davies, well known as one of the pioneers of the single-phase induction motor (who is not to be confused with a member of the Union of Democratic Control of similar name), has returned from Vancouver, B.C., where he has been for some years laboratory superintendent over the lines of the British Columbia Electric Railway Co., and has taken an office at 7, Quality Court, Chancery Lane, W.C. He is developing a new patent arc welder.

We are informed that Mr. J. F. Shipley has taken up the position of engineer to Messrs. Graham, Rowe & Co., of Liverpool.

Mr. Chas. Roland Robson-Muller, electrical engineer, residing at "Chevening," 11, Park Drive, Hampstead, announces in the *London Gazette* that on July 8th he renounced the surname of Robson-Muller, and adopted the name of Chas. R. Robson.

Roll of Honour.—Mr. S. J. Daniels, who was an instrument maker at the Marconi Works at Chelmsford, has died at Malta whilst on active service. Last October he joined the Royal Engineers Wireless Signal Section, and left for the Dardanelles about 10 weeks ago.

Rifleman Geo. Booth, of the 9th Battalion King's Royal Rifles, who was on the electricians' staff at Creswell Colliery, and was trained at Sheffield University, has been killed in action.

The death, from wounds received at the Dardanelles, of Mr. W. A. B. Kirwan Ward, was recently announced. Mr. Kirwan Ward commenced his business career with the National Telephone Co., subsequently joining the Constantinople Telephone Co., where he remained until October, 1913. He was next associated with the Relay Automatic Telephone Co. (then called the Betulander Automatic Telephone Co.), and was for some time employed in London and in France in connection with the installation erected in the Bois de Boulogne. On the outbreak of war he was called up to serve with his company, in which he held the rank of second lieutenant, and about six weeks ago was ordered to Alexandria, with a view to joining the Mediterranean Force in the Dardanelles. He was very popular with the staff with whom he served, and will be remembered by some of the Marconi staff as the representative of the Relay Co. in the competition for the Tennis Challenge Cup.

Private Herbert Smith, of the 15th Manchester Regiment, of Eccles, who has died from wounds received in the fighting at the Dardanelles, was a draughtsman in the employ of Messrs. Eckstein, Heap & Co., electrical engineers, Manchester.

Obituary.—Much sympathy has been expressed with Mr. W. H. Miller, the Fleetwood Council's electrical engineer, in the loss of his wife. Mr. and Mrs. Miller were on a motoring holiday when Mrs. Miller was taken ill and had to return home by train. She was 37 years of age.

We regret to record that Mr. Thos. L. Hellyar, of King Street, Hammersmith, electrical engineer and contractor, who retired four years ago, died on August 13th after an operation. He had been connected with the electrical trades for very many years, and was well known amongst electrical men.

Mr. J. A. Seager.—With great regret we announce the death of Mr. J. A. Seager, B.Sc., of Bristol, who for many years was a regular and valued contributor to our pages, and a personal friend whom we held in high esteem. Mr. Seager was the son of the Rev. Jno. Seager, of Truro. For some years he was lecturer in electricity at Nottingham University, and afterwards he was employed on the staff of the Charing Cross and City Electricity Supply Co. at their Bow generating station. Later he joined the Newcastle and District Electric Supply Co., taking charge of their publicity department; in this capacity he edited the *Tyneside Pioneer*, and much of the publicity literature of the company. In 1911 he went to Bristol, and took up an appointment with the United Stone Firms. He became an Associate of the Institution of Electrical Engineers in 1900. He was an able and prolific writer on engineering subjects, and his "Simple Stories," which he contributed to our columns over the pseudonym of "Innocens," were characterised by a gentle satire and a keen sense of humour which rendered them exceptionally enjoyable. As he rarely wrote over his own signature, the readers of the Electrical Review and other technical journals, both British and American, for which he wrote, are not aware of the extent to which engineering literature is indebted to his pen. Modest and unassuming to a degree, cheery and witty in conversation, and of untiring industry, he was a friend whom we could ill spare, and we tender our sincere sympathy to his relatives.

NEW COMPANIES REGISTERED.

Patent Lighting Co., Ltd. (141,238).—This company was registered on August 10th, with a capital of £100 in £1 shares, to carry on the business of manufacturers of and dealers in appliances connected with the lighting or heating (by gas, electricity, or otherwise) or ventilating of railway carriages, tramcars, ships, boats, buoys, buildings, etc. Power is also taken to manufacture munitions, etc. The subscribers (with one share each) are: A. Hall, J.P., D.L., Barkway House, near Royston, Herts.; C. P. Whitcombe, Durward House, Kensington Court, W., civil engineer; F. C. Fairholme, Nether Hale, Hathersage, Derbyshire, civil engineer; D. M. Leslie, 49, Charing Cross, S.W., bank clerk; J. Russell, 15, Victoria Street, S.W., M.Inst.C.E.; H. A. Butler, 13, Fenchurch Buildings, E.C., wine merchant; F. R. C. Worsley, 28, St. George's Road, S.W., secretary, public company. Minimum cash subscription, 20 per cent. of the shares offered to the public. The number of directors is not to be less than three or more than seven; the first are W. B. Rickman, A. Hall, C. P. Whitcombe, and F. C. Fairholme. Qualification, £10. Remuneration, £1,050 to £1,550 per annum (according to dividends) divided between them. The Board of Trade has authorised the acquisition by this company of the undertakings of Pintsch's Patent Lighting Co., Ltd., and Pintsch's Electric Manufacturing Co., Ltd., the books and documents of which are liable to inspection under Section 2 (2) of the Trading with the Enemy Act, 1914. Registered by Blyth, Dutton, Hartley & Blyth, 112, Gresham House, Old Broad Street, E.C.

Killorglin Electric Light and Power Co., Ltd. (4,268).—This company was registered in Dublin on August 11th, with a capital of £1,650 in £1 shares, to carry on at Killorglin, Co. Kerry, the business of an electric supply company in all it branches. The subscribers are: J. Diggan, Killorglin, merchant, 25 shares; D. M. O'Sullivan, Killorglin, merchant, 50 shares; D. Murphy, Killorglin, merchant, 25 shares; W. Crowley, Killorglin, merchant, 60 shares; T. O'Donnell, Killorglin, merchant, 25 shares; P. J. O'Shea, Killorglin, merchant, 40 shares; J. O'Regan, Killorglin, merchant, 25 shares. The number of directors is not to be less than three or more than seven; the first are D. M. O'Sullivan, D. Murphy, J. O'Regan, J. Diggan, W. Crowley, T. O'Donnell, P. O'Shea, and E. L. Cantwell. Qualification, £25. Remuneration as fixed by the company. Registered office: Power House, Killorglin, Co. Kerry.

Industrial Invention, Ltd. (141,222).—This company was registered on August 8th, with a capital of £3,000 in £1 shares, to carry out experiments and research work chiefly in the direction of deposition of metals and utilisation of waste products. The subscribers (with one share each) are: F. H. Skimmell, 30a, Glenfield Road, Balham, S.W., clerk; J. Camp, 14, Serjeants' Inn, E.C., registration agent. Private company. The first directors are not named. Solicitor: T. H. Goodwin, 10, Basinghall Street, E.C. Registered by C. Doubble, 14, Serjeants' Inn, E.C.

Electric Safety Hoists, Ltd. (141,264).—This company was registered on August 13th, with a capital of £500 in £1 shares, to take over the business of a dealer in patent electric safety hoists and all electrical appliances, manufacturer and equipper of electrical plant, machinery and stock, manufacturers' agent, electrical and mechanical engineer, etc., carried on by A. H. Colley at Seaton Building, Water Street, Liverpool, as the "Star Electrical Co." The subscribers (with one share each) are: A. H. Colley, 17, Water Street, Liverpool, electrical engineer; L. H. Wright, 24, Water Street, Liverpool, biscuit manufacturer and miller; E. C. Marriatt, Patterdale, Egerton Park, Rock Ferry, Cheshire, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are A. H. Colley (permanent managing director) and L. H. Wright. Qualification, £50. Remuneration as fixed by the company. Solicitor: R. B. Jones, 50, Sir Thomas Street, Liverpool. Secretary: Elsie M. Colley. Registered office: Seaton Buildings, 17, Water Street, Liverpool.

"Ballantyne" Submarine-Craft Detector and Telegraphs, Ltd. (9,452).—This company was registered in Edinburgh on August 12th, with a capital of £500 in 115 preference and 350 ordinary shares of £1 each and 700 deferred shares of 1s. each, to provide for making and testing of an experimental apparatus and acquiring certain valuable inventions relating to "apparatus for the detection and location of submarine craft and submarine telegraphy between ships or ships and shore," and to carry on the business of experimental engineers, etc. The subscribers (with one share each) are: H. A. Lamont, 4, Annandale Terrace, Old Kilpatrick, Dumbarton, mechanical engineer; R. Semple, jun., Braeside House, Johnstone, Renfrewshire, mechanical engineer. Private company. The number of directors is not to be less than three or more than five; the first are J. H. Ballantyne, R. Semple, jun., and D. Mactaggart. Qualification, 50 ordinary or 50 deferred shares. Remuneration, £5 per annum, or any sum which may be determined. Registered office: Glasgow.

CITY NOTES.

Marconi's Wireless Telegraph Co, Ltd.

Senator G. Marconi presided, on Wednesday, over an extraordinary general meeting of the shareholders, held at Marconi House, Strand, when the resolution agreed to at the ordinary general meeting for the alteration of certain of the Articles of Association was confirmed as a special resolution. The Chairman said it might interest the shareholders to know that wireless communication had been established between the United States and Japan by means of the company's stations in America and the Pacific. That was very satisfactory, as a regular commercial service would soon be opened for the receipt of public messages, and it would also be available from England *via* their stations in the United States. That brought them one point nearer to the completion of their general programme by means of which they were going to establish wireless telegraphic communication between various parts of the world.

Mather & Platt, Ltd.—Interim dividend on the ordinary shares of 3 per cent., less income-tax, for the half-year to June 30th, being at the rate of 6 per cent. per annum.

Official Notices re Companies.—The following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary :—

Collieries Electric Power Development Syndicate.
Dimming Switches.
Duplex Radiators.
Electric Speller.
Horsfall Destructor Co.
Hydro-Electric Lift and Crane Co.
London Electric Treatment Co. (1911).
Magnet Galvanising and Plating Co.

County of Dorset Electric Supply Co., Ltd.

At the second ordinary general meeting of the company, held at Moorgate Court, Moorgate Place, London, E.C., on July 14th, 1915, the Chairman (Dr. J. A. Hosker) pointed out that the balance sheet to December 31st, 1914 (p. 181) showed that the company's progress from its commencement had been uniformly steady and satisfactory, and continued on the same lines in spite of the drawbacks incidental to the war. The cost of generation due to the increased price of coal, etc., had gone up, and necessarily increased the running expenses. Again, the restricted lighting orders, which had been so severely in force in all four towns, considerably reduced the amount normally used, especially for shop lighting purposes, and in the case of all consumers the economy which had been so widely practised had also had an effect on the consumption. In spite, however, of all these adverse factors the company had largely increased the number of consumers, in fact, during the war period they had added 86 new consumers and 4,325 lamps. June showed the largest increase in any month since the four companies had been in operation, as during this month lamps to the equivalent of over 1,000 30-watt lamps had been connected. An important factor in the company's progress had been the Dorchester prisoners' camp. This had recently doubled in capacity, and if it were still in use during the winter its requirements in the way of electricity should be more than double that used last winter. The works cost per unit had been less than half the cost for the same period last year, and the company's engineer reported that he hoped to have still better results during next winter. At Dorchester, for the month of January the generating cost came out at only .601d. per unit generated. During the half-year which had elapsed since the date of the balance sheet, the revenue had materially increased; in fact, at June 30th the receipts equalled fully two-thirds of the total for the whole previous year, while against a debit balance of £160 the company had now a net profit of £222, or already a net increase for the half-year of £382 over the whole year of 1914. Given the proportionate increase for the next half-year, the debit balance of the previous years should practically disappear.

The report was unanimously adopted, and Lieut.-Col. E. C. Castleman-Smith and Col. W. H. Baxter (the retiring directors) were re-elected directors of the company.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange is in a rather more confident mood. Why this should be, it is not easy to explain, but the firmness originated with a sharp fall in the rate of exchange for the Russian rouble. Rightly or wrongly, such a drop was interpreted as meaning that events in the Dardanelles were moving more quickly to a favourable conclusion, and the effect was felt in practically all departments. Rightly or wrongly, also, the impression spreads that the Austro-German effort must be regarded as virtually at its maximum, and that even if the enemy makes further progress into Russia, he will find it impossible to maintain his position, faced as he is with the possibility of another winter campaign.

Less superficial, but perhaps quite as effective, is the fact that the check to all investment which was imposed by the issue of the War Loan at the end of last June is steadily lifting. Capital is once more flowing into normal channels, and, bit by bit, securities which were all but unsaleable a month ago are being inquired for by their usual supporters, although, naturally, at the lower standard of values brought into being by the War Loan.

While the course of the Russian exchange affords ground for satisfaction and for hope, the position with regard to the United States exchange is far from pleasant. Even during the past few business days, the exchange has again moved sharply against this country. The committee formed to explore the situation, with a view to seeing what can be done to mitigate the difficulties and complexities arising out of the overweighted dollar, will earn the thanks of the business community the country through if they take such steps as will deal promptly and effectively with the situation—which, in point of fact, is distinctly grave.

Meanwhile, there is this gamble in all kinds of industrial shares which is taking place in America, and so developing an insecure internal basis upon which the expansion of the United States trade has to rest. The Stock Exchange watches the matter with growing concern, and it is difficult for the layman to see how a proper balance is to be restored what time gold is flowing out from this country, with very little to correct the efflux in the shape of exports from England or sale of American securities by British holders.

Mexican securities have come to a halt, after their fairly rapid rises, and there is a little disposition to wait and see what are likely to be the next developments. So far as can be observed, the pacification proposals do seem to be making headway—certainly slow, but, perhaps, none the less sure for all that—through the medium of the United States. Accordingly, Mexican Railway stocks are continuing to advance, though the industrials are scarcely so good this week. Mexican Light & Power first mortgage bonds reacted 5 points to 40, but the other gains of last week have been well held.

Brazilian Tractions, allowing for the dividend, are unchanged at 49, but interest in them as a speculative counter has shifted into some of the American "war specials"—now the pivots of the New York gamble. Brazilian Traction preferred keep firm about 75. There is a fair amount of business doing in the bonds of the various Canadian power companies, and Shawinigan Water common shares are better at 119, the rights being now valued about 1 per cent. Canadian General Electrics are about 110 for the common and 106½ for the preferred. Consolidated Gas, Electric Light & Power of Baltimore common are firm at 110. Kaministiquia Power capital stock has not changed hands for nearly four months, but Toronto Power debenture stocks are being dealt in on the basis of 87 for the 1918 issue and 86 for the consolidated guaranteed, both securities carrying 4½ per cent. interest.

The Victoria Falls & Transvaal Power report has further stimulated dealings in the shares, and the preference are comparatively active round about 15s. 6d., while the ordinary are called 4s. 6d.—5s., and the 5½ per cent. second mortgage debentures are 86.

The Telegraph market gives some indication of recovery. The recent pressure to sell has been removed, and greater attention is being directed to the cheapness of the best-class stocks in this section, such as those to which we have drawn attention as having fallen unduly far. To amplify our contention, it is, we hope, of interest to reproduce some of the most striking figures extracted from the reports for 1914 in the case of a few of the leading companies. We will take first the receipts, both gross and net, for the past two years, and it will be noticed that the comparisons make a very favourable showing:—

Company.	Gross receipts.		Working expenses.		Net receipts.	
	1913.	1914.	1913.	1914.	1913.	1914.
	£	£	£	£	£	£
Cuba Submarine	38,490	38,245	15,473	16,702	23,017	21,543
Direct Spanish ..	36,958	55,018	19,214	20,594	17,738	34,423
Eastern	1,462,844	1,646,741	685,218	786,449	777,626	859,293
Eastern Extension	738,129	819,583	354,864	364,979	383,265	454,604
Great Northern ...	575,601	682,309	229,470	250,590	346,131	431,719
Indo-European	172,532	189,384	91,441	88,395	81,091	100,988
Western	889,710	830,056	360,738	389,943	528,972	440,113
	3,914,264	4,261,336	1,756,418	1,917,652	2,157,840	2,242,683

The Western Telegraph Co., which shows a decrease, closes its books at the end of June, so the above figures do not take into account the effects of the war. The Cuba Submarine is the only other company in the group having a decrease on the year. It is worth noticing how working expenses have risen, though, at the same time, gross receipts have more than kept pace with these.

Dividends for 1914 of the cable companies can be seen by reference to our price lists; and, to complete the figures, we may set out the reserves, etc., of the septet under examination. Taking the figures from the various balance sheets, this is what we find:—

Company.	Total capital.	Reserves.	Book value of cable, etc.	Cash and investments.
	£	£	£	£
Cuba Submarine	220,000	110,824	225,751	122,099
Direct Spanish	94,655	67,895	90,974	71,035
Eastern	8,000,000	2,396,969	8,040,752	1,981,552
Eastern Extension	3,752,400	1,140,680	3,806,837	936,459
Great Northern	1,500,000	2,551,015	1,623,518	2,307,278
Indo-European	425,000	297,067	56,316	661,220
Western	2,897,975	2,017,232	3,109,202	1,731,020

The above table shows the strength of the financial position occupied by the best cable concerns.

The Marconi group is much quieter, and business has fallen off considerably, with the result that the parent shares lost their previous week's rise, Americans are lowered to 18s. 6d., while Canadians keep strong at 6s. 3d.

In the market for home electric shares, the tone continues to be heavy. Westminsters, South Londons, St. James' and Chelseas are amongst those that have given way from ⅛ to ¼. Charing Cross ordinary and preference are both ex-dividend, and have recovered their deductions. The uncertainty of outlook with regard to coal is one of the reasons that keeps people out of this market, and another is the practical certainty that the lighting regulations are not likely to be relaxed, but, if anything, will be made more stringent as a result of the nocturnal visits from German gas-bags. The manufacturing shares are also somewhat easier, Edison & Swan, Electric Construction, General Electric preference, for instance, being amongst those which have reacted. Henley's Telegraph has declared the regular interim dividend of 10 per cent., and the Telegraph manufacturing shares keep steady.

The London & North-Western secured a success in its issue of 4½ per cent. preference stock at 96, the money being required in part for electrification of suburban lines. Travellers by the London & South-Western, by the way, are interested to notice the new electric stock which is making its appearance in different places, from which it would seem that the running of electric trains is likely to take place very shortly. Underground Electric income bonds have hardened to 74¾, but the "A" shares are 3d. lower at 5s. 9d. Sellers predominate in Central London ordinary assented stock, the nominal quotation being 73. Metropolitans and Districts maintain their previous prices.

The Armament section displays a disposition to weaken, and rubber shares are quiet. With raw rubber the merest shade better, it is thought that the round 2s. 6d. per lb. will shortly be reached again; in the meantime, rubber shareholders are by no means anxious sellers. The copper group is naturally languid and dull, in consequence of the depression in the price of the metal, and most of the leading shares show falls on the week.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Aug. 17, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	8	—	£6 5 0
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4 xd	+ ⅛	6 5 0
do. do. do. 4½ Pref. ..	4½	4 xd	+ ⅛	5 12 6
do. do. City Pref.	4½	3⅞	—	5 16 2
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4⅜	— ⅛	5 14 3
do. 4½ Deb.	4½	88	—	4 17 10
City of London	9	13	—	6 18 6
do. do. 6 per cent. Pref. ..	6	11	—	5 9 1
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10½	—	6 13 4
do. do. 6 per cent. Pref. ..	6	10½	—	5 14 3
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6¼ xd	—	7 4 0
London Electric	4	1¾	—	8 8 4
do. do. 6 per cent. Pref. ..	6	4¾	—	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	8½	2¾ xd	—	6 7 3
do. 4½ per cent. Pref. ..	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6¾	— ¼	7 8 2
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	— ⅛	6 19 0
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	6¾	— ¼	6 13 4
do. 4½ Pref.	4½	4½	— ⅛	5 0 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	98	+1	6 2 6
do. Def.	1½	21¼	—	7 1 2
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8¼	—	6 1 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11	—	*7 5 6
do. 4 Deb.	4	79	+1	5 2 1
Eastern Tel. Ord...	7	116	—1	*6 18 6
do. 3½ Pref.	3½	70	—	5 0 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	9¾	+ ¼	*7 0 8
do. Pref.	6	10	—	6 0 0
Gt. Northern Tel.	22	33	—	6 13 4
Indo-European	10	50	—	6 10 0
Marconi	10	1 15/16	— 2/-	5 3 1
New York Tel. 4½..	4½	97½	+1	4 12 3
Oriental Telephone Ord.	10	2	—	5 0 0
do. Pref.	6	1⅛	—	5 6 8
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5½	—	*8 6 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	11½	—	*6 19 0
do. 4 Deb.	4	81	—	4 16 5
Home Rails.				
Central London, Ord. Assented ..	4	73	—	5 8 1
Metropolitan	1½	23½	—	5 6 5
do. District	Nil	14	—	Nil
Underground Electric Ordinary ..	Nil	1½	—	Nil
do. do. "A"	Nil	5/9	— 3d.	Nil
do. do. Income ..	6	74¾	+ ¾	*9 8 0
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref. ..	5½	4	—	6 17 6
do. 2nd Pref.	5½	8½	—	7 17 2
do. 4 Deb.	4	71	— 2	5 12 7
do. 4½ Deb.	4½	75	—	6 0 0
do. 5 Deb.	5	71	—4	7 0 10
Brazil Tractions	3½	49 xd	—	7 2 10
Bombay Electric Pref.	6	10	— ¼	6 0 0
do. 4½ Deb.	4½	87	—3	5 3 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds ..	—	50	—	Nil
do. 6 per cent. Bonds ..	—	35	—	Nil
Mexican Light Common	Nil	25	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	40	—5	—
Adelaide Sup. 6 per cent. Pref. ..	6	5	—	6 0 0
do. 5 Deb.	5	98	—1	5 2 0
Manufacturing Companies.				
Babcock & Wilcox	14	2 3/16	— 1/16	6 8 5
British Aluminium Ord.	5	1 1/16	—	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	10¾	— ¼	6 19 4
do. Pref.	6	6	—	5 0 0
British Westinghouse Pref.	7½	31/-	— 6d.	9 13 6
do. 4 Deb.	4	68	—	5 14 4
do. 6 p. lien	6	101	+1	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref...	5	4¾	—	5 5 3
do. 4½ Deb.	4½	95	—	4 14 9
Castner-Kellner	15	8¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/-	— 6d.	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	60	—	6 13 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	11/-	—1/-	10 18 2
do. do. Pref.	7	19/-	—1/-	7 7 4
Gen. Elec. Pref.	6	9½	— ½	6 6 4
Henley	20	14	—	*8 8 8
do. 4½ Pref.	4½	4¾	—	4 14 9
do. 4½ Deb.	4½	95	—	4 14 9
India-Rubber	5	8¾	—	5 14 8
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

Waste Heat and Gas Electrical Generating Stations, Ltd.—Interim dividend of 2½ per cent. on the issued share capital in respect of the half-year ending July 31st, 1915, payable, less income-tax, on August 31st.

Electro-Bleach and By-Products.—Interim dividend of 3½ per cent. on preference shares in respect of year to December 31st next, payable September 1st.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 18th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a " Nitric	"	..	..
a " Oxalic	per lb.	..	..
a " Sulphuric	per cwt.	..	..
a Ammoniac Sal	"	£49	..
a Ammonia, Muriate (large crystal)	per ton	£40	..
a Bleaching powder	"	£9	..
a Bisulphide of Carbon	"	£23	£2 inc.
a Borax	"	£23	£1 inc.
a Copper Sulphate	"	£28	..
a Lead, Nitrate	"	..	..
a " White Sugar	"	..	..
a " Peroxide	"	..	..
c Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	8½d.	1d. inc.
a Potash, Caustic (88/90 %) ..	per ton	..	..
a " Chlorate	per lb.	1/6	..
a " Perchlorate	"	1/6	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	"	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers ..	"	£11 10	..
a " Recovered	"	£8	..
a " Lump	"	£8 10	..
a Soda, Caustic (white 70/72 %) ..	"	..	..
a " Chlorate	per lb.	1/2	1d. inc.
a " Crystals	per ton	45/-	..
a Sodium Bichromate, casks ..	per lb.	5d.	1d. inc.
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	..	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	..	..
b " Sheet, in ton lots ..	"	..	..
p Babbitt's metal ingots	"	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/1¾ to 1/2¼	..
c " Tubes (solid drawn) ..	"	1/2 to 1/2½	..
c " Wire, basis	"	1/1¾ to 1/2¼	..
c Copper Tubes (solid drawn) ..	"	1/1½ to 1/2¼	..
g " Bars (best selected) ..	per ton	£98	£4 dec.
g " Sheet	"	£98	£4 dec.
g " Rod	"	£98	£4 dec.
d " (Electrolytic) Bars ..	"	£82	£6 dec.
d " " Sheets ..	"	£100	£6 dec.
d " " Rods ..	"	£83	£5 dec.
d " " H.C. Wire	per lb.	11d.	½d. dec.
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	1 10	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/4¾	¼d. dec.
j Iron Pig (Cleveland warrants) ..	per ton	65/1½	10½d. dec.
l " Wire, galv. No. 8, P.O. qual.	"	£26	..
g Lead, English Pig	"	£22	£2 15 dec.
g Mercury	per bot.	£18 5	..
e Mica (in original cases) small ..	per lb.	4d. to 2/6	..
e " " " medium	"	3/- to 5/-	..
e " " " large ..	"	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	"	Nom.	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/2 to 1/3½	..
p " " rolled strip & sheet	"	1/3½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£80	..
g Tin, Block (English)	"	£152	£6 dec.
n " Wire, Nos. 1 to 16	per lb.	2/7	1d. dec.
p White Anti-friction Metals ..	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

- a G. Boor & Co.
- b The British Aluminium Co., Ltd.
- c Thos. Bolton & Sons, Ltd.
- d Frederick Smith & Co.
- e F. Wiggins & Sons.
- f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
- g James & Shakspeare.
- h Edward Till & Co.
- j Bolling & Lowe.
- k Morris Ashby, Ltd.
- l Richard Johnson & Nephew, Ltd.
- n P. Ormiston & Sons.
- o Johnson, Matthey & Co., Ltd.
- p
- r W. F. Dennis & Co.

Tyneside Electrical Development Co., Ltd.—Interim dividends for the half-year ended July 31st, at the rate of 6 per cent. per annum on the preferred ordinary shares, and 5 per cent. on the deferred ordinary shares, payable, less income-tax, on August 31st.

W. T. Henley's Telegraph Works Co., Ltd.—Interim dividend on the preference shares at the rate of 4½ per cent. per annum, less income-tax, and on the ordinary shares at the rate of 10 per cent. per annum, less income-tax, for the half-year ending June 30th last, both payable September 1st next.

Melbourne Electric Supply Co., Ltd.—Dividend at the rate of 7 per cent. per annum, less income-tax, on the first cumulative preference shares for the half-year ending August 31st, 1915, payable on September 1st.

Adelaide Electric Supply Co., Ltd.—Dividend at the rate of 6 per cent. per annum, less income-tax, on the cumulative preference shares, for the half-year ending August 31st, 1915, payable on September 1st.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JULY, 1915.

The last completed returns of electrical export and import business, dealing with the month of July, show a considerable decrease in values as compared with the preceding month.

Thus both the exports, valued at £371,732, as compared with £417,769 in the previous month, and the imports, which totalled £212,414, as against £223,801 in June, reveal a considerable falling off; the re-exports, on the other hand, advanced in value from £10,778 in June to £15,097 last month.

The decreased activity in the exports appears to have affected all sections except telegraphic and lamp exports, and the former of these was some £19,000 above the June total.

While machinery imports fell off considerably, cable, and telegraphic and telephonic imports reached higher values than in June.

In recent times Canada has turned importer of various electrical material into this country, while Spain has for some months been an appreciable source of electrical carbons.

During the month Victoria and India were the largest purchasers from this country, the export business being, however, well distributed over the world.

Rather less material was imported from the States than in June, and Belgium appears again in the list of importers.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,725	2,422	492	317	2,159	1,743	3,221	190	129	662	701	9,840	23,601
German West Africa	...	...	...	...	...	...	...	...	...	...	...	13	13
Netherlands, Java and Dutch Indies ...	279	5,057	455	...	...	...	131	...	12	...	94	3,156	9,184
Belgium	26	22	...	...	...	...	34	...	29	...	...	24	135
France	606	...	1,034	...	67	585	5,240	5,434	409	62	5,696	3,355	22,488
Portugal	30	3,736	...	139	...	281	47	275	23	...	447	4,500	9,478
Spain, Canary Isles and Spanish N. Africa...	554	53	199	...	...	563	3,025	29	...	8	16	293	4,740
Switzerland, Italy and Austria-Hungary ...	88	...	4	...	...	232	1,594	8	...	70	8,390	1,799	12,185
Greece, Roumania, Turkey and Bulgaria ...	20	...	...	...	...	...	219	4	...	...	3	3,884	4,130
Channel Isles, Gibraltar, Malta and Cyprus...	101	71	38	111	...	...	50	...	23	...	82	195	671
U.S.A., Philippines and Cuba	230	382	...	...	189	187	643	...	57	47	...	698	2,433
Canada and Newfoundland	115	243	119	...	...	1,432	489	...	302	...	...	18,100	20,800
British West Indies and British Guiana ...	154	174	61	74	56	66	113	...	11	...	...	70	779
Mexico and Central America	...	319	61	30	18	...	111	...	...	...	...	139	678
Peru and Uruguay	...	112	...	68	...	...	...	...	14	...	...	28	222
Chile	213	1,018	16	154	...	119	437	...	29	...	...	134	2,120
Brazil	104	930	665	361	89	501	1,407	460	448	...	73	304	5,342
Argentina	1,536	724	946	797	76	...	3,233	991	297	131	1,519	232	10,482
Colombia, Venezuela, Ecuador and Bolivia...	135	164	...	152	...	...	143	...	59	...	27	59	739
Persia	18	...	15	...	...	...	...	...	...	...	...	...	33
Egypt, Tunis and Morocco	60	209	129	753	...	...	236	326	49	11	67	2,424	4,264
British West Africa	60	2,401	10	15	...	...	129	...	578	36	113	5,894	9,236
Rhodesia, O.R.C. and Transvaal	682	300	1,034	1,200	1,170	296	2,589	...	1,414	112	188	16	9,021
Cape of Good Hope	832	2,613	698	711	...	594	5,002	...	665	64	40	160	11,179
Natal	296	2,930	738	...	...	363	6,249	1,183	133	45	321	59	12,317
Zanzibar, Brit. E. Africa, Mauritius & Aden	22	14	115	61	...	109	214	24	13	...	47	15,869	16,488
Azores, Madeira and Portuguese Africa ...	72	36	...	58	...	...	215	...	...	18	129	50	578
French African Colonies and Madagascar...	12	...	158	...	...	...	...	...	109	...	...	...	279
China and Siam	866	2,172	505	909	41	258	3,685	276	216	24	97	...	9,049
Japan and Korea	274	...	18	45	52	484	995	3,181	1,359	...	21	...	6,429
India	2,710	11,712	4,392	2,761	54	1,479	15,273	2,896	1,653	80	889	292	44,191
Ceylon	12	80	79	...	30	...	459	117	68	...	21	55	921
Straits Settlements, Fed. Malay States and Sarawak	812	672	888	92	...	733	1,117	298	62	33	853	121	5,681
Hong Kong	...	98	125	24	...	...	3,195	330	127	61	64	...	4,024
West Australia	110	339	191	1,532	...	262	...	68	425	...	17	...	2,944
South Australia	158	3,010	315	215	21	488	...	1,640	32	12	805	...	6,696
Victoria	849	19,692	2,262	929	...	512	18,286	1,989	193	163	2,043	468	47,386
New South Wales	1,504	4,199	1,533	1,155	65	132	12,398	1,060	1,621	735	2,498	3,137	30,037
Queensland	7	887	411	104	...	117	1,025	...	90	...	3,821	...	6,462
Tasmania	...	...	74	...	...	...	164	...	...	...	420	12	670
New Zealand and Fiji Islands	1,402	2,275	843	424	...	906	1,429	348	1,492	11	3,506	991	13,621
Total, £	16,674	68,684	19,005	13,191	4,087	12,242	92,797	21,127	12,061	2,385	33,008	76,371	371,732

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Norway, Sweden and Denmark ...	1,117	2,738	17	...	688	...	4,124	...	932	1,116	3,923		14,655
Germany	...	...	...	...	...	...	...	...	...	...	...		...
Holland...	...	...	...	7,049	523	...	629	...	...	...	1,375		9,576
Belgium	...	...	...	...	...	...	...	...	...	...	1,460		1,460
France	101	228	781	1,852	1,473	757	342	...	2,429	2,751	1,868		12,582
Switzerland	1,565	...	41	36	9	3,096	1,527	18	...	765	125		7,182
Italy	291	8,228	...	...	...	...	718	2,680	...	131	...		12,048
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...		...
United States	16,063	6,613	2,501	3,244	9,292	118	34,897	66,204	3,397	8,179	843		151,351
Total, £	19,137	17,807	3,340	12,181	11,985	3,971	42,237	68,902	6,758	12,942	9,594		208,854

Additional imports.—Spain, carbons, £1,794. Canada, goods, £291; wires and cables, £1,150; meters, £20; electrical machinery, £32; carbons, £148; telegraph and telephones, £125.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above... ...	2,199	505	39	1,054	40	530	5,311	...	1,615	1,582	2,222		15,097

Total Exports: £371,732 Total Re-Exports: £15,097 Total Imports: £212,414

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

ALTERNATING-CURRENT CABLE TELEGRAPHY:

With Special Reference to Signal-Reception, Signal-Records, and Auto-re-Transmission.

By EDWARD RAYMOND-BARKER.

Lieut.-Colonel G. O. Squier, well known in the past[*]—cojointly with Dr. A. C. Crehore—as originator and advocate of telegraphic sine-wave transmission,[†] and for other important cable matter due to himself alone,[‡] in his last inspiring paper recently read before the Physical Society,[§] has not only broken new ground, but has opened up quite new vistas in submarine-cable signalling practice and development.

Lieut.-Colonel Squier has done this along lines illumined, from the onset, by points of arresting interest, and by a telling use of graphs.

Broadly considered from a practical point of view, the salient features of the new transmission system brought forward by Lieut.-Colonel Squier may be stated thus:—

1. The *unbroken* nature of the alternating current employed as medium for the formation and transmission of sine-wave signals of various amplitudes.

2. The inter-locking or inter-dependent gearing by which the auto-transmitter tape perforations are caused to move forward synchronously with the rotary generator which is the source of the sine-wave alternations: the resulting co-operation causing the changes of impedance in the generator primary circuit, controlled by the tape perforations, to take place severally at the zero periods occurring between successive rythmically-maintained current alternations: *positive* and *negative*.

Under the foregoing first heading cluster innumerable resulting advantages, due to the master fact that the transmitting current traversing the unbroken circuit *continues to pulsate* even during the various space-periods between letters, words and messages, whilst signals are produced by slightly increased amplitudes for "dot" signals of either *sign*, and by greater increase in amplitudes—*positive* or *negative*, as the case may be—for "dash" signals. Thus there are three degrees of alternations of either *sign*—namely, those severally pertaining to spaces, to "dots," and to "dashes," all these rhythmic pulsations being equal in period, though varying in amplitude.[‖]

One of the foremost of these advantages attaching to Lieut.-Colonel Squier's unbroken circuit is the ease apparent in cable-duplex balancing, even in cases where a Heurtley or an Orling magnifier is used across the duplex-bridge as receiver: a receiver—be it remembered—hitherto, in ordinary transmitting methods, riskily exposed to out-going heavy charge-impacts alternating with abrupt earthing periods, when these took effect under conditions of not absolutely perfect duplex balance.[**] Then, too, the unbroken and undulating nature of the alternating current involves safety to cable cores, even under increased initial voltages.

The present purpose of the writer, however, is not so much to comment on Lieut.-Colonel Squier's instructive presentment of sweeping yet desirable improvement schemes in telegraph-cable transmission practice, as to direct attention to the joint problems relating to:—

(*a*) *Reception* and *record* of the alternating-current signals at the receiving end of the line in *simplex*, and across the arms of the duplex-bridge at each end of a *duplex*-worked cable; also to (*b*) the practicability of automatic re-transmission of alternating-current signals of equal period but of varying amplitude.

This problem of reception is of special interest to the writer, in view of his own previous work in this direction. This work is found to be on lines parallel to, but—in this one particular matter of uni-linear signal-record—advancing beyond the results attained by Lieut.-Colonel Squier. Indeed *rectification* and registration of alternating-current signals, in terms of uni-linear recorder-code, have, by the writer, been successfully effected, and the same electro-mechanism which has produced the *rectified* signals may be used for auto-re-transmission purposes.

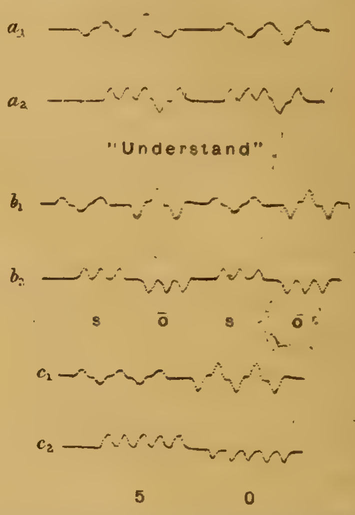


Fig. 1.—Conversion of Gott Two-Power Inverse Currents into Siphon-Recorder Code by Raymond-Barker Rectifier.

The problem how to convert received alternating-current signals of more than one degree of amplitude as shown in a_1, b_1, c_1, fig. 1, into uni-linear siphon-recorder-code signals of the customary kind, as shown in a_2, b_2, c_2, fig. 1, first became urgent on the appearance of the late Mr. John Gott's device for sending into a cable two-power inverse-current impulses—that is to say, impulses alternating in *sign*, and differing only in amplitude.

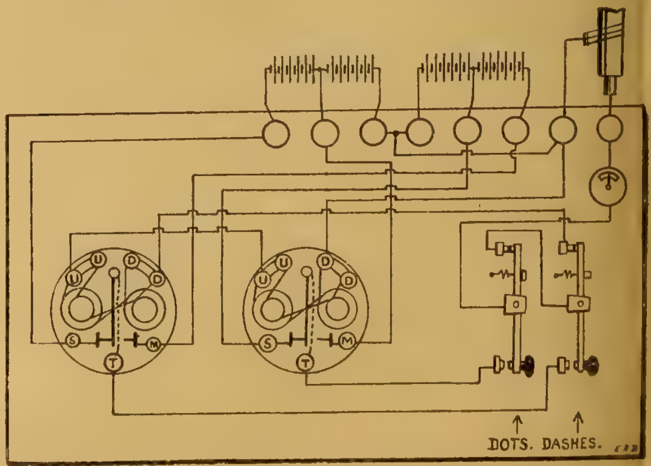


Fig. 2.—Gott "Cable-Discharge" Transmitter of Two-Power Inverse Currents.

The terms "inverse-current" and "alternating-current" are—in a way—synonymous, excepting that the former is conveniently used in connection with battery transmission in square-topped current-impacts, whereas the latter may well be reserved for use as relating to the dynamo-generated rhythmical sine-wave alternations so closely associated with the name of Lieut.-Colonel Squier.

Fig. 2 shows Mr. Gott's two-power inverse current transmission device controlled by cable discharge, as used in practice by the writer. This invention, as described in Gott's British Patent, No. 10,534, 1912, whilst showing how two-power inverse-current transmission could be effected, offers no solution as to how these impulses, when received from a high-KR cable, are to be legibly recorded.

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[*] The Synchronograph: "A New Method of Rapidly Transmitting Intelligence by the Alternating Current." By Albert Cushing Crehore and George Owen Squier. The Electrical Review, Vol. XL, No. 1,015, May 7th, 1897.

By the same authors: "Tests of the Synchronograph on the Telegraph Lines of the British Government." The Electrical Review, Vol. XLII, February 18th and February 25th (Nos. 1,056 and 1,057), 1898.

[†] An advocacy subsequently confirmed by the mathematical investigations of Dr. H. W. Malcolm.

[‡] "An American Pacific Cable." By George Owen Squier. The Electrical Review, January 12th, 19th and 26th, 1900.

[§] "On an Unbroken Alternating Current for Cable Telegraphy." A paper read by Lieut.-Colonel George O. Squier, Ph.D., before the Physical Society of London, June 25th, 1915. The Electrical Review, July 30th, and August 6th, 1915.

[‖] Mr. Axel Orling, by means of a special arrangement, has dealt with this circumstance without in any way impairing or lessening the essentially great sensitiveness of the jet relay or magnifier.

[**] See Colonel Squier's fig. 4. The Electrical Review, July 30th, 1915.

The writer, in his British Patent, No. 27,225, 1913, indicated :—

1. How Gott's received two-power inverse-current impulses could be *rectified* and registered in uni-linear recorder-code.

2. How the received two-power inverse-currents could be made to control and to re-transmit fresh two-power inverse-current, or any other class of impulse, into a second cable.

In fig. 1, a_1, b_1, c_1, indicate how Gott signals from a very short cable would be recorded if left unrectified.

In fig. 1, a_2, b_2, c_2, show the same signals converted by the writer's *rectifier.*

These last-mentioned records—it must be remembered—enjoy all the advantages accruing from inverse-current working, and the resulting maintenance of electrical equilibrium in the cable, with comparative absence of signal distortion.

It was with the keenest pleasure that the writer noted the arrangements made by Lieut.-Col. Squier for the recording of his alternating-current impulses of varied amplitudes—a system to which the writer's *rectifier*, already referred to, is found to be perfectly applicable.

Up to a certain point—as already mentioned—Col. Squier's methods of reception are similar to the writer's, the only difference being that the former comprises, as *receiver* and controller of the local circuits, a Muirhead gold-wire relay (shown in Col. Squier's fig. 5),* whereas, to fulfil a like purpose, the writer has employed an Orling jet relay.

Indeed, if recording siphons were placed on the armature levers of the two electromagnets constituting the first stage, only, of the writer's rectifying system (corresponding to Col. Squier's armatures $g\,g^1$ of electromagnets $h\,h^1$ in his fig. 5), a record as shown in fig. 3, a_3, b_3, c_3 would be obtained, which to all intents and purposes would be the same as that effected by Col. Squier, and shown in fig. 3, a_4, b_4, c_4, excepting that, by means of the pretty mechanical device described in his paper, Col. Squier secures greater symmetry in the grouping of his black dots.

Fig. 4 shows the writer's own form of transmitter for the production of Gott two-power inverse-current impulses. This instrument produced the parallel sets of signals—non-rectified and rectified—shown in fig. 1.

P C is a pole-changer of special design suggested to the writer by a radio-telegraphic device of Mr. Axel Orling, described in Albert Turpain's "*Les Applications Pratiques des Ondes Electriques*": (C. Naud, Editeur, Paris.)

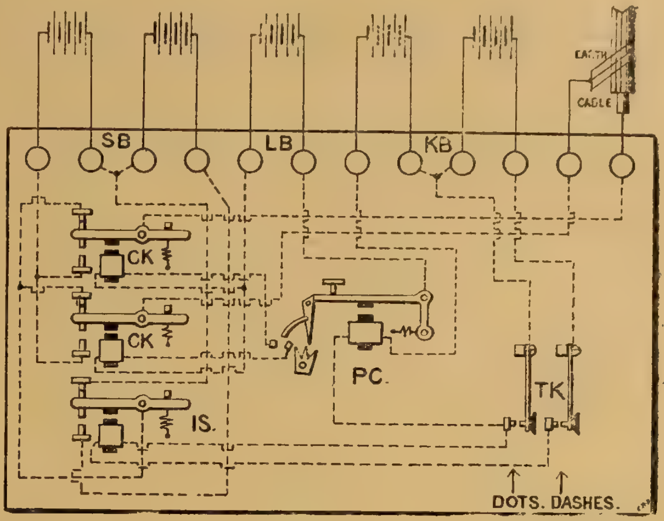

Fig. 4.—Raymond-Barker Transmitter of Gott Two-Power Inverse Currents.

The cable keys C K, C K, alternately actuated by P C, send impulses to line of alternate + and − *sign.*

The increment switch I S, when actuated, brings the higher battery-power into play.

The "dot" key of T K works P C, whereas the "dash" key works P C + I S. Thus the current-impulses passing to line are alternately + and −, increment of battery-power, irrespective of *sign*, being determined by the pressing of the "dash" key and the consequent working of I S as well as of P C.

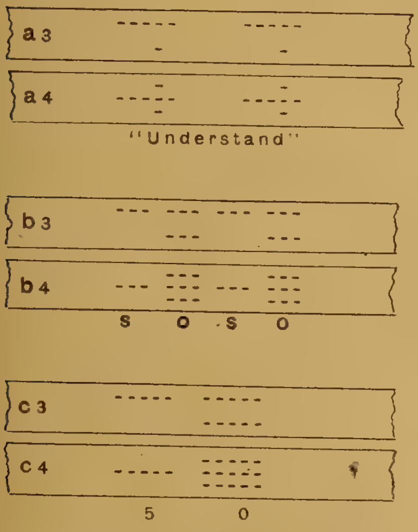

Fig. 3.—Records from Initial Stage of Alternating-Current Rectification into Siphon-Recorder Code.

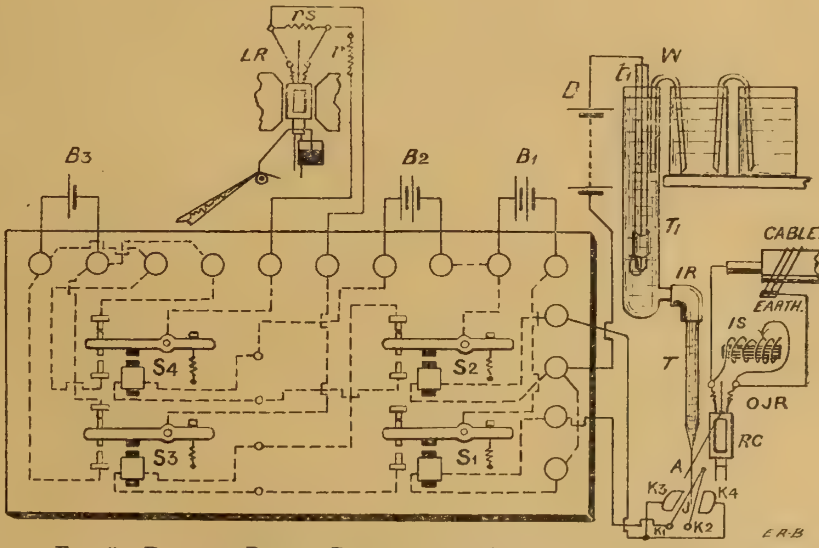

Fig. 5.—Raymond-Barker Rectifier for Conversion of Two-Power Inverse or Alternating Currents (received on Orling Jet Relay) into Siphon-Recorder Code.

There is, however, no need for one to rest content with black dots when the production of uni-linear recorder-code signals is feasible. An effective advance, therefore, may be made in this direction, especially in view of the fact that for avoidance of eye-fatigue during long hours of tense occular and mental concentration, uni-linear signals would be considered by cable men highly preferable to a register composed of black dots. This is clear if we compare the rectified signals a_2, b_2, c_2 in fig. 1 with the corresponding signals in either of the two sets shown in fig. 3.

A *direct* record of these signals would appear as in a_1, b_1, c_1, fig. 1.

Fig. 5* shows one form of the writer's *rectifier* controlled by an Orling jet relay—the receiver of the impulses from the cable. Weak "dot" impulses cause the water-jet J to impinge against K_1 or K_2 alternately, thus working S_1 which, in its turn actuates S_3 *through the armature-lever of* S_2. Strong "dash" impulses carry the jet further in either direction, and cause the jet J to impinge with practical simultaneity against K_1, K_3, or against K_2, K_4, thus causing both S_1 and S_2 to operate together.

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* The Electrical Review, July 30th, 1915.

* Figs. 2, 4 and 5 are from a series of diagrams by the writer, connected with a work he has in course of preparation for the press.

S_2, in its turn, duly works S_4, but, in this case, S_1 is powerless to affect S_3, because the local circuit in which the coil of S_3 is included is interrupted by the armature of S_2, at this moment, being *down*.

Thus it is brought about that a weak deflection of the jet, irrespective of direction, works S_3 which is an electromagnetic "dot" key, whereas a stronger deflection of the jet infallibly works only S_4 which is a "dash" key.

S_3 and S_4 now constitute a common cable key, and if, between the two levers, one connect up the local siphon-recorder S R, one gets a *rectified* record as shown in a_2, b_2, c_2, fig. 1.

Also these same two levers of S_3 S_4 may be used to control, and to retransmit into a second cable, alternating-currents or any other form of signal.

In the working of the *rectifier*, the deflections of the jet against either K_1, K_3 or against K_2, K_4—thus working either S_1 or S_1 and S_2 simultaneously—correspond with those of Lieut.-Col. Squier's Muirhead gold wire f against the contacts f_4, f_4, which actuate either h, or h and h_1 simultaneously.

So, instead of recording (as shown in fig. 3) the armature workings of S_1 and S_2, the writer, by co-relating S_1, S_2, S_3, S_4, has produced :—

1. Uni-linear recorder-code signals.
2. Possible automatic re-transmission of two-power inverse-current impulses.

This *rectifier*, designed in the first instance to satisfy the reception requirements of Gott's two-power inverse-current transmission, is equally applicable to the needs of Lieut.-Colonel Squier's *unbroken alternating current.*

SOME WRINKLES ON THE OPERATION OF ALTERNATORS.

By E. B. PAUSEY.

The following hints on running alternating-current generators are based on practical experience, and are, as I have ascertained, not altogether matters of common knowledge. I venture to hope, therefore, that they may be of assistance to many of those who are in charge of the running of alternators.

At the present time power factor indicators are so universally installed on A.C. generator panels, and are so useful in preventing excessively heavy idle currents to circulate between machines running in parallel, that many switchboard operators feel rather lost if one or more of these instruments is removed for repairs or put out of commission in any way. A little thought, assisted by a simple vector diagram, will show that when all the machines in parallel have the same power factor, the sum of their main ammeter readings will be a minimum. Therefore, if the excitation of the machines is regulated so as to keep this figure a minimum, or as nearly so as possible, the absence of the power factor indicator will be compensated for.

Another use of a power-factor meter is in reducing the load on a machine preparatory to switching it out. It is well known that if the excitation of a machine be too weak or too strong at the time of switching it out, a more or less severe kick in the bus-bar voltage will occur, and that this can be avoided by regulating the field as the load is reduced according to the reading of the power-factor indicator. If the power-factor indicator be inoperative for any reason, the kick in the volts can be obviated by making sure that the field current is reduced to its "no-load" value before switching out. The no-load excitation current of every alternator in the station should be ascertained and noted for this purpose; and it will be found useful even where the power-factor indicator is in use.

Most A.C. ammeters have a very close scale for some distance above the zero mark, so much so that in some cases a machine may be doing perhaps 10 per cent. or 15 per cent. of its load, and yet the ammeter reading be barely perceptible. In the absence of a wattmeter this makes it a difficult matter to know when the load is all off a machine and to avoid undesirable fluctuations in the voltage and frequency due to switching out with too much load on. In the case of generating sets with throttle governing the steam pressure necessary to run the set excited, but without load, should be ascertained and noted, and the driver should signal to the switchboard attendant when the pressure gauge on the engine side of the throttle valve indicates this no-load pressure. The switchboard attendant will then know certainly that the machine is nearly or quite without load. Another indication of the load being very nearly off is given by the power factor indicator, whose readings become very variable under those conditions, the needle moving through a considerable arc for a very small alteration of the field strength. This indication is not so reliable, however, as that of the pressure gauge above mentioned.

A simple matter, which everyone in charge of an A.C. switchboard ought to understand, but which many do not, is a means of testing the correctness of the synchroniser connections, so that they can be confidently passed as right after having been disconnected and connected up again. The method is this:—Plug any machine that is running on the bus-bars on to the synchroniser, in just the same manner as if it were to be synchronised. If all is right as regards that machine the instrument will indicate synchronism.

In case of accident to the synchroniser, a temporary arrangement consisting of a bank of lamps can be connected across the machine voltmeter plug of the incoming machine, one of the machines on load being plugged on to the machine voltmeter bus wire. These lamps will then indicate synchronism by being extinguished. Such an arrangement as this should, of course, only be used under the immediate supervision of a responsible person, since an error would have very serious effects.

A NEW BATTERY SIGNALLING BELL.

By W. M. THORNTON, D.Sc., D.Eng.

(*Paper read before the* North of England Institute of Mining and Mechanical Engineers.)

The recent important Home Office report by Dr. R. V. Wheeler[1] on the risks of ignition of methane by battery signalling bells has proved beyond reasonable doubt that the spark in the bell or on the wires is a danger that must be dealt with. Before, however, this can be done effectually, it is necessary to know the nature of the spark, and the limits to its igniting power. Dr. Wheeler has given in his report several ways of improving the safety of bells, and much useful information for the guidance of bell manufacturers. The present paper is a statement of the chief points which arise in the working of such bells, and affect sparking; and an arrangement is described by which danger from the spark is prevented.

In the first place, the spark at the trembler contact is not continuous. If viewed in a revolving mirror, it is seen to be regularly intermittent; and if the current is observed by an oscillograph, it is found to have the general form shown in fig. 1.

In the case of an electric circuit of resistance r and inductance L, the curve O A has the form $i = E/r\,(1 - \epsilon^{-rt/L})$, where E is the battery voltage, and $\epsilon = 2{\cdot}718$, the base of the natural logarithms. E/r is the final steady value of the current i if the circuit is closed for a long time. In bells this curve is modified by the movement of the armature and by eddy currents in the solid parts of the magnetic circuit of the windings, and may become a straight line, as in fig. 2.

The voltage e, which causes the spark at the trembler contact is produced by the rush of magnetism out of the coils when the current is broken. It is, in fact, $L\,di/dt$, where L is the self-induction and di/dt the rate of break of the current. When L is in henries and di/dt in amperes per second, $L\,di/dt$ is the voltage on the spark. At the moment of break the battery voltage is all absorbed in the resistance, and does not affect the initial value of e. The gap voltage as observed is that shown in fig. 3; after the spark has ceased, the voltage across the spark-gap is that of the battery alone.

In good bells the time of break is found to be about half that of make, and the maximum voltage v is about ten times that of the battery e. The spark at the trembler contact is a series of ordinary break-sparks of short duration, in which both current and voltage are greatest at the instant of break.

Now, the igniting power of an electric break-spark depends on the voltage with which it is associated. It has been shown that the product of these is roughly constant, as in fig. 4. When the voltage is high, a small current becomes dangerous, and the degree of danger increases with the inductance in the circuit. With single continuous-current break-sparks on a 20-volt battery circuit, 0·5 henry causes ignition of the most inflammable mixtures of illuminating gas with a current of 0·5 ampere.

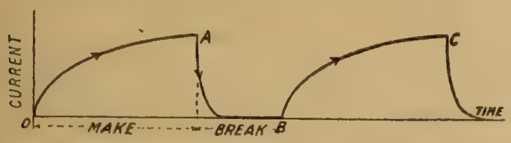

Fig. 1.—Curve of Current in a Battery Bell Circuit in Full Ringing.

Another factor of great importance is the duration of the spark. It is clear from the curves of figs. 1, 2 and 3 that the duration of the high voltage is small compared with the period of the bell. Measurements of curves taken show that it is sometimes as low as a fiftieth of the period, so that in a bell ringing 20 times a second the time of high voltage is 1,000th of a second. So short a duration is less favourable to ignition than an ordinary non-inductive break-spark, and this may account to some extent for the rarity of accidents in coal mines which might have arisen from bells.

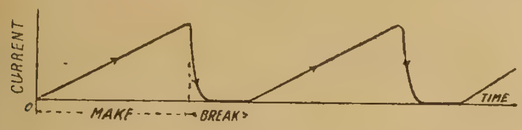

Fig. 2.—Form of Current-Curve Occasionally Found.

The power w of the bell-spark—that is, the product $\mathrm{L}\, i\; di/dt$ of volts and amperes in it—is given in fig. 5, and is seen to be even less uniform than the voltage. As shown in fig. 4, the ease of ignition of a given mixture by break-sparks, as measured by the product $\mathrm{L}\, i$, is approximately constant. So long as w does not reach the critical value, the bell is safe. In order to keep w low, it is advisable to make the product $\mathrm{L}\, i$ as small as possible, for the rate of break depends to a great extent on the mechanical design and setting of the bell. Measurements of L have been given in the Home Office Report, and have since been found to reach the high value of 1 henry. There is an upper limit to the current, depending on the kind of battery used. It may be taken that signalling currents range on an average between 0·1 and 0·5 ampere, and the value of $\mathrm{L}\, i$ from 0·05 to 0·1. There is no limit to the number of turns on the bell, that is, to the self-induction L. Expressed in terms of dimensions, $\mathrm{L} = 4\,\pi\,\mathrm{T}^2/\mathrm{R}$, where T is the number of turns on the windings and R the reluctance of the magnetic circuit, which is equal to the average length of the magnetic lines of force divided by the sectional area of the core and by its magnetic permeability. The air-gap has a greater reluctance than the iron of the magnetic circuit.

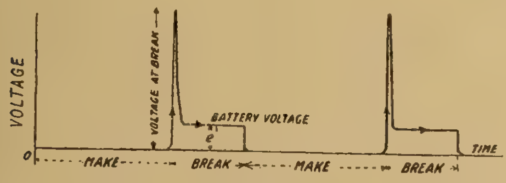

Fig. 3.—Voltage across Spark-Gap at Trembler Contact.

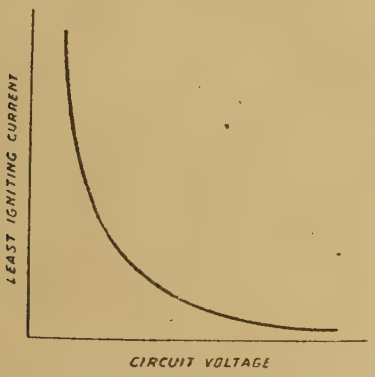

Fig. 4.—Change of Least Igniting Current with Voltage in a Non-Inductive Continuous-Current Circuit.

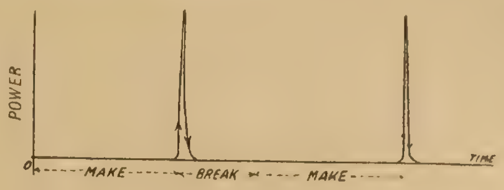

Fig. 5.—Volt-Amperes of Trembler Spark.

The total energy of the break-spark is $\frac{1}{2}\,\mathrm{L}\,i^2 = 2\,\pi\,i^2\,\mathrm{T}^2/\mathrm{R}$. It therefore varies as the square of the amperes and turns on the coils for a given magnetic circuit. For a given number of ampere-turns it varies inversely as $\mathrm{R} = l/\mathrm{A}\,\mu$, where, since the air-gap has much greater magnetic resistance than the core of the coils, l is the double length of the air-gap, A the mean area of the magnetic field in the gap, and $\mu = 1$, when l and A are in centimetre measure. The product $\mathrm{L}\,i$ is the number of lines of force N linked with the coil windings. N only affects the spark when changing, for

$$e_s = d\,\mathrm{N}/d\,t = \mathrm{L}\,d\,i/d\,t. \quad \mathrm{L}\,i = 4\,\pi\,\mathrm{T}^2\,i/\mathrm{R},$$

and is, therefore, proportional to the current and to the square of the turns. The voltage

$$e_s = 4\,\pi\,\mathrm{T}^2/\mathrm{R}.\; d\,i/d\,t.$$

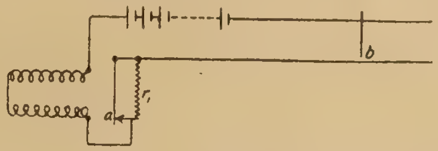

Fig. 6.—Shunt Resistance across Spark-Gap diminishes Spark at a, but Increases that on Line at b.

The rate of break depends so much on the mechanical adjustments that it is the least definite of all the important factors in sparking. For a fixed rate of break it is nearly proportional to the current broken. Writing $di/dt = ki$, the result is $e_s = 4\,\pi\,k\,\mathrm{T}^2 i/\mathrm{R}$, following the same law as $\mathrm{L}i$.

How does sparking depend upon the working resistance in the circuit? The greater the resistance r, the greater is the drop of voltage in the wires for a given current, and the less of it there is for the gap while the current lasts. The equation of the current in the bell at break may be written $i = \mathrm{E}/r\,.\,\epsilon^{-r_1 t/\mathrm{L}}$, where r_1 is the resistance after break, including that of the spark. From this $e_s/\mathrm{E} = r_1/r$, and the resistance of the spark r_s, which is $r_1 - r = r\,(e_s/\mathrm{E} - 1)$.

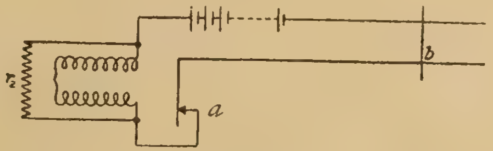

Fig. 7.—Resistance Across Magnet-Coils Suppresses Sparks Both at a and at b.

The resistance of the spark is not independent of the current in the circuit, but it is clear that the greater the resistance r of the circuit the smaller is the sparking voltage e_s for a given size of spark. Resistance in the battery or line, or bell-windings, therefore, diminishes the igniting power of the spark. Wet Leclanché cells, having a higher resistance than dry cells, are from this point of view safer. To ring over a long distance is safer than over a short distance, because the ratio r_1/r is less for the same ringing current.

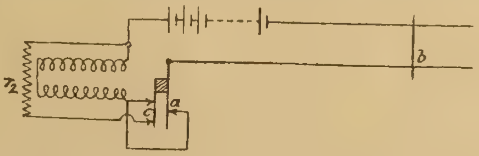

Fig. 8.—Resistance Connected at c Just Before Break at a.

From observed values of e_s the resistance of the spark at break can be found. A common ratio of e_s/E is about 10. Thus if $r = 6$ ohms, $r_s = 54$ ohms at the moment of break. This rapidly increases as the spark is drawn out and breaks.

For the purpose of preventing ignition of gas by a signalling bell, the first suggestion is to bridge the spark-gap by a resistance, but this may be in practice a positive danger, for by it a large part of the energy of the spark at the trembler is handed on to the signalling point on the wires. These wires are near the roof, and there is probably more risk of inflammable mixtures being formed there than at a bell in a haulage-house. When the gap is bridged, there is no free gap at *a*, but there is at *b*, and it has been shown by Mr. C. P. Sparks, and also by Dr. Wheeler, that there is danger of ignition there equal to that at *a* under normal working conditions (fig. 6).

When, however, a suitable resistance is placed across the terminals of the coils, and the gap left unbridged, a break there gives rise to a spark of much less magnitude. The resistance r_2 may be always connected (fig. 7), or it may be so arranged that it is joined up by the movement of the armature just before break (fig. 8), so avoiding the small current which passes through r_2 continually while the bell is ringing. The value of r_2, so as to give the best results in practice, is found to vary from 20 to 150 ohms, depending on the design of the bell. This resistance provides a path for the "extra current" at break. In other words, the voltage e_s at the spark-gap stops at the moment when it begins, for the current and magnetism in the coils die down slowly instead of being broken suddenly. Oscillograph records such as those illustrated in fig. 9 show that the voltage across the gap never rises above the battery volts, and the igniting power of the spark is reduced, or the factor of safety increased, by at least 4 or 5 to 1; and by 10 to 1 if the voltage only is considered.

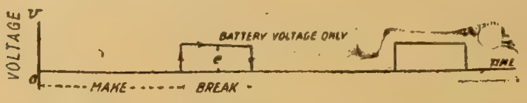

Fig. 9.—Voltage across Spark-Gap when Resistance is Connected as in Figs. 7 or 8.

The effect of the suppression of the sparking voltage is very marked. It is possible to work any bell in full ringing in the most inflammable mixture of illuminating gas and air without igniting the mixture while the shunt path is connected. Ignition occurs the moment that it is disconnected. By having a scraping contact in the box, it can be shown that the same increase of safety is obtained on the signalling wires as at the trembler-contact.

When applied for the purpose of preventing ignition of gas, there is another important point to consider which is not well known. It is only within the last five or six years that the currents which will ignite gas have been determined, and it is only as a result of long and laborious trials that one is able to say by inspection whether or not a certain spark will ignite gas. When the use of a resistance across bell-coils (and not across the gap) was first tried by the author in discussion with his colleague, Mr. W. W. Firth, who had suggested shunting the gap, he was able to say from previous work—of which accounts have been given to the Institute—that from its appearance the nature of the spark was completely changed, and that ignition would not occur. This was soon verified by enclosing the bell in a large explosion box, and the method has never been found to fail. The device does for electric signalling bells what gauze does for a miner's safety-lamp; so long as it is in normal action, ignition cannot occur.

This arrangement, which was first demonstrated at the Senghenydd inquiry, although it greatly diminishes the wear at the sparking contacts, does not appear to have ever been used on electric bells, although Mr. H. R. Kempe* recently states that the principle is well known to telegraphists. It has the advantage that it can be fitted to any existing bell, so making it incapable of igniting the most inflammable pit gas.

The author ventures to submit the device to the consideration of those concerned with the management of coal mines, as a contribution to the safety of underground working.

A discussion followed the reading of the paper, and was reported in the *Colliery Guardian*, to which we are indebted for the following extracts:—**Dr. R. V. Wheeler** wrote expressing his admiration of the manner in which Dr. Thornton had presented the theory of the common form of battery bell. He had examined a bell fitted with Dr. Thornton's device to prevent sparking, and could testify to its efficiency. There was, however, a practical disadvantage attaching to the use of any device to prevent sparking which involved a circuit other than the ringing circuit. Should the additional circuit by some mischance become broken, the bell would become unsafe and would continue to ring. For that reason, he favoured any device which, though not theoretically or in practice as efficient as Dr. Thornton's, formed an integral part of the ringing circuit and could not be separated from the bell without destroying it. He hoped that, as a result of the investigation now being made for the Home Office, several methods alternative to those already outlined in his recent report would emerge.

Mr. H. R. Kempe wrote that in regard to the influence of resistance, he thought when Dr. Thornton stated "that resistance in the battery or line or bell windings diminished the igniting power of the spark," the author did not sufficiently define what he meant by "resistance in bell windings." High resistance could be obtained by winding the electromagnet with a great number of convolutions of wire. That, however, whilst giving the bell a high resistance, would also give it a high inductance, which was certainly not desirable unless the electromagnet was shunted, which, at that part of the paper, Dr. Thornton did not seem to suggest. He did not consider the arrangement suggested in fig. 8 of the paper was at all a good one. It introduced three contacts in the place of one, and the amount of current which such a device saved was insignificant, as the proper resistance for the shunt would be ten times that of the bell coils which it shunted. He thought Dr. Thornton should, in speaking of the shunt being of "suitable" resistance, have pointed out that "suitable" included "double winding." Also, it would have been better to have said that the value of the shunt should be about ten times the resistance of the coils that it shunted, rather than to have made a rather indefinite statement that the value might be from 20 to 150 ohms. The value ten times was the one adopted by the Post Office for all local apparatus such as sounders, the object of the shunt being to get rid of sparking at the relay contacts. Such shunts had been in use for the last 30 to 40 years. In regard to the statement that the shunt device had never been used on electric bells, he might mention that the Post Office arranged, some time ago, to fit a number of bells for special purposes with spark shunts (bell coils 100 ohms, shunt 1,000 ohms), and he believed these were being installed. The bells were rather large and were to be worked from relays. The use of bells shunted to prevent gas ignition was novel, and should be made compulsory. "Double winding" of the shunts should be specifically mentioned in the specifications of such bells.

Mr. W. C. Mountain remarked that the experiments they had just seen were very conclusive proof that Dr. Thornton had almost certainly produced a bell which would reduce risks from explosion. A bell built upon Dr. Thornton's idea would cost so very little more than an ordinary bell that he thought what Dr. Thornton had done was of very considerable value. He did not suggest that the use of the improved bell should be compulsory; there were many places in which there was no risk at all. He thought the installation of such a bell should be determined by the conditions.

In a brief reply, **Dr. Thornton** said Dr. Wheeler had raised the most vital objection—if it were vital—namely, that one should have some arrangement for checking sparks, the failure of which would stop the bell. That would be ideal, of course, but it could not be done without the introduction of auxiliary devices, which were not wanted.

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[*] Electrical Review, 1915, Vol. LXXVI, page 886.

TRADE STATISTICS OF ITALY.

The following statement, showing the imports of electrical and similar goods into Italy during the year 1913, is extracted from the recently issued trade statistics. The figures for 1912 are added for purposes of comparison, and notes of any increases or decreases are given.

	1912.	1913.	Inc. or dec.	
	Lire.	Lire.		Lire.
Copper, brass or bronze wire more than ½ mm. diameter.—				
From France	1,114,000	908,000	–	206,000
,, Germany	1,176,000	1,003,000	–	173,000
,, Great Britain ...	31,000	7,000	–	24,000
,, United States ...	65,000	—	–	65,000
,, Other countries ...	72,000	49,000	–	23,000
Total	2,458,000	1,967,000	–	491,000
Copper, brass or bronze wire of ½ mm. diameter or less.—				
From Germany	511,000	353,000	–	158,000
,, France	161,000	89,000	–	72,000
,, Other countries ...	10,000	45,000*	+	35,000
Total	682,000	487,000	–	195,000
Boilers.—				
From France	41,000	23,000	–	18,000
,, Germany	434,000	231,000	–	203,000
,, Great Britain ...	1,865,000	1,077,000	–	788,000
,, Switzerland	55,000	146,000	+	91,000
,, Other countries ...	276,000	41,000	–	235,000
Total	2,671,000	1,518,000	–	1,153,000
Electrical apparatus.—				
From Germany	3,827,000	3,978,000	+	151,000
,, Great Britain ...	187,000	145,000	–	42,000
,, Switzerland	269,000	330,000	+	61,000
,, United States ...	145,000	369,000	+	224,000
,, Other countries ...	222,000	165,000	–	57,000
Total	4,650,000	4,987,000	+	337,000
Arc lamps.—				
From Germany	279,000	220,000	–	59,000
,, Austria-Hungary ...	11,000	5,000	–	6,000
,, Great Britain ...	4,000	2,000	–	2,000
,, France	15,000	19,000	+	4,000
,, United States ...	5,000	1,000	–	4,000
,, Other countries ...	3,000	2,000		1,000
Total	317,000	249,000	–	68,000

* Great Britain, 43,000.

	1912. Lire.	1913. Lire.		Inc. or dec. Lire.
Steam engines, stationary, without boilers.—				
From Belgium	—	137,000	+	137,000
,, Germany	623,000	646,000	+	23,000
,, Great Britain ...	1,184,000	802,000	–	382,000
,, Switzerland	16,000	4,000	–	12,000
,, United States ...	357,000	86,000	–	271,000
,, Sweden	87,000	3,000	–	84,000
,, Other countries ...	163,000	77,000	–	86,000
Total	2,430,000	1,755,000	–	675,000
Steam engines, semi-stationary (with boilers), hot-air motors, compressed air, gas, petrol, etc.—				
From France	133,000	150,000	+	17,000
,, Germany	2,250,000	1,401,000	–	849,000
,, Great Britain ...	1,924,000	1,779,000	–	145,000
,, Switzerland	496,000	329,000	–	167,000
,, United States ...	192,000	150,000	–	42,000
,, Other countries ...	287,000	165,000	–	122,000
Total	5,282,000	3,974,000	–	1,308,000
Dynamo-electric machines weighing more than 1,000 kg.—				
From Austria-Hungary ...	590,000	398,000	–	192,000
,, France	163,000	177,000	+	14,000
,, Germany	4,453,000	2,937,000	–	1,516,000
,, Great Britain ...	471,000	428,000	–	43,000
,, Switzerland	159,000	178,000	+	19,000
,, United States ...	60,000	56,000	–	4,000
,, Belgium	133,000	24,000	–	109,000
,, Other countries ...	79,000	94,000	+	15,000
Total	6,108,000	4,292,000	–	1,816,000
Dynamo-electric machines weighing 1,000 kg. or less.—				
From Austria-Hungary ...	786,000	636,000	–	150,000
,, France	123,000	132,000	+	9,000
,, Germany	3,353,000	2,689,000	–	664,000
,, Great Britain ...	311,000	322,000	+	11,000
,, Switzerland	198,000	161,000	–	37,000
,, United States ...	125,000	131,000	+	6,000
,, Other countries ...	95,000	28,000	–	67,000
Total	4,991,000	4,099,000	–	892,000
Electric transformers.—				
From Austria-Hungary ...	557,000	911,000	+	354,000
,, France	21,000	36,000	+	15,000
,, Germany	2,862,000	1,816,000	–	1,046,000
,, Great Britain ...	12,000	33,000	+	21,000
,, Switzerland	266,000	279,000	+	13,000
,, United States ...	72,000	180,000	+	108,000
,, Other countries ...	2,000	1,000	–	1,000
Total	3,792,000	3,256,000	–	536,000
Parts of dynamo-electric machines and of transformers.—				
From France	132,000	168,000	+	36,000
,, Germany	1,158,000	975,000	–	183,000
,, Great Britain ...	138,000	194,000	+	56,000
,, United States ...	115,000	60,000	–	55,000
,, Switzerland	222,000	49,000	–	173,000
,, Other countries ...	110,000	407,000	+	297,000
Total	1,875,000	1,853,000	–	22,000
Electric lamps, incandescent.—				
From Austria-Hungary ...	2,340,000	2,362,000	+	22,000
,, Sweden	40,000	—	–	40,000
,, France	266,000	138,000	–	128,000
,, Germany	5,105,000	5,486,000	+	381,000
,, Great Britain ...	10,000	8,000	–	2,000
,, Switzerland	163,000	141,000	–	22,000
,, Other countries ...	685,000	957,000*	+	272,000
Total	8,609,000	9,092,000	+	483,000

* Netherlands, 921,000.

	1912. Lire.	1913. Lire.		Inc. or dec. Lire.
Carbons of all kinds for electro-technical purposes.—				
From Austria-Hungary ...	221,000	133,000	–	88,000
,, Germany	580,000	666,000	+	86,000
,, France	81,000	86,000	+	5,000
,, Switzerland	11,000	41,000	+	30,000
,, United States ...	54,000	50,000	–	4,000
,, Other countries ...	2,000	4,000	+	2,000
Total	949,000	980,000	+	31,000
Accumulators and metal parts.—				
From Germany	64,000	33,000	–	31,000
,, Great Britain ...	1,000	10,000	+	9,000
,, France	77,000	80,000	+	3,000
,, Other countries ...	2,000	8,000	+	6,000
Total	144,000	131,000	–	13,000

The classes of electrical and allied goods, in which Italy is making most progress as an exporter, are shown in the following comparative figures of her exports (special trade) in 1912 and 1913:—

	1912. Lire.	1913. Lire.		Inc. or dec. Lire.
Dynamo-electric machines, weighing 1,000 kg. or less.—				
To Argentine Republic ...	666,000	730,000	+	64,000
,, France	265,000	332,000	+	67,000
,, Brazil	202,000	201,000	–	1,000
,, Austria-Hungary ...	108,000	69,000	–	39,000
,, Other countries ...	624,000	714,000	+	90,000
Total	1,865,000	2,046,000	+	181,000
Copper, brass or bronze wire more than ½ mm. diameter.—				
To India and Ceylon ...	292,000	426,000	+	134,000
,, Tripoli	99,000	79,000	–	20,000
,, Egypt	20,000	16,000	–	4,000
,, Other countries ...	27,000	40,000	+	13,000
Total	438,000	561,000	+	123,000
Boilers (including multitubular).—				
To Argentine Republic ...	183,000	163,000	–	20,000
,, Tunis	112,000	13,000	–	99,000
,, Tripoli	50,000	28,000	–	22,000
,, Brazil	59,000	40,000	–	19,000
,, Chili	122,000	14,000	–	108,000
,, Other countries ...	160,000	187,000*	+	27,000
Total	686,000	445,000	–	241,000

* Egypt 163,000.

	1912. Lire.	1913. Lire.		Inc. or dec. Lire.
Steam engines, stationary, without boilers.—				
To Argentine Republic ...	730,000	124,000	–	606,000
,, Spain	152,000	109,000	–	43,000
,, Tunis	113,000	5,000	–	108,000
,, Russia	33,000	41,000	+	8,000
,, Portugal	29,000	—	–	29,000
,, Other countries ...	199,000	263,000*	+	64,000
Total	1,256,000	542,000	–	714,000

* Turkey, 50,000.

	1912. Lire.	1913. Lire.		Inc. or dec. Lire.
Steam engines, semi-stationary, with boilers.—				
To Argentine Republic ...	346,000	990,000	+	644,000
,, Tripoli	397,000	312,000	–	85,000
,, Roumania	372,000	167,000	–	205,000
,, Egypt	213,000	792,000	+	579,000
,, France	119,000	59,000	–	60,000
,, Russia	111,000	594,000	+	483,000
,, Other countries ...	518,000	1,844,000*	+	1,326,000
Total	2,076,000	4,758,000	+	2,682,000

* Great Britain, 328,000; Spain, 349,000; Turkey, 234,000.

N.B.—25 lire = £1.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

PANAMA.—The Government of Panama has recently imposed certain new taxes on commercial documents as follows:

Bills of exchange: A 10 cents stamp for every 100 dollars or fraction thereof must be affixed to bills of exchange or drafts drawn in national territory or drawn in foreign territory to be collected in Panama.

Bills of lading for merchandise imported into the country must bear on the first two copies a 50 cents stamp, and those authorised and issued in the Republic for national or foreign ports 25 cents for each of the first two copies.

Accounts, invoices, receipts and, in general, every private document acknowledging debt or the cancellation thereof, must bear stamps as follows: Up to 5 dols., 1 cent; from 5 dols. up to 10 dols., 2 cents; from 10 dols. to 25 dols., 5 cents; from 25 dols. to 50 dols., 10 cents; from 50 dols. to 100 dols., 20 cents; from 100 dols to 200 dols., 30 cents; over 200 dols., 50 cents.

SOUTH AFRICA.—A recent Act of the South African Government raises the import duty on "goods not separately mentioned in the tariff" (under which heading various electrical and similar goods are dutiable) from 15 per cent. to 20 per cent. in the case of goods of foreign origin, and from 12 per cent. to 17 per cent. in the case of British goods.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

11,161. "Method of generating high-frequency electric current." T. F. Wall. August 3rd.

11,168. "Manufacture of electrical conductor or wire retaining bands and apparatus therefor." E. Fewkes. August 3rd.

11,172. "Means for suspending and adjusting electric overhead conductors." British Insulated & Helsby Cables, Ltd., and J. W. Astley. August 3rd.

11,201. "Mounting of switches and other electrical apparatus in wall boxes." C. H. Burt. August 3rd.

11,214. "Electric light fittings, such as electroliers, wall brackets, sconces, and the like." J. A. Chell. August 3rd.

11,218. "Arc lamp electrodes." British Thomson-Houston Co., Ltd. (General Electric Co., United States). August 3rd.

11,224. "Magnetos applicable for the lighting of vehicles." J. Bethenod. August 3rd. (Convention date, July 27th, 1914, Belgium.) (Complete.)

11,259. "Signalling device for printing telegraphs." D. Murray. August 4th.

11,260. "Method of synchronism for printing telegraphs." D. Murray. August 4th.

11,262. "Coating metals." British Thomson-Houston Co., Ltd. (General Electric Co., United States). August 4th.

11,263. "Electrical windings." British Thomson-Houston Co., Ltd. (General Electric Co., United States). August 4th.

11,264. "Electrically-operated tools." Frankfurter Maschinenbau Akt. Ges. vorm. Pokorny & Wittekind. August 4th. (Convention date, August 14th, 1914, Germany.) (Complete.)

11,314. "Electrolytic magnifiers." W. Judd, A. Fraser & Eastern Telegraph Co., Ltd. August 5th. (Complete.)

11,321. "Starting and synchronising of dynamo-electric machines." British Thomson-Houston Co., Ltd., & F. P. Whitaker. August 5th.

11,322. "Cord grips for electrical purposes." R. G. Stripp. August 5th.

11,332. "Incandescent electric lamps (or) and the method of manufacturing same, especially applicable to the manufacture of so-called half-watt lamps or gas-filled glow lamps." C. O. Bastian. August 5th.

11,335. "Electrolytic recovery of zinc from ores and other zinc-bearing materials." U. C. Tainton. August 5th. (Complete.)

11,336. "Electrolytic recovery of metals from their solutions, and apparatus therefor." U. C. Tainton. August 5th. (Complete.)

11,374. "Elastic fluid turbines." British Thomson-Houston Co., Ltd. (General Electric Co., United States). August 6th.

11,375. "Means for the production of sound by electromagnetically-operated diaphragms." E. A. Graham. August 6th. (Complete.)

11,410. "Trolley wheels for electric tramcars and other vehicles." E. J. Neachell & L. Loukes. August 7th.

11,415. "Telephone transmitters and the like." A. Marr. August 7th.

PUBLISHED SPECIFICATIONS.

1913.

23,449. Electric Protective Systems. E. G. Waters. October 16th. (April 16th, 1914.)

28,369. Spark-gap Apparatus for producing Electric Oscillations. Dr. E. F. Huth Ges. December 9th. (December 27th, 1912.)

28,898. Arrangements for Automatically Regulating the Voltage of Dynamo Machines. Fried. Krupp Akt. Ges. December 15th. (January 11th, 1913.)

29,227. Auxiliary Machinery for Steam-condensing Plants. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.). December 18th.

29,341. Electric Tumbler Switches. Geb. Jaeger. December 19th. (November 27th, 1913.)

29,344. Pendant Switches for Electric Circuits. Geb. Jaeger. December 19th. (November 27th, 1913.)

29,426. Circuit Arrangements for Automatic or Semi-automatic Telephone Systems. Siemens & Halske Akt. Ges. December 20th. (December 20th, 1912. Patent of addition not granted.)

29,609. Means for Effecting the Gas-tight Introduction of Electrodes into Metal Vapour Apparatus. A. Scherbius. December 23rd. (December 23rd, 1912.)

29,645. Automatic Prepayment Telephone Apparatus. Ges. fur Elektrische Industrie. December 23rd. (November 19th, 1913.)

29,689. Electrically-actuated Mechanism for Controlling from a Distance Railway Trains and other apparatus. C. Wirth. December 24th.

29,883. Automatic Selecting Devices for Telephone Systems. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges.). December 29th.

29,981. Electric Incandescent Lamps. H. A. Gill (Wolfram Lampen Akt. Ges.). December 30th.

30,045. Means for pulling off Overhead Electrical Conductors or Contact Wires. Siemens Schuckertwerke Ges. December 31st. (December 31st, 1912.)

1914.

134. Electric Safety Lamp for Mines. W. Kraushaar. January 2nd. (January 7th, 1913.)

10,193. Apparatus for the Production of Alkali Metals by the Molten Electrolysis of Alkali Compounds. Deutsche Gold & Silber-Scheide-Ansalt vorm Rössler. April 24th. (April 26th, 1913.)

10,478. Connecting Device for the Leads from Portable Secondary Batteries. Robert Bosch (firm of). April 28th. (March 24th, 1914. Addition to 7,686/14.)

11,052. Telephone Instruments. Siemens Bros. & Co. and F. Baker. May 5th.

11,102. Methods of Producing Electric Oscillations. E. von Lepel. May 5th.

11,112. Manufacture of Stratified Fibrous Materials, especially for Chemical and Electric Insulating Purposes. Meirowsky & Co. and M. Meirowsky. May 5th.

11,212. Circuit Arrangements for Telephone Exchanges. Siemens Bros. and Co., Ltd. (Siemens & Halske Akt. Ges.). May 6th. (Addition to 27,458/09 and 18,356/12.)

11,310. Means for Preventing too Rapid Changes of Speed of Machinery. Siemens Schuckertwerke Ges. May 7th. (May 7th, 1913.)

11,408. Appliance for Electrical Jacquard or Card-punching or like Machines. Osterreichische Siemens Schuckertwerke & Regal Patente Ges. May 8th. (May 10th, 1913.)

11,410. Electrical Contact Devices for Reading Electrical Patterns or the like. Osterreichische Siemens Schuckertwerke & Regal Patente Ges. May 8th. (May 10th, 1913.)

11,561. Apparatus for converting Alternating-current into Pulsating Direct-current. W. Otto. May 11th. (May 24th, 1913.)

14,513. Method of and Apparatus for use in and in connection with Electrolytic and Metal-cleaning Processes. A. E. Battle. June 17th.

14,514. Recovery and Electro-deposition of Tin. A. E. Battle. June 17th. (Cognate application, 15,602/14.)

14,798. Telephonic Transmitters and Receivers. International Electric Co., Ltd. (Akt. Ges. Mix & Genest). June 19th.

14,866. Apparatus for Controlling Motors from a distance. A Mond (Maschinenfabrik Oerlikon). June 20th.

15,758. High-tension Electric Ignition for Internal-combustion Engines. A. R. Bellamy. July 1st. (December 30th, 1914.)

16,696. Railway Block Telegraph Signalling Apparatus. O. W. Brain and C. A. Hodgson. July 13th.

16,776. Apparatus for Producing Galvanic or Electrolytic Deposits. P. L. Ozil. July 14th. (July 15th, 1913.)

17,131. Methods for Producing Devices consisting of substances liable to changes in their ohmic resistance under the action of light, especially electric light sensitive preparations and the like. S. Kahan (Yapolsky). July 20th.

17,317. Electrical Measuring Instruments. British Thomson-Houston Co. (General Electric Co., U.S.A.). July 21st.

17,331. Apparatus for Generating High-frequency Electric Currents. A. Heyland. July 21st. (August 18th, 1913.)

17,332. Filament for Incandescent Electric Lamps. W. G. Hughes. July 21st.

17,335. Trolley Wheels or Collectors for Electricity. H. C. Adam and J. C. Adam. July 21st.

17,391. Electrical Heating Apparatus. G. H. Collins & H. F. Collins. July 22nd.

17,424. Protecting Device for the Accessories of Electrical Meters and Measuring Instruments. W. E. Evans (Allgemeine Elektricitäts Ges.). July 22nd.

17,425. Furnace Electrode. W. E. Evans (Elektrochemische Werke Ges.). July 22nd.

17,426. Method of and Apparatus for producing Flows in the Molten Masses of Electrical Furnaces. W. E. Evans (Electrochemische Werke Ges.). July 22nd.

17,437. Junctions or Connections for Electrical Conduits and other Pipes. H. H. Longbottom & T. Farrar. July 23rd.

17,446. Telephone Systems. M. S. Conner & R. E. Robinson. July 23rd.

17,611. Electric Fire and Temperature Alarms. N. Bendixen. July 25th.

17,894. Electric Motor Control. British Thomson-Houston Co. & A. C. Hastings. July 28th.

18,281. Ventilation of Dynamo-electric Machines. G. A. Juhlin. August 7th.

18,738. Electrically-actuated Tools. W. J. Mellersh-Jackson (Commonwealth Electric Tool Co.). August 17th.

18,842. Valve-operating Mechanism for Elastic Fluid Turbines. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). August 19th.

19,886. Sparking Plugs for Internal-combustion Engines. T. Crosbee and Sons, Ltd., & D. McGregor. September 17th.

20,133. Electrical Contacts. Igranic Electric Co. (Cutler Hammer Manufacturing Co.). September 24th.

20,871. Electric Coupling Mechanism for use on Railway Vehicles. R. Belfield (Doyle & Hedley). October 12th.

21,190. Electro-osmotic Impregnating Process. Ges. fur Elektro-Osmose October 19th. (January 7th, 1914. Addition to 19,849/14.)

21,727. Electrolytic Apparatus. G. Plancq. October 29th.

21,793. Automatic Selecting Devices for Telephone Systems. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). October 30th. (Addition to and divided application on 29,883/13, dated July 16th, 1914.)

21,921. Loud-speaking Telephone Apparatus. H. J. C. Forrester (International Callophone Corporation). November 3rd.

22,914. Operation of Polyphase Electric Motors in connection with Single-phase Alternating Currents. B. G. Lamme. November 23rd. (December 26th, 1913.)

22,989. Controlling Arrangements for Electric Motors. C. B. Burdon (Siemens Schuckertwerke Ges.). November 24th.

1915.

121. Means for obtaining a High-starting Torque on a Continuous-current Motor with a relatively small starting current. A. J. Leigh and H. J. Osborn. January 4th.

275. Electric Wave Amplifying Apparatus. Western Electric Co. (Western Electric Co., U.S.A.). January 7th.

831. Stray-wave Protective Devices for Electric Circuits. Siemens-Schuckertwerke Ges. January 19th. (January 20th, 1914. Addition to 17,532/13.)

1,007. Means for obtaining Periodically-interrupted Currents of Electricity. W. H. Grinsted. January 21st.

3,715. Sparking Plugs for Internal-combustion Engines. H. W. van Raden. March 9th.

4,761. Electrical Cables, specially applicable to Cables having a Protective Sheathing of Rubber. British Insulated and Helsby Cables, Ltd., and J. Brotherton. March 27th.

5,696. Automatic Switching Apparatus for Electrically-illuminated Signs and the like. E. Savoye. April 15th. (April 30th, 1914. Addition to 823/15.)

8,561. Loud-speaking Telephone Systems and Apparatus. H. J. C. Forrester (International Callophone Corporation). (Divided application on 21,921/14, November 3rd.) June 9th.

U.S.A. Electrical Exports.—The *Electrical World* states that the figures of electrical export trade for May do not sustain, as they might be expected to do, the figures of April, which showed a gain of about $250,000 over the previous year, the totals being respectively $1,741,551 and $2,055,375; the May figures are $1,802,209, as compared with $2,040,720 a year ago. The figures for the 11 months of the fiscal year, inclusive of May, are more "revelatory" of the fact that up to the present the United States has not been able to seize the opportunity of supplying neutral markets, deprived by the war of apparatus and appliances from Europe; or it may be that the various dams of blockade, submarine attack, high rates of freight and insurance do not hold up European exports. The total electrical exports for the 11 months of 1914-15 were only $17,724,676, as compared with $23,610,407 in 1913-14 and $24,458,084 in 1912-13.

THE

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Vol. LXXVII.] CONTENTS: August 27, 1915. [No. 1,970.

Page
German Fuel Problems 257
"Be Prepared" 258
Rubber 258
German Espionage... 258
Some Motors I have Met, by E. F. Butler 259
Electric Vehicle Progress (*illus.*) 260
Ilkley Electricity Works (*illus.*) 262
A New Printing Telegraph System (*illus.*) (*concluded*) ... 263
New Electrical Devices, Fittings and Plant (*illus.*) 265
An Electromagnetic Vacuum Balance, by J. S. Anderson (*illus.*) 267
Electrical Houses at Dumbreck, Glasgow (*illus.*) 268
Correspondence—
  Staff Engineers and Labour Exchanges 268
  Units from Refuse 269
  From the Dardanelles 269
War Items 269
Electric Railways and the Law of Negligence 270
Import Trade of Chile 271
The Arbitration Clause 272
Business Notes 272
Reviews 276
Notes 276
City Notes 278
Stocks and Shares 279
Share List of Electrical Companies 280
Lamp and Lighting Developments in the Near Past and Future, by L. Crouch (*concluded*) 281
British Electrical Trade with Egypt, by "Anglo-Egyptian" 283
The Use and Abuse of Oils on Mining Plant, by T. C. Thompsen (*illus.*) 284
New Patents Applied for, 1915 288
Abstracts of Published Specifications 288
Contractors' Column ... ... Advertisement page xx

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1915 EDITION

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GERMAN FUEL PROBLEMS.

IN many respects the fuel problem has been much more serious to the enemy than to us for, although we have been amiable enough to tolerate German influence and ownership in time of peace, and a state of affairs in the colliery world in time of war, which has, in both instances, been a great source of moral and material benefit to the enemy, still we have at least had the seas open to our shipping, whereas Germany has had to depend almost entirely on her own fuel resources. These are, of course, very great, but the interruption of imports and exports has caused notable changes or rather developments in the utilisation of German fuel.

To a far greater extent than in this country, the value of by-products from coal was appreciated in Germany before the outbreak of war, and the technology of separating and utilising these by-products had been carried to a very high level. In the aggregate, German coal production exceeds the needs of the country, and the imports, though considerable, were only of special coals (such as our anthracite, the full national value of which will apparently be realised only when the beds are exhausted). On the other hand, German fuel exports were very largely coal briquettes and coke, *i.e.*, coal from which the valuable by-products had been extracted.

Since the outbreak of war the value of those by-products has much increased, for they include toluene (the basis of the high explosive "T.N.T."), coal tar oil (a good substitute for petroleum), and benzol (which is equal, or superior, to petrol). The importance of the liquid fuels derived from coal is particularly great since the enemy relied for petroleum and petrol on imports from America and Russia, excepting those from the oil-fields of Galicia.

The increased military demands for coal by-products, the practically vanished outlet for coke by export, and the intensified industrial and military demands for coal for those purposes to which coke is not applicable, have all combined to increase the importance of using coke wherever possible, as, for example, in admixture with coal for boiler-firing. The "influence" of the State has been brought to bear on this matter.

Just what the practice of efficient fuel technology is worth to Germany at the present moment it is difficult to estimate. Its methods and its practice have been considerably improved and extended since the outbreak of war, and, when peace is declared, the ways of economy and efficiency will undoubtedly remain in use. They will constitute an important asset in the industrial war that is to come, by making for cheapened power production and for conservation and cheapening of materials. The fundamental practice on which this asset is based is that of burning as little "raw" coal as possible. A large percentage of coal as mined is worth far more as a material for manufacture or as a secondary fuel than as fuel in the state in which it first exists. The erection of by-product plant is not the work of a moment, and we are probably denied the full benefit of its use during the period of the war; but it is a matter of the very highest importance that from now onwards we should utilise coal very much more efficiently than in the past—use it, in fact, as Germany was doing to a great extent as a matter of economic policy before the war, and as she has since been compelled to do to a very much greater extent.

"Be Prepared."

During the period of the war we have published a number of articles on the trade position in other countries, so that those interested in the electrical industry might learn from thoroughly qualified experts just what are the outstanding features of the situation and make preparations accordingly. For years before the war we made it our business to place such matters periodically before our readers, many of whom made profitable use of the information that we were able to lay before them. Even then the urgent advice was continually coming to us from all parts of the world, and we were passing it on, that British traders must prepare more energetically for meeting the serious industrial position that had arisen consequent upon Teutonic competition, in which our rivals did not disguise their desire to throttle our industries. We were always being told to make plans, to develop schemes, to adopt this, that, and the other move to counteract German influence. To-day, when, roughly speaking, we have the world largely to ourselves, because of the removal of German influence for the time being, the same kind of counsel is being received—Be prepared for what is coming!—though unfortunately our pre-occupation with the manufacture of war munitions and the general financial situation prevent our following this injunction as we might have done in days of peace. But as we have said before, not all the departments of our manufacturing businesses are engaged on war munitions, and in addition to our needing to make special efforts to maintain our exports, the advice, "Be Prepared!" should be very seriously considered in its relation to after-war business. Stocks abroad are depleted, there will be big demands for all classes of electrical manufactures, and those who are able to offer them will find a ready sale.

The article by "Anglo-Egyptian," on "British Electrical Trade with Egypt," which appears elsewhere in this issue, is by no means the least interesting of our series of articles on the foreign markets; indeed, we believe it to be one of the most practical and suggestive. It is certainly timely, and the views are those of one most highly qualified to report upon the Egyptian electrical trade position. On this point the reader need have no misgivings—he would certainly have none were we at liberty to disclose the writer's identity.

Rubber.

Signs of returning vitality in the rubber market are still lacking, and market conditions, taken as a whole, remain disappointing, prices showing a drooping tendency, with only fitful gleams of recovery, although very fair quantities of material are supposed to have been disposed of out of the liberal arrivals coming to hand. While there is very little indeed to induce much hopefulness concerning the market in its present mood, it is regarded as somewhat surprising that prices should have displayed so much resistance, though the opinion that the underlying conditions are stronger than generally supposed finds fewer advocates than it did a month ago. The lingering hopes that a reawakening of interest on a large scale on the part of United States consumers would develop have not yet matured, though there are still chances in this respect. Generally, the statistical position remains fair, and this rather tends to restrain offers by importers in the hope that the approach of the new season may bring about some further developments.

The July statistics here showed a reduction in the warehouse stocks of plantation rubber, the quantities actually delivered having exceeded the arrivals by about 1,000 tons. Larger supplies, however, are expected during the autumn, and the information coming to hand as to the progress of operations in the Eastern plantations is entirely satisfactory. There has lately been a reduction in the premium of Highland smoked sheets over other descriptions of fine material, the change in the position being attributed to the fact that there has been considerable improvement effected in the curing process recently, owing to the adoption of more scientific methods. The following details show the exports of plantation rubber from the Federated Malay States during the past three years:—

	1913. Tons.	1914. Tons.	1915. Tons.
January ...	2,131	2,542	3,473
February ...	1,757	2,364	3,411
March ...	1,737	2,418	3,418
April... ...	1,626	2,151	2,777
May	1,225	2,069	2,708
June... ...	2,005	2,306	3,403
July	1,781	2,971	3,687
Total ...	12,262	16,821	22,877

Official figures recently issued by the Dutch authorities reveal a marked growth in the rubber exports from Java, the 1914 figures just available showing an increase of 50 per cent. compared with 1913. It is pointed out that in the latter year the Netherlands and the United Kingdom were almost equal participants in Java rubber, but during 1914 the latter country increased its purchases by more than a million lbs.

German Espionage.

A "Neutral," writing in the *Times* of August 21st, drew attention once more to the German system of espionage. He pointed out that when our Government made the statement that the German spy system in this country had been broken up, the announcement was received by the enemy with shouts of derision. He went on to say that spying in the Fatherland had been reduced to a fine art, and that, wholly apart from military matters, it was practised by peaceful citizens. Your German firm even had spies amongst those who were employed by a rival in trade!

Those who are concerned with electrical matters in this country could say something of the manner in which our whilom German rivals have endeavoured to filch orders which ought to have come to English firms.

One can recall an instance of "the German method" which occurred in relation to a power station not 100 miles from the offices of the Electrical Review. New dynamos were required. Invitations to tender were sent to certain English firms, the directors being determined to support home industry. The lowest tender received was about £20,000—the exact figure is of no consequence. Before the order was placed, a polite German was shown into the office of the managing director. After a little general talk about the weather, he offered, on behalf of his German principals, to supply the goods for £18,000. In this instance he received but short shrift. The managing director told him that his company declined "To provide any funds for the building of German Dreadnoughts." Subsequent inquiry showed that the German spy had been "nosing around" among, and possibly bribing, the clerks, in order to acquire sufficient information to enable him to advance his tempting offer.

These Teutonic methods are not the mere growth of yesterday. They are apparently characteristic of the race. When reading (for the *n*th time) Smiles's "Life of James Watt," we recently discovered an example which dates back well into the Eighteenth Century. Having drawn attention to the fact that after the efficiency of Watt's engine had been proved in the Cornish mines, orders for the engines came in from France and Holland, the biographer proceeds:—

> Watt was more alarmed than gratified by the foreign orders, fearing that the engine would be copied and extensively manufactured abroad, where patents had not yet been secured. He did not see that the best protection of all was in the superiority of his mechanics and tools, enabling first-class work to be turned out—advantages in which the Soho firm had the start of the world. It is true his mechanics were liable to be bribed, and foreigners were constantly haunting Soho for the purpose of worming out the secrets of the manufacture, and decoying away the best men. Against this every precaution was taken, though sometimes in vain. Two Prussian engineers came over from Berlin in 1779, to whom Watt showed every attention; after which, in his absence, they got into the engine room and carefully examined all the details of "Old Bess," making notes. When Watt returned he was in high dudgeon, and wrote to his partner (Boulton) that he "could not help it, unless by discountenancing every foreigner who does not come avowedly to have an engine."

We may be pretty sure that henceforth manufacturing firms in this country will be strictly on their guard against German methods of peaceful penetration

SOME MOTORS I HAVE MET.

By E. F. Butler.

In an experience which covers some thousands of machines, although the majority call for no comment, yet some are remembered, either for something out of the ordinary in their construction or operation, or else for some fault unusual or hard to locate. An instance of the former class was a 20-H.P. motor in the Midlands, driving a foundry blower. The remarkable thing about it was that it appeared to have only one terminal. Curiosity prompted the writer to investigate, and as the owner had no objection he did so. The terminal in question was a huge brass affair, almost big enough to lift the motor by, and fitted into an insulating bush screwed into the place where the eye-bolt usually is. It turned out that the motor was a two-pole series machine, the two armature leads being connected between the two field coils, in place of the usual connector, one end of the field coils being taken to the only terminal, while the other end was connected to one of the holding-down bolts. The starter was connected up as usual, being in series with the terminal. The other main was connected to an iron gaspipe. The return from the motor was *via* the holding-down bolts, which went through a girder, thence to the corrugated iron motor-shed, and on to an iron standard supporting a crane track to which the gaspipe was also connected.

Although not a motor, another machine, located about half a mile from the Bank, may be noticed. This is an old Gramme dynamo, of about 6 volts, used for plating, which has been running for over 40 years, and is still in daily use. The remarkable part about it is the brushgear.

The brushes, copper, of course, are fixed in a clamp which is free to swing round the spindle. Clamped in with the brush is a brass plate, nearly the same size as the brush, with a hole in the end. Hooks are fixed in the wooden beams above the machine, and a cord is tied through the hole in the brass plate and passed over the hook. Pressure on the brushes is obtained by hanging weights on the free end of the cord. When trade is slack a few large iron nuts are sufficient, but in busy times anything up to about 14 lb. of metal are attached, the quantity in use serving as a crude ammeter. It is interesting to note that during the whole time this machine has been running, the only renewals, apart from brushes, have been two new commutators and one new set of bearings.

The electrical end often receives the blame for troubles which are purely mechanical. Probably the most common complaint in this connection, more particularly with belt drives, is that the motor goes too slow, or will not take the load. The writer has come across several instances of this, and in most cases the trouble can be traced to excessive slipping of the belt. It may be pointed out that when there is more than one belt between the motor and the driven machine, it is not necessarily the motor belt that is slipping.

A metal pulley, however long it may run, does not get polished if the belt does not slip unduly, but has a leaden appearance. When slipping takes place, the pulley will be bright and shine like polished silver. An examination of the belt will usually show it to be smooth and glazed on the inner side, and in bad cases the smell of burnt leather will be noticed. A speed counter will easily confirm whether the motor is running at its proper speed or not.

On one occasion the driving end bearing of a large motor in a saw mills seized badly. It had practically welded on, and as much of the shaft as was visible between the end plate and pulley was blue from heat. The oil well was nearly full of good clean oil, and, on first thoughts, it almost seemed as if the law of cause and effect had ceased to work. The common-sense view, however, was that the colour of the shaft showed that it must have reached a temperature of somewhere in the neighbourhood of 500° F., and long before that time the oil would have been volatilised or burnt up. The obvious conclusion arrived at was that the oil had been added after the shaft had seized. The attendant was asked point blank if this was the case, and eventually he admitted that it was so.

The truth of the matter probably was that the motor had been out of use for some time, was in an exposed position by the river side, and, being cold weather, the oil had thickened sufficiently to prevent the ring revolving.

About the same time the writer came across another bearing trouble, this time in a wood-working shop, the owner doing jobbing work for the furniture trade. He had prospered in a small way, and installed a larger motor. After it had been running for a few weeks complaint was made that the commutator end bearing was running hot at intervals.

The first time it did so the owner washed it out with paraffin, and, after refilling with fresh oil, it ran all right. A few days afterwards it again ran hot, and the owner asked to have the trouble investigated. It turned out that the motor was fixed close to a moulding machine, a tool which runs at a very high speed and throws off a lot of chips. The cause of the trouble was soon apparent. The end of the oil well was open, and occasionally a chip of wood flew in and dropped in the oil well, got picked up by the ring, and lodged between the ring and the bush; in fact the ring was actually seen resting on a chip. A cover was fitted over the end of the oil well and the trouble did not recur.

An unusual case of bearing trouble was met with a few years ago on a motor in a steel works. Again, the complaint was a heated bearing, this time on the driving end. The motor was an old two-pole over-type machine, having split bearings, with caps held down by set screws.

On removing the bearing cap it was found that the oil ring had cut a groove all round the shaft as neatly as if it had been turned to a depth of about a quarter of an inch. The shaft was so weakened that it had to be renewed. The explanation of the trouble seems to be that the ring was very heavy, being about a quarter of an inch wide by three-eighths of an inch deep. On that account it travelled much slower than the motor shaft, picked up particles of slag and grit, acting practically as a saw.

Let me give a final instance of bearing trouble. The hoist of an overhead travelling bearing crane was driven by gearing from a 20-H.P. motor. After it had been in use a short time one of the armature bands came off, and it was found that the lift in the bearings was excessive, the armature being practically on the pole pieces. The motor was taken apart, and the bearings tried on the shaft. It was somewhat surprising to find that they were a very good fit and showed no signs of wear. The bearings were next tried in the end-plate, and the cause of the trouble was apparent. The wear was on the outside.

The bearing was 6 in. long, and the outside was left rough, excepting for about 1 in. at the centre, which was turned to a radius. The seating in the end-plate was bored out parallel, consequently the weight of the armature and the load and the pull of the brake blocks was only taken on a line of contact.

Men who do nothing else but power work often get into the habit of locating faults almost automatically by symptoms, without the aid of a testing set or test lamp, and can usually make a very good guess at the trouble. On the other hand, they sometimes guess wrong. Such a case occurred on a metal-cutting saw, in which both the motor and gearing were enclosed. The only indication of the running of the motor was the movement of the saw. When starting up one day the operator was unable to get the saw to move. The electrician, who had examined the motor earlier in the day, came to the conclusion that the starter had burnt out. Borrowing one from a standing machine near by, he connected up and tried again, still without result. Noticing that the no-volt release was energised and holding up the starter arm, he left it so, removed one of the motor covers, and found the motor running merrily. The key had come out of the pinion and the shaft was revolving in the bore of the wheel.

The writer has come across several instances of mice and rats getting into electrical machinery. They usually get in when the machine is warm after a day's run. Generally speaking, no harm is done, excepting to the animals themselves, although in one instance a large rat got into a fan-ventilated motor and wedged up the fan. In another case a rat found its way into a lift controller on 530 volts, and caused a short-circuit.

An unusual fault took place on a motor in a leather works some time ago. The motor was hard to start up, would sometimes race, and at other times run at normal speed, and would flash over frequently.

It was not overloaded, and all connections were apparently in order. It took some time before the trouble was located, but the fault was very simple, after all.

The no-volt coil was in series with the shunt field winding, and the overload release operated in the usual way by short-circuiting the no-volt coil.

An intermittent break was found in the no-volt coil, and what happened was this: The contact on the starter arm was burnt and roughened, so that it did not fly back when the current was shut off. When the shunt field was opened by the break in the no-volt coil, the armature took an excessive current, which pulled in the overload coil and re-established the field. Sometimes the overload stuck in and kept the field, and sometimes it dropped, and the motor either flashed over or pulled it in again.

Another case had somewhat similar features. A new motor and starter, which had previously been tested and run satisfactorily on load, were packed and sent off to a customer about a 100 miles away.

A short time after, an angry purchaser telegraphed up to say that the motor was no good, and the starter got red-hot every time an attempt was made to start the motor.

A man was dispatched to the scene, and found the motor already packed up for returning. It was hastily connected up without removing it from the packing-case, and the customer's complaint was confirmed. The armature lead was taken off the starter, the arm moved on and off the first step, and the absence of any flash showed that there was a break in the field circuit. The armature lead was replaced, the field wire taken off and connected to the line terminal of the starter, thus placing the field across the main as soon as the switch was closed. On trying again, the motor ran perfectly, plainly showing the trouble to be in the starter itself. The closest inspection failed to show anything wrong, and in desperation it was decided to pull the starter to pieces and take the fittings off the slate. This ultimately showed the source of the trouble. The no-volt coil had its inner end connected to the iron core of the magnet with the object of cutting out the starting resistance from the field when the starter arm was full on. A brass set-screw went through the slate with the connection under the nut, and this set-screw, possibly owing to its having been tightened up too much, or being of hard brass, had broken in half in the centre of the slate, the connection on the back being stiff enough to hold it from dropping out.

ELECTRIC VEHICLE PROGRESS.

Electric Street Watering at Blackpool.—Blackpool is ever ready to adopt improvements, and has recently made a new venture by introducing an electric vehicle into municipal service. This takes the form of an electrically-propelled street watering tank wagon supplied by the General Vehicle Co., Ltd., of Imperial House, Kingsway, W.C.

Until recently, the work of watering the roads in Blackpool had been carried out by means of horse-drawn vehicles, which go a long way in a long time, whereas the new sprinkler can water a road 21 ft. wide, at a speed of 10 M.P.H., and recently, on test, distributed 6,000 gallons on 12 miles of road in $2\frac{3}{4}$ hours. This time included the running to the hydrant and loading, and from these figures, Mr. Bee, cleansing superintendent, Blackpool, estimates that he will be able to replace three or four of the horse-drawn vans. Apart from the great saving which this will mean to Blackpool, a great gain will be made in the expeditious manner in which the work will be carried out, which is highly desirable for a place like Blackpool during the season.

The tank, which has a capacity of 750 gallons, was supplied by Messrs. J. W. Glover & Sons, of Warwick, and is equipped with their patent Warwick sprinkler in the front of the vehicle, which arrangement enables the driver to exercise continual supervision over the spread of the water, and obviates the necessity of looking back.

The chassis itself is of standard G.V. pattern of $3\frac{1}{2}$-ton capacity, fitted with 44-cell 17-plate Ironclad battery, which has an ampere-hour capacity of 268, and gives a range on one charge of 40 miles. It is understood that Mr. Bee, the cleansing superintendent, has made arrangements to charge this up at his destructor works.

Electric Street Watering Wagon at Blackpool.

The chassis frame is constructed of 5-in. channel steel; the motor is a G.E. totally-enclosed type; the controller is of the G.E. type having four speeds forward and two reverse, regulated by field coils. Transmission is by double reduction, first by Morse silent chain enclosed from motor to countershaft, second by roller chains from countershaft to rear wheels. The countershaft is of the housed type on Timken roller bearings with spur gear differential.

The vehicle complete looks smart, and has the usual advantages of the electric, namely, silence and cleanliness.

Electric Vehicles in U.S. Postal Service.—Mr. A. Jackson Marshall, secretary of the American Electric Vehicle Association, writing on the above subject, gives some interesting data regarding the performance and cost of delivery vehicles. This matter is of particular interest in the States, as the Government there is obtaining tenders for mail transport in 100 cities, while in this country there is obviously an enormous field for the use of the electric van in parcel delivery work, which has scarcely been touched, and in which the actual delivery cost per parcel is probably higher than it would be under electrical delivery conditions.

Two experimental parcel post journeys were made with a 1,000-lb. Walker truck, for delivery and collection of parcels respectively, the stops being accurately timed and other essential data being carefully compiled.

As regards the delivery run, 150 packages were delivered by 143 stops covering 46·3 miles in 6 hr. 23 min. The time taken in travelling and making delivery per stop was 2 min. 40·7 sec. Similarly the average travelling and delivery time per parcel was 2 min. $33\frac{1}{3}$ sec., while the average stops per mile were 3·067. The cost per mile and per parcel for energy was ·55d. and ·17d. respectively.

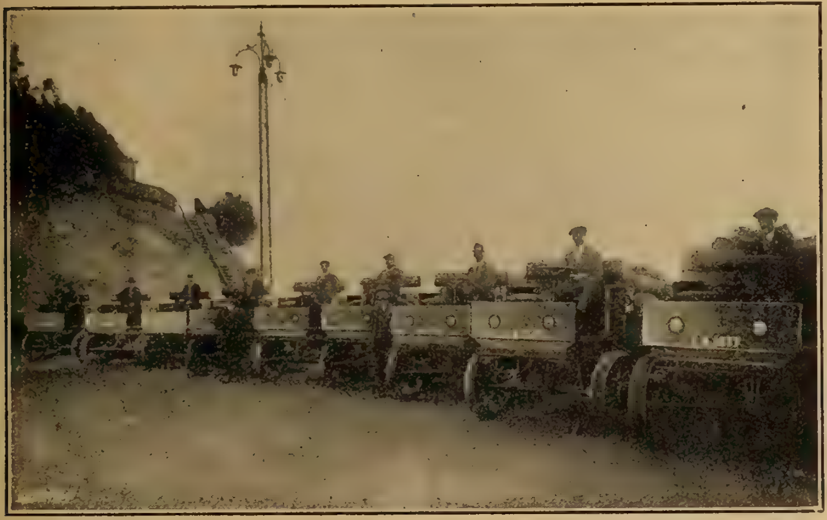
In the case of the collection run, 147 collections were made with 137 stops, covering 26·5 miles in 4 hr. 28 min.

The time taken in travelling and collecting per stop was 1 min. $57\frac{1}{3}$ sec., and per collection 1 min. $49\frac{2}{5}$ sec., while the average number of stops per mile was 5·17, and the cost per mile and per collection, of electrical energy was ·85d. and ·15d., current in both cases being figured at $1\frac{3}{4}$d. per unit.

The figures given are satisfactory so far as they go, but give little indication of the overall cost of delivery per parcel; fortunately many of the items which go to make up this cost can be filled in by those undertaking such work from known data.

Mr. Jackson Marshall believes that the motor vehicle must necessarily supersede the horse vehicle equipment in the U.S. postal service, and points out that in recent years 20 to 30 electrics have been used in New York city in the service, although, owing to changes in the system, only 12 are now in service, making deliveries from 19 postal sub-stations of large and heavy packages sent through the parcel post. During one winter month in 27 days these machines travelled 7,111 miles, and delivered 98,243 parcels, an average distance of 22 miles per individual vehicle.

The machines have, however, capacities of 45 miles per charge. The deliveries average out at 303 per day per vehicle, and the average distance per packet at 382 ft., while the average cost per parcel, excluding the salary of the attendant who accompanied the truck and made the actual deliveries, was between $1\frac{1}{2}$d. and $1\frac{3}{4}$d.



Electric Vehicles used by the South African Railways.

In addition to the above trucks, a number of heavy machines are used for mail haulage between New York city depôts and postal stations, and some have been in service five or six years, having been used 24 hours a day in the year during that period. Such mail service is considered to be one of the most exacting to which motor trucks can be applied.

The Indianapolis Post Office has used three electric delivery wagons which, in point of reliability, speed and mileage, have proved very satisfactory.

In a seven-hour day these wagons averaged 271·5 parcels in 189 stops over a distance of 18·75 miles. The cost of the day's run, not including the wages of the carrier, was about 23s.

The stops per mile were 6·02; cost per stop, 1·6d.; and cost per parcel, 1d.

Last year the Parcel Post Delivery Committee of the E.V.C. of America conducted an extensive campaign with all the U.S. Government officials at Washington, the post-masters generally throughout the country and others interested, with a view to inducing the Post Office authorities to recognise the value of the electric vehicle in their business. The work is so similar to that of the house-to-house delivery undertaken by large stores that their successful use by the many important American houses, should, it is considered, have considerable influence on the Post Office authorities. Mr. Jackson Marshall gives a list of large users of electric delivery vehicles, including the Ward Baking Co., with 510; the Adams Express Co., 326; the Marshall Field Co., 230; the American Express Co., 220; and several others, although these also employ numerous petrol-driven vans. For transport work over comparatively short distances, requiring frequent starting and stopping, the electric vehicle has proved its utility and economy, both in this country and the States, one writer estimating a saving of 25 per cent. on the cost of petrol delivery vans for such service. The range of delivery is such as will cover all city work and specified journeys beyond town limits.

While the publication of data regarding "frequent stop and start" service is useful, there appears to be considerable scope for a more extended investigation of the cost and limitations of the electric as compared with the petrol, steam and horse-drawn vehicle in this country. One writer, for instance, has stated that it is found that where the proportion of running time is low and the standing time high, the electric vehicle is the more suitable; this raises the question of the influence on cost per ton delivered of standing charges in the case of an expensive electric vehicle as compared with, say, a horse equipment, where the idle waiting time is a considerable proportion of the whole.

Many transport services involve such conditions, and the electric vehicle is peculiarly suited to undertake the work from many points of view, but comparative data is lacking as to influence of standing charges on the cost of delivery where lengthy periods of waiting nullify to a large extent the possible saving in expense while running.

We want a better idea of the service limitations of the electric apart from limitations of distance.

South African Railway "*Electrics.*"—At the latter end of last year the South African Railways at Cape Town obtained nine 7,000-lb. electric lorries from the South African General Electric Co. for delivery work from the Cape Town docks. These vehicles are of standard G.V. type; the battery is underslung and supplies a G.E.C. motor, from which transmission is by Morse chain to a countershaft in which is incorporated the differential, and from sprockets on the countershaft by heavy side chains to the rear wheels. Timken roller-bearings are fitted to the wheels, and the tires are solid, with twin tires on the rear wheels; external contracting brakes are fitted on the countershaft and internal expanding brakes on the driving wheel sprockets.

The control gives four speeds forward and two reverse. Motor, differential and axles are high off the ground, and the battery cradle gives 14-in. clearance from the ground.

The S.A. Railway Administration has had extensive experience of electric traction for short distance haulage, and its adoption on so liberal a scale points to the conclusion that within the limitations indicated the "electric" has peculiar advantages of its own.

"Bottle Rays."—According to the *Times* of August 19th, the German wireless news circulated through German official wireless stations and received by the Wireless Press contained the following:—Prof. Goldstein has discovered a new kind of rays which he calls "Bottle Rays" because they are produced from Leyden jars. They belong to the same class as the X-rays, but are of different colour when exported to the same surroundings. The gases of the "Bottle Rays" are very long and variously shaped, and at their end seem to dissolve in forms like clouds or cascades.

We are at a loss for an appropriate comment on this remarkable item of news, which leaves us dazed. We should be glad to know whether Prof. Goldstein did it into English, or whether the Wireless Press is responsible for the translation.

Horsham.—Plant Extension.—The Council has decided to arrange for the extension of the storage battery at the generating station in readiness for the winter load.

ILKLEY ELECTRICITY WORKS.

Some three weeks ago the electric supply undertaking of the Ilkley Urban District Council was officially inaugurated, Dr. Bates, chairman of the Council, performing the opening ceremony.

The Council purchased a Provisional Order for the area about 13 years ago, from a private firm, but as it did not take the necessary steps to utilise its powers, this order was revoked. A second Provisional Order was granted in 1912, and the question of evolving a suitable scheme came under consideration.

Ilkley Electricity Works.

The idea of purchasing electricity in bulk from the West Yorkshire Electric Power Co., who were intending to erect a generating station at Bingley, was abandoned, the Council deciding to provide its own plant; a further proposal to utilise the water-power of the river was also discussed, but ultimately a steam-generating scheme, prepared by Mr. George Wilkinson, borough electrical engineer of the neighbouring town of Harrogate, was adopted, he being subsequently appointed consulting engineer to the Council.

The estimated cost of the work was rather under £18,000, and we gather that for that portion of the work the cost has not been exceeded; but additional cable extensions have been made, so that some £21,000 has been spent on the scheme.

The generating station, which has been erected in Little Lane, adjoining the Council's gasworks, is a plain brick structure, laid out suitably for extension, and includes a combined engine and boiler room—in which the "locomobile" type of prime mover is installed—with adjoining coal bunkers to hold 180 tons of coal, and an accumulator room.

The generating plant consists of two 200-H.P. locomobile sets, in which the engine is mounted directly over the boiler, and due to the high superheat and relatively small steam losses, some remarkable efficiencies were obtained on test at the works of the makers, Messrs. R. Garrett & Sons, Ltd.

The boiler is of the multitubular Cornish type, a special feature being that the corrugated furnace and tubes can be withdrawn as a whole for cleaning, &c.; at the end of the boiler is a tubular superheater chamber. The working steam-pressure is 190 lb., and 180° of superheat are added.

The engine, mounted over the boiler, is of the side-by-side compound type; the cylinder jackets are fed direct with boiler steam, and balanced piston valves are fitted to each cylinder. The engine is fitted with two fly-wheels and a shaft governor, and drives through a flexible coupling, an extension shaft carrying a chain sprocket, the drive on to the generator being by means of a Hans Renold chain running in an oil bath.

The engine exhausts into a jet-type condenser working in conjunction with a single Edwards-type air pump, the condensing water being passed through a sprinkler-type cooling plant outside.

The boiler is fitted with a special type of internal direct-contact feed water heater, water from which at high temperature is fed into the lower and cooler part of the boiler shell, thus improving the circulation.

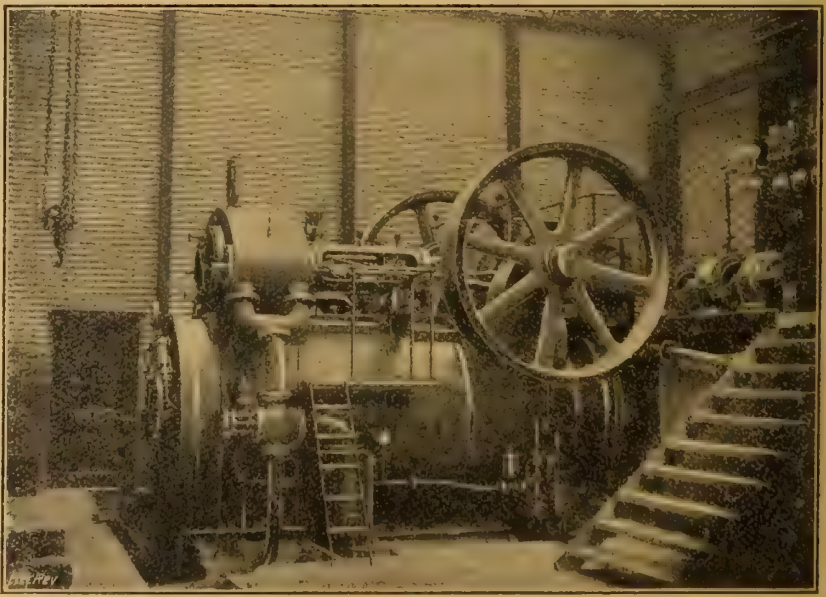
The engine runs at 170 R.P.M.; the test steam consumption was 10·6 lb. per B.H.P. on full load (180 B.H.P.), and the coal consumption, with high calorific fuel, 1·4 lb. per B.H.P. The mechanical efficiency of the unit is about 95 per cent.

The contract for the electrical generators, switchgear, &c., was carried out by the Phœnix Dynamo Mfg. Co., Ltd.; the main generators are 100-KW. units, and there are in addition two balancers and one double-ended booster to operate in conjunction with the battery plant.

The main switchboard was supplied by Messrs. Whipp and Bourne, as sub-contractors, and includes seven generator and works panels and four feeder panels for controlling the main feeders to Ben Rhydding, Middleton, the Town Hall, and King's Road, and from these points distribution cables are carried through all the principal streets and roads. The total length of cables laid is, approximately, 16 miles, and this work has been carried out by the Western Electric Co., Ltd. The distribution is on the three-wire system at 460 and 230 volts, motors above 1½ H.P. being supplied on the higher pressure.

About 50 consumers have been connected to the mains, and the prospects of superseding the private plants in the district are good.

It was at one time proposed to light some of the streets electrically, and also to illuminate West View Park with electric fairy lamps, but owing to the prevailing conditions this has been deferred.

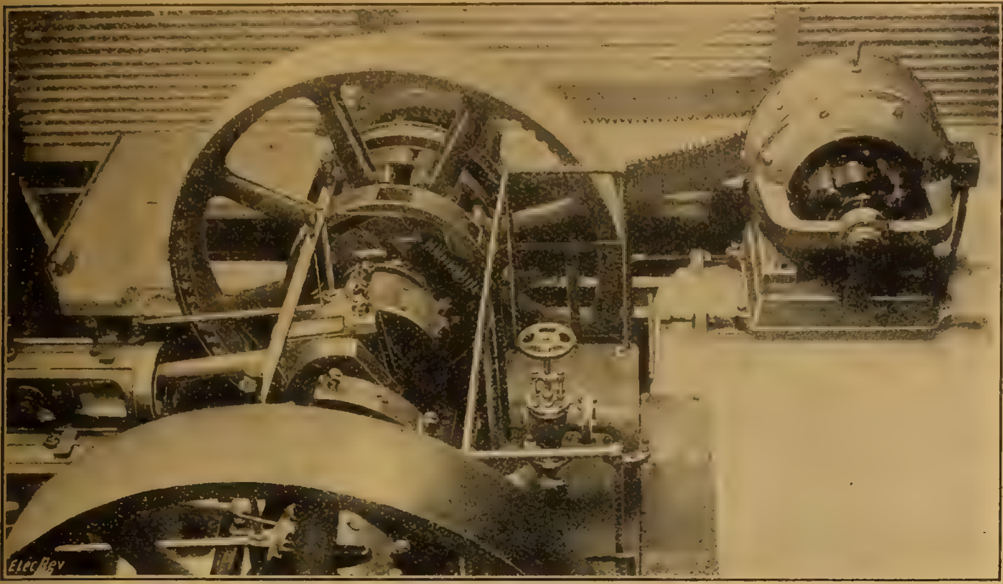


Garrett 200-B.H.P. Locomobile installed at Ilkley.

The charges for energy in Ilkley are 5d. per unit for lighting and 2d. per unit for power and heating purposes.

At the commencement of the work Mr. Wilkinson, junr., took charge of the cable laying as clerk of the works, but being on the reserve of officers, he was called up to serve with the first contingent of the Expeditionary Force, being subsequently wounded in the retreat from

Mons and taken prisoner. In October last his position as clerk of works was taken by Mr. Sydney H. Bill, who has since been appointed electrical engineer to the Council, as announced in a recent issue. There can be no doubt that a public supply of electricity will prove a valuable acquisition to Ilkley, and add to its numerous attractions as a health resort and residential centre; our congratulations are due both to the consulting engineer, Mr. Geo. Wilkinson, and to Mr. Bill, the Council's electrical engineer, on the successful initiation of the scheme; to Mr. Bill our thanks are also due for material assistance in the preparation of this short description.



View of P.D.M. Generator and Chain Drive, Ilkley Electricity Works.

A NEW PRINTING TELEGRAPH SYSTEM.

(*Concluded from page* 232.)

The perforator, shown in fig. 1, is provided with a keyboard similar to that of a standard typewriter. The stroke of the keys is short, so that it can be operated without fatigue. Fig. 9 shows the interior of the apparatus. The selecting mechanism consists of five horizontal bars placed beneath the keys and so arranged that each key, when depressed, will engage one or more of the various bars and depress them. The depression of these bars selects the punches in the punch-head.

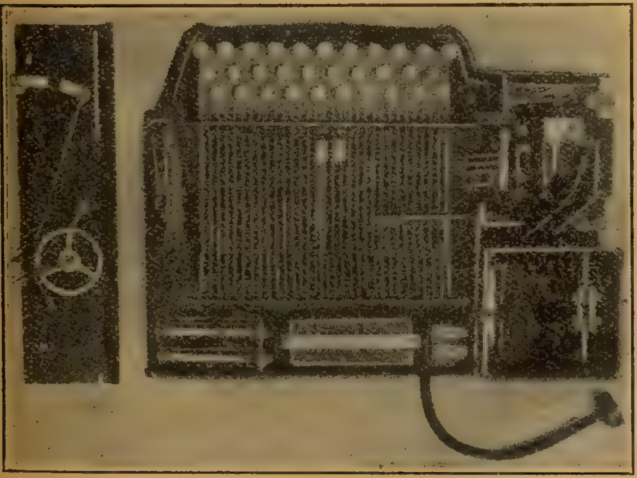


Fig. 9.—Keyboard Mechanism.

After the selection of the punches is made, a common contact is closed which operates the perforating magnet. The tape is perforated crosswise instead of lengthwise, thereby effecting a considerable saving in the amount of tape. This is illustrated by fig. 10, in which A represents the piece of tape required for transmitting the words "London, New York, Paris." One-half the tape shown in B is the tape required to send the same words by the Wheatstone. The two pieces shown in B represent the amount of paper used by a printing telegraph system which utilises the Continental Morse code. One tape is required for transmission, and the other is prepared by a receiving perforator and is then fed into a printing machine, which translates it and prints it on a tape. From this it will be appreciated that the economy in - tape is a feature of some consideration. Fig. 9 also shows the mechanism of the indicator, the purpose of which is to indicate to the operator the number of letters that have been punched on one line. This is a ratchet mechanism which is operated one tooth for each operation of the punching mechanism, carries a pointer across a graduated scale, and is returned to normal at any time the carriage return key is depressed. A lamp signal is also provided which warns the operator that she is nearing the end of a line. This perforator is extremely fast and on test has perforated correctly up to a speed of 92 words per minute, which was the limiting speed of the operator.

Fig. 11 shows the transmitter with the tape inserted. At each revolution of the distributor, the tape is moved one step to the left. This is accomplished by means of a pulse of current from a segment in the local ring, No. 4, of fig. 6, as has already been described. The location of this segment is such that the stepping of the tape takes place shortly after the transmission from the fifth segment of the distributor, so that the tape can be moved forward and a new combination set up on the levers before the brush is ready to transmit another signal from this particular quadrant. Five fingers are raised which, if they find holes in the tape, move upward and operate levers which correspond to those shown in figs. 3 and 4, thus setting up in one quadrant or one group of five segments the necessary combination for a given signal. The transmitter is provided with two switches for control by the operator. The upper switch, which has two positions, "start" and "stop," is used when it is desired to insert a new tape or when it is desired to stop the transmitter. In the "start" position the tape is moved forward one step per revolution, as described. In the "stop" position the fingers which feel out the holes in the tape are all held down, thus connecting only the spacing battery to the five segments connected to this transmitter. The switch in the base, which has two positions, "on" and "off," opens and closes the circuit of the stepping magnet. If in the "off" position, the tape will therefore not be stepped forward, but the signal which happens to be in the transmitter will be repeated once for each revolution of the distributor, because the operation of this switch does not draw down the fingers which feel out the holes in the tape, as does the operation of the other switch. This is sometimes desirable for testing purposes. Normally, this switch is left in the "on" position. Fig. 13 shows the transmitter with the cover removed and the clips which are provided to make contact with springs mounted on the table. This method is adopted with the various pieces of apparatus, as will be noted later, so that a piece of apparatus can be readily removed, if suspected of being faulty, and replaced by one which is known to be in working order.

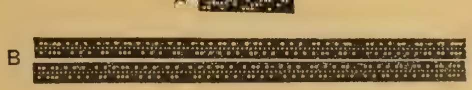


Fig. 10.—Comparison of Perforated Tapes.

The printer is shown in fig. 1. In front of the printer proper is a box containing the relays and resistances essential to its operation. A bell is also provided which responds to a predetermined signal sent over the line, this signal being the signal for "J" preceded by a figure-shift signal. Alongside of this box on the printer frame are two push-buttons, one marked "CR" and the other "LF." By operating these push-buttons, the operator can return the carriage or cause the paper to be moved upward. This is frequently desirable, particularly in starting up after an interruption, in preparing the printer for a new message. "CR" indicates "carriage return," and "LF" "line feed." The printer and the relay box are two separate units and are connected to the table wiring through spring clips similar to that shown on the transmitter. The relay box is removed by pulling forward, and the printer by sliding backward. The printer is arranged to print the message in column form on paper 8.5 in. wide. Fig. 14 shows the form of message and style of characters. Paper is supplied to the machine from a roll mounted on the back, and so arranged that it can be readily replaced by an operator standing in front of the table. Just above the window of the printer is a cutting edge which permits a message to be torn off as soon as completed. The machine is of the type in which the paper moves and the type wheel is stationary, except for its rotary movement, in order to bring the desired letter opposite the paper. The type wheel is mounted on a vertical shaft driven by a spring which is kept under the desired torque by a small motor and dynamometer. The type shaft is released after the letter has been selected, and it revolves until it strikes a stop thrown up in its path. The position of the stop is determined by the letter selected and brings the desired letter in front of the paper. As soon as the type wheel is stopped the paper is forced against the type wheel by a printing magnet, and the letter is printed. The wheel is inked by two felt rollers which have been saturated with ink and which are held against the type wheel. The selection of stops is obtained mechanically by the use of five disks. The position of each disk is determined by an electromagnet which is under control of one of the relays connected to the receiving segments. For each combination of relays selected there is a corresponding movement of the disks which permits the required stop to be moved into such a position as to stop the type wheel in the proper position. Fig. 13 shows the printer and relay box with covers removed. The paper has also been removed, in order to show parts which would otherwise be hidden. The type wheel and ink rollers are shown at 1, the selecting disks at 2, and the motor at 3.

One unique feature in the design of this printer is its unit of construction. For example, the mechanism which moves the paper carriage and the paper across in front of the type wheel is a complete unit by itself, as is shown at 4. In case of trouble in this unit, it can be replaced in a very few minutes without disturbing the adjustments of the other units which go to make up the printer. The printing unit is shown at 5, and is likewise easily replaced. The paper carriage, 6, is a unit which can be readily removed. Likewise the paper lift, 7. In fact, the working parts of the printer consist of twelve units, each distinct and readily removed. Two lamps are provided for special signals, No. 8 and No. 9. Lamp No. 8 is used in the one-way system when the printer is used in connection with a keyboard, and indicates to the operator that she is nearing the end of the line. Signal lamp No. 9, used in all methods of operation, indicates whether or not signals are coming in to the printer. In all the methods of operation using a distributor, two-way, double-duplex, triple-duplex and quadruple-duplex, this lamp is operated directly from the distributor through the intermediate segments in the receiving ring R, (fig. 4). The flashing of this lamp when the printer is not working indicates that the latter is out of service.

The function of this lamp is to eliminate the possibility of an operator sending messages when the distant printer is not working and the receiving operator assuming that the failure to print is due to the fact that the transmitter at the distant end is not sending. In the relay box the five relays to the left constitute the five selecting relays shown in figs. 3 and 4. The sixth relay from the left is the one which receives a pulse from a segment in the local ring, No. 4, and starts the mechanism of the printer after the selection has been received by the selecting relays. The remaining seven relays are required to perform various functions, the description of which would lead to considerable detail.

Fig. 15 shows a piece of apparatus known as the automatic control. The function of this piece of apparatus is to stop the transmitter in case the operator is unable to keep up with the pace set by the distributor. Its position on the printing table is shown in fig. 1, directly behind the transmitter, the projecting lever arm extended forward between the perforator and the transmitter. The tape normally forms a small loop as shown. If the perforating operator should stop, the transmitter will continue until the slack in the tape is used up and the tension of the tape lifts the lever of the automatic control. This movement automatically stops the transmitter, which, however, continues to transmit only spacing current, having no effect on the distant printer. As soon as the operator begins perforating, the lever arm is dropped and the transmitter continues from the point of the interruption. Thus the message at the distant end is not mutilated. The automatic control has one other important feature, namely, it enables the receiving operator to send bell signals over the line, as has already been referred to. This is accomplished by an escapement mechanism which drives cams, causing certain spring combinations to be made in sequence. For example, to ring the bell once at the distant end, the operator will insert a finger in the hole marked "start" and pull down until the finger engages the stop, and then release. In returning to the normal position shown the cams will be rotated and the required contacts made to give the bell at the distant end one stroke. In doing this the transmitter is automatically stopped and started, thus causing no mutilation of the message which is being transmitted. If it is desired to ring the bell twice at the distant end, indicating to the operator that the tape should be re-run, the operator will insert the finger in the second hole marked "re-run," pull the lever down to the stop and release as before, and so on. Thus signals of one, two, three, four or five strokes of the bell can be automatically transmitted over the line without mutilating the message that is being transmitted. The automatic control is also arranged with the clip connections, so that it can be readily removed. Fig. 15 shows the interior of the apparatus, the cams and contact springs being plainly visible in the foreground.

Fig. 1 shows a complete multiplex table equipment. On the left is the printer with its relay box, in the centre are the transmitter and automatic control, and at the right is the keyboard perforator. Beneath the table at the left will be noted a metal terminal box. This box contains fuses, and in it all the connections are made between the table and the distributor. This table is a standard unit for use in the two-

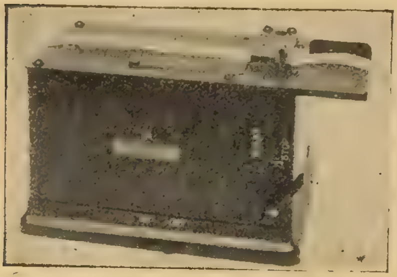


Fig. 11.—Tape-operated Transmitter.

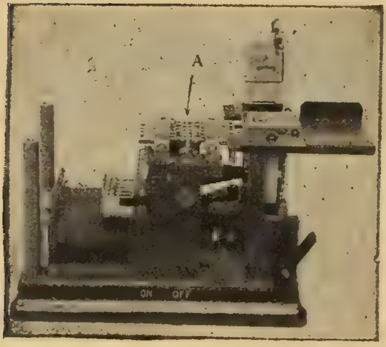


Fig. 12.—Transmitter with Cover Removed.

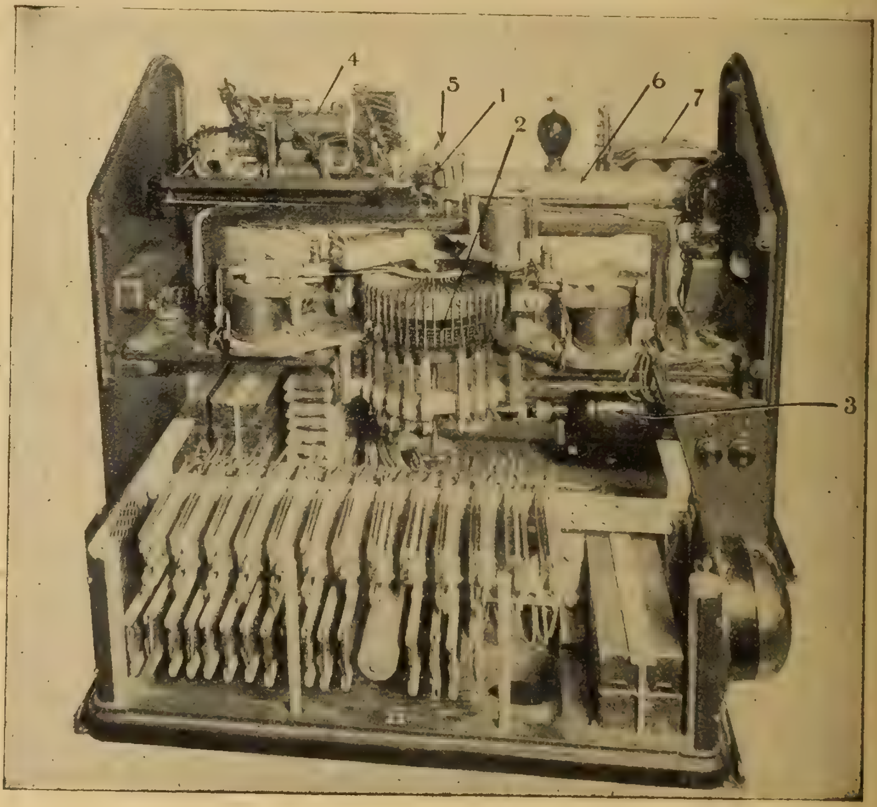
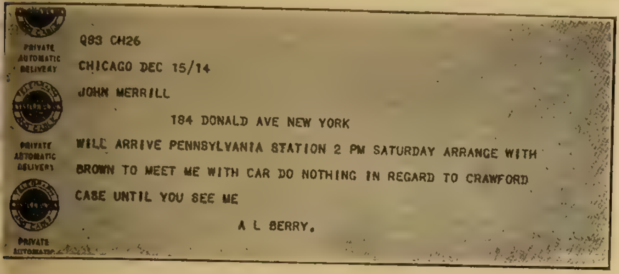


Fig. 13.—Interior of Printer and Relay.

way, double-duplex, triple-duplex, and quadruple-duplex methods of operation. The number of table units required for the various methods of operation are as follows: Two-way, one at each end; double-duplex, two at each end; triple-duplex, three at each end; quadruple-duplex, four at each end.

In addition to the number of table units required for each method of operation, there will be required at each end an electrically driven tuning fork, a motor, a mechanical corrector, and a distributor having the proper segment arrangement for the particular service required.

For the one-way service using keyboard transmission the same printer as shown in figs. 1 and 13, without the relay box, is mounted on a special table with a direct transmitting keyboard, this combination sometimes being called the short-



PRIVATE AUTOMATIC DELIVERY

Q83 CH26

CHICAGO DEC 15/14

JOHN MERRILL

184 DONALD AVE NEW YORK

WILL ARRIVE PENNSYLVANIA STATION 2 PM SATURDAY ARRANGE WITH BROWN TO MEET ME WITH CAR DO NOTHING IN REGARD TO CRAWFORD CASE UNTIL YOU SEE ME

A L BERRY.

Fig. 14.—Message Printed as Received.

ıe printer. Where the characteristics of the line will permit, e one-way system is capable of satisfactory operation at the ghest operator speeds. On more difficult circuits it may be lvisable to resort to tape transmission, for reasons already ıted. Where this method of operation is used as a feeder distributor for one of the other methods of operation, it ıy be advisable to use tape transmission at the central-ice end, since then it will be possible to utilise tape pro-ced by a re-perforator for transmission purposes. In this se it is not essential to have the printer at the central office ord outgoing messages, since the tape may constitute an ıce record.

Γhe practicability of the system has been proved by tests the quadruple-duplex by the Western Union Telegraph Co.

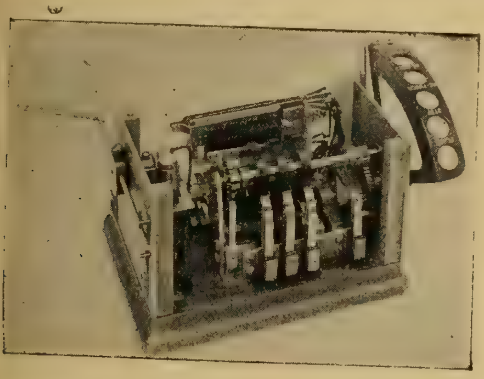


Fig. 15.—Interior of Automatic Controller.

; equipment has been in operation for more than a year. results of this and other less extended tests indicate that system is thoroughly practical and is well past the experi-tal stage.

ıe success achieved is the result of the concentration on a le problem of a number of minds, each particularly well pped with knowledge and experience for the consideration ome important phase of the problem. Nor has the work arlier investigators been neglected. The multiplex prin- of Baudot and the five-unit code used by him over 30 s ago form the foundation of the system.

remained, none the less, for Mr. Donald Murray, who previously developed a high-speed system using the Baudot unit code, to appreciate the inherent advantages of the lot multiplex system. This he incorporated in the Murray iplex system, which included machine sending and column ing. Although novel in many respects, the system des-d is not altogether an innovation, but is rather the reali-n and working out of old principles which have been tried found successful.

exico.—The Commercial Intelligence Branch of the of Trade has received the following telegram from His ty's Consul at Mexico City:—"Communications restored) Vera Cruz by rail. In my opinion it will be preferable to shipments (of) British merchandise for the present except by of agents here. Communications interrupted between here orthern frontier still."

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Multi-Pole Isolating Switches.

It often occurs in modern practice that it is preferable to install multi-pole rather than single-pole isolating switches; it is, for example, sometimes difficult to mount the ordinary hook-operated single-pole type where they can be easily and quickly reached by the hook, and for such cases a multi-pole switch, such as shown in fig. 1, will be found particularly useful. It will be noted that this switch is provided with a spindle on which may be mounted a chain-wheel or crank for any system of mechanical romote control, by means of which the three poles may be switched in or out immediately with certainty and ease. These switches are supplied by the Electric and General Works, Ltd., of 15, Victoria Street, London, S.W., for any voltage up to 50,000.

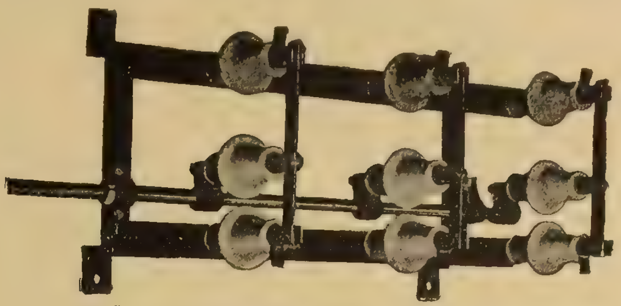


Fig. 1.—Multi-Pole Isolating Switch.

Condenser Protection against Surges.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., recently issued an illustrated brochure giving a full account of the condenser system of protecting electrical networks, &c., against the effects of surges. These phenomena were practically unknown or, at any rate, unrecognised, until, with the growth of electrical undertakings, the amount of energy stored in long overhead or underground cables became sufficiently great to allow of surges which imperilled the integrity of the insulation or actually broke it done. Such surges may be due to resonance, switching operations, arcs and sparks, and lightning discharges, and differ in their nature according to their origin, but any kind of surge is capable of producing severe stresses on the insulation of a system

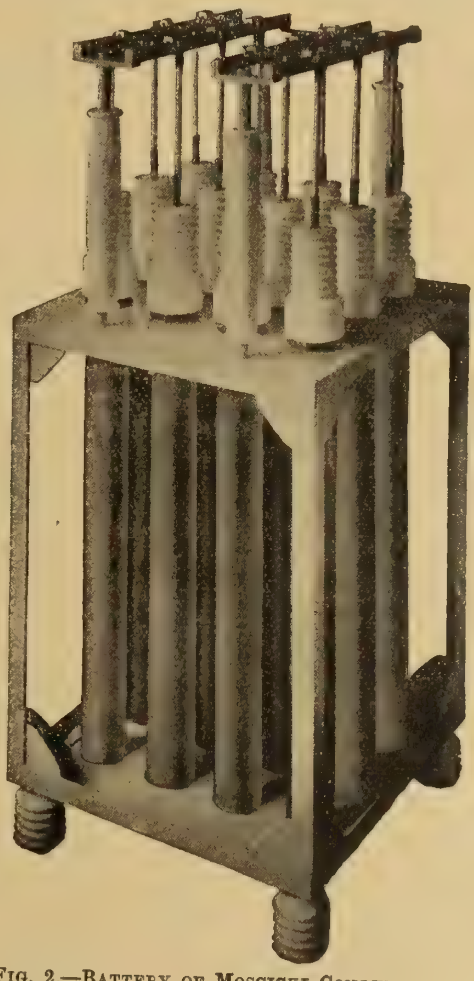


Fig. 2.—Battery of Moscicki Condensers.

at some point or other. The horn type of arrester is useless except for high voltages, and as its use involves the formation and rupture of an arc, its disadvantages may outweigh its advantages. The aluminium electrolytic arrester is excellent for use with direct current, but cannot be used on A.C. lines without a spark-gap in series with it, and has to be charged daily. Multi-gap arresters have been widely and successfully installed, but will not operate at low voltage, and are easily put out of action by a discharge, leaving the system unprotected. The presence of a high resistance in series with the surge arrester, which is necessary to prevent the possibility of resonance, also limits the effectiveness of the arrester in reducing the surge voltage. From all these objections the condenser type of arrester is free; it offers a high impedance to line voltages of normal frequency, while it practically short-circuits the line for high-frequency surges, and dissipates the energy of the surge without allowing a heavy line current to flow to earth. It is connected directly to the line, without any spark-gap, and thus is in a position to act instantaneously and at all voltages, and has the important advantage that it modifies the wave-form of steep-fronted waves, which are apt to break down the end turns of transformers and generators. All these points are discussed in the brocuure, which, as a technical essay, is of quite exceptional quality, and illustrations are given of the Moscicki condensers in various applications.

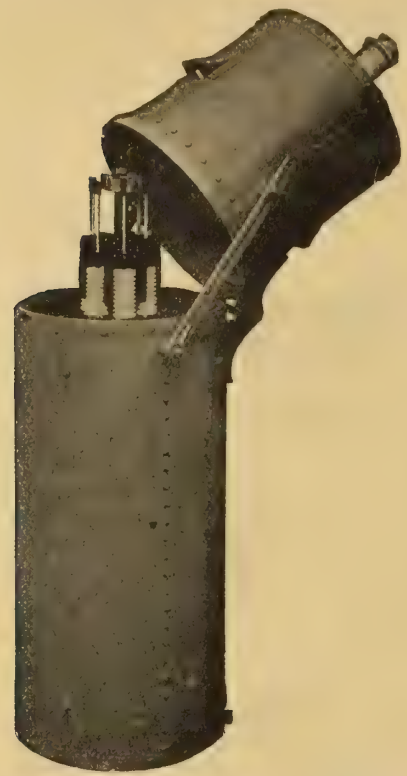


Fig. 3.—Outdoor Type of Condenser.

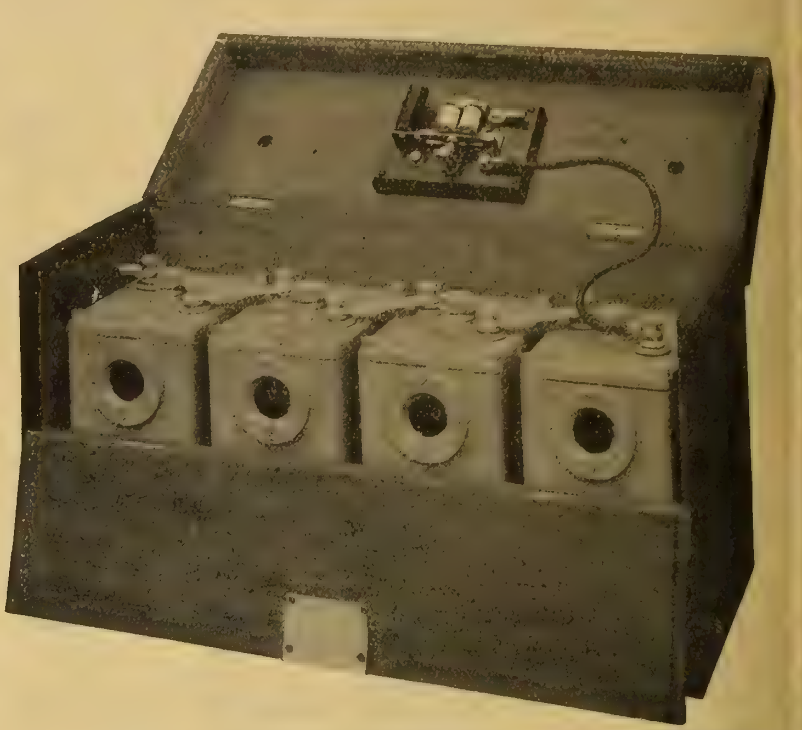


Fig. 4.—Battery of Electrolytic Condensers for Tramcar Protection.

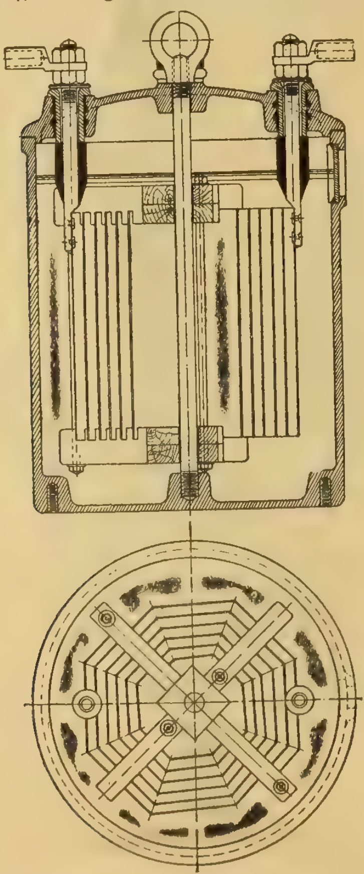


Fig. 5.—Section Through Electrolytic (D.C.) Condenser.

This device has been previously described in our pages; briefly, it consists of a long narrow glass tube, coated with metal inside and out; at the neck, where the static stress is greatest, the glas is thick, but elsewhere it is very thin, so that the capacity i great. A china insulator surrounds the neck, and the whole i mounted in an iron tube, filled up with a mixture of water an glycerine, to maintain the temperature uniform. These element are grouped together in frames to form batteries of suitabl capacities, of which one is shown in fig. 2, for indoor use; fig. shows a battery for installation out of doors, with an iron cover As the condenser alone cannot deal with high-pressure, low-frequency discharges, the Giles valve is employed for this purpose it consists of a spark-gap in series with a resistance, and with number of spark-gaps, each of which is shunted by a condenser t earth. This device, owing to the use of condensers, begins to ac with much smaller excess pressures than ordinary multiga arresters. Other apparatus dealt with in the brochure are th water-jet resistance for relieving lines of static charges; electr lytic condenser batteries, for protecting D.C. tramcars, and discon necting switches for condenser batteries. Fig. 4 shows a batte of four electrolytic condensers, for use on a circuit up to 600 volt and fig. 5 is a section of the D.C. arrester, which consists of tw

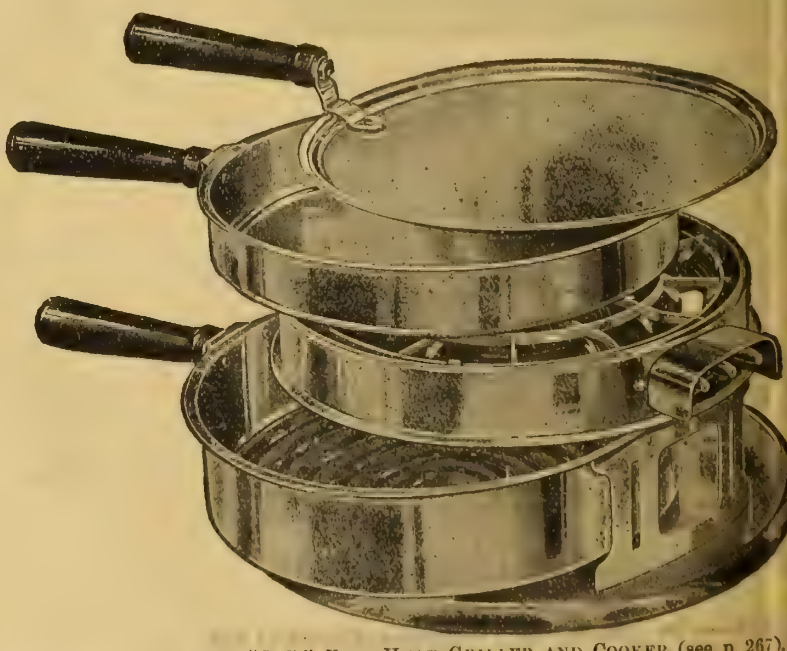


Fig. 6.—"D.G." Four-Heat Griller and Cooker (see p. 267).

aluminium plates wound in coaxial spirals and immersed in an electrolyte. Illustrations of large installations of condensers are also given in the brochure, and technical explanations, diagrams of connections, &c., are included. It is certainly an admirable specimen of trade literature.

The "D.G." Four-Heat Griller and Cooker.

Messrs. Drake & Gorham, of 66, Victoria Street, S.W., are placing on the market a new pattern of griller and cooker made in nickelled steel, and consisting of a 7½-in. diam. circular open-type heater, supported on brackets above a 9-in. diam. base; grilling and toasting operations are carried out on the underside, and boiling and frying above, a full complement of utensils, including shallow and deep pans, strainer and reflector or lid, being provided for this purpose, as shown in fig. 6 (page 266).

The feature of the apparatus which will appeal to purchasers is that by connecting up to specified pairs of the four plugs provided, four heat variations can be obtained, thus enabling only the necessary amount of heat (and electrical energy) to be used for a particular purpose. The four loadings are 600, 330, 270 and 140 watts. This arrangement, besides facilitating cooking operations, means a considerable saving in cost of current in many cases.

The construction of the heater unit is simple and robust, and it appears to be easily repairable.

The apparatus is connected to the mains by means of flexible with twin sockets; it appears to be excellently finished, and as it costs considerably under 30s., its cost is quite moderate.

AN ELECTROMAGNETIC VACUUM BALANCE.

By JOHN S. ANDERSON, M.A., B.Sc., Ph.D.

(*Abstract of paper read before the* Faraday Society.)

During the course of work carried out by the author on the rates of absorption and giving up of water, alcohol, and benzene vapours by a gel of silicic acid, an electromagnetic balance was designed to allow of substances being weighed *in vacuo*. The chief aim was to be able, if possible, to weigh a substance, whose weight may alter under certain conditions, from time to time without removing it from the vacuum. The principle involved is that of the well-known Kelvin balance for "weighing" electrical currents. One of the scale-pans of an ordinary balance is replaced by a circular coil of wire whose axis is vertical. This coil is movable between two larger fixed coils of wire, which have the same vertical axis. The three coils are so connected that an electrical current may be passed through them in series, through the movable coil and the lower fixed coil in one direction and through the upper fixed coil in the opposite direction. Thus when an electrical current is passed through the coils, the movable one is attracted towards the lower, and repulsed by the upper, fixed coil. These attractive and repulsive forces may be increased or decreased by increasing or decreasing the current passing through the coils; they are made use of to counterbalance the force of gravity acting on the substance to be weighed in the scale-pan hanging from the other end of the beam of the balance. Should the weight of the substance vary from time to time, the variations can be determined by altering the current passing through the coils until equality of the forces acting on either end of the balance beam is obtained. The balance is enclosed in a bell-jar which can be evacuated, so that the process of weighing can be carried out while the substance whose weight is required is in a vacuum.

The chief metallic parts are nickel-plated. The movable coil of wire which takes the place of the second scale-pan hangs halfway between the fixed coils of wire and when the beam is at rest, that is, when the pointer is at zero. The knife-edge at the centre of the beam rests on a small plate of agate. The balance is fixed to a round glass plate which lies on a steel table having three legs. This table rests on a wooden board, to which are attached three screws, the height of which may be varied at will. By adjusting the screws the plate on which the balance rests may be fixed in a horizontal position. The dimensions of the movable parts of the balance are such that the total surface exposed on either side of the beam is approximately the same. The reason for this is that when in an experiment water vapour, or other vapour, is introduced into the balance, there will be approximately the same amount of vapour adsorbed by the metal, glass, &c., on either side of the beam.

The method of connecting up the coils of wire B, B′, and B″, fig. 1, with one another and with the necessary battery is as follows: Two brass terminals F′ and F″ pass through small holes in the glass plate. In order to prevent leakage of air at the terminals when the bell-jar cover is on the balance and the apparatus is evacuated, small leather washers are provided above the plate, and the terminals are sealed below the plate by means of wax. A little rectangular box of ebonite is fixed at the top of the pointer, and is divided into two compartments, each containing a little mercury. Above the box, and attached in a horizontal position to the centre of the beam, is a small rod of ivory. Two small pieces of platinum passing through this rod are fixed vertically in such a position that each of them dips into one of the mercury compartments of the box. When the beam vibrates about its position of equilibrium the pieces of platinum move through the mercury, but friction is reduced to a minimum owing to the fact that the lower ends of the platinum pieces are very fine and are slightly flattened in the planes of motion. On the end of the balance beam from which the coil B hangs is fixed another small ivory rod. Two very fine wires are stretched from the pieces of platinum over this rod and pass down in the form of spirals to the two ends of the movable coil B. Wires connect the terminal F′ and one of the compartments of the box, the terminal F″ and the coil B″, the coil B″ and the coil B′, the coil B′ and the other compartment of the box. Thus there are electrical connections from the terminal F′ through the mercury in one of the compartments, the piece of platinum and the wire to the coil B and back through the wire, piece of platinum and mercury in the other compartment to the coil B′, and thence through the coil B″ to the terminal F″.

When the balance is not in use the beam rests on the framework. An electrical method is used for releasing and fixing the beam. The outer end of a lever at the back of the balance is connected above and below by two metal pieces to two cylindrical iron rods, which can move freely in a vertical direction inside two solenoids O′, O″ fixed to the central upright stem of the balance. When a current of electricity is passed through the coil of the lower solenoid O″ its iron core is drawn down into the solenoid. Thus the outer end of the lever is drawn downwards, allowing the framework which is connected to it to fall down a short distance, the balance beam being thus released. The weight of the cores causes the lever to remain down when the current is switched off. When an electrical current is now passed through the coil of the upper solenoid O′ its iron core is drawn upwards. This action causes the outer end of the lever to rise, thus raising the framework. The beam is therefore held fixed at rest again. A wire spring holds up the lever when the current is switched off. Thus in order to release or fix the beam of the balance, a current of electricity need only be momentarily passed through the lower or the upper solenoid.

Three wires, insulated from one another by means of ebonite, pass through the metal base of the balance and through the glass plate. They end below the steel table in three terminals P, P′ and P″. One end of the coil of wire in the solenoid O′ is connected to the terminal P′, one end of the coil in the solenoid O″ is connected to the terminal P″, while the other ends of the coils are both connected to the middle terminal P.

The electrical connections necessary for operating the balance are shown diagrammatically in fig. 1. The connections below F′ and F″ are all outside the balance; the others have already been described. R is an amperemeter for measuring the current passing through the coils. The battery S′ gives a pressure of about 70 volts. T is a resistance box, and T′ represents two slide resistances connected in series. V′ is a key by means of which the circuit may be made or broken at will. To the left are shown the connections necessary for releasing and fixing the balance beam by means of the lever operated on by the solenoids O′ and O″ and their iron cores. The battery S″ gives a pressure of about 10 volts. T″ is a slide resistance. V″ is a two-way key; when the lever is placed in the upper position (dotted line), the circuit through the upper solenoid O′ is closed, and when placed in the lower position (dotted line) the circuit through the lower solenoid O″ is closed. When the lever is in the middle position no current passes through either circuit.

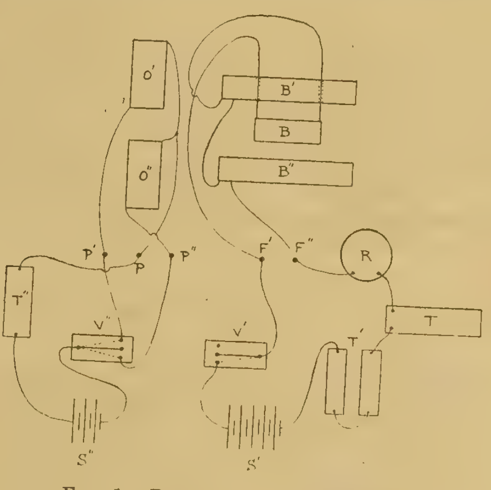


Fig. 1.—Diagram of Connections.

The balance should be carefully calibrated before and after a series of experiments. This may be done by placing certain known weights in the scale-pan of the balance and determining the strengths of the currents that must be passed through the coils in each case. A curve may then be constructed, giving the relation of electrical current to weight.

With the amperemeter used in the experiments a difference of 0·1 milliampere could be detected. This corresponds to a difference in weight of 0·35 to 0·7 milligram, depending on the portion of the range of weights used. If more care were to be taken in choosing the range of weights, and if a more accurate amperemeter were employed, it would be possible to increase the sensitiveness of the balance considerably. It is advisable to determine approximately before an experiment what the total variation in weight of the substance under examination will be, so that a convenient range of current may be employed. The maximum current applied should be kept fairly small, in order to prevent heating of the coils.

There are numerous physical and chemical processes which may be investigated with the help of the balance.

ELECTRICAL HOUSES AT DUMBRECK, GLASGOW.

Electricity offers such advantages in cleanliness, convenience and comfort that it is not surprising to find it daily growing in favour with the modern housewife. Particularly when applied to cooking and heating it eliminates much of the drudgery from the home besides possessing undoubted hygienic properties.

An electrical garden city fittingly describes the latest development in the form of a number of neat and compact villas erected on a charming little estate called "Hazlewood," situated at Dumbreck, a comfortable car journey from the centre of the City of Glasgow.

According to Mr. Lackie, chief electrical engineer of the city, these are the first houses where domestic requirements are entirely dependent upon the electric power.

These villas, which have been erected by Messrs. Geo. Hamilton and Co., of Glasgow, are built in several sizes of four, five, and six apartments, and present a most picturesque appearance against the thick foliage of the trees, with which the estate abounds.

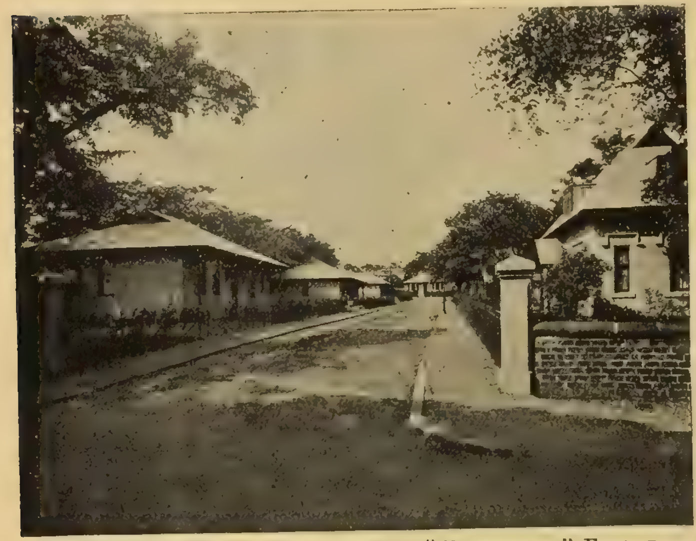


Fig. 1.—One of the Avenues at "Hazlewood" Estate, Dumbreck, near Glasgow.

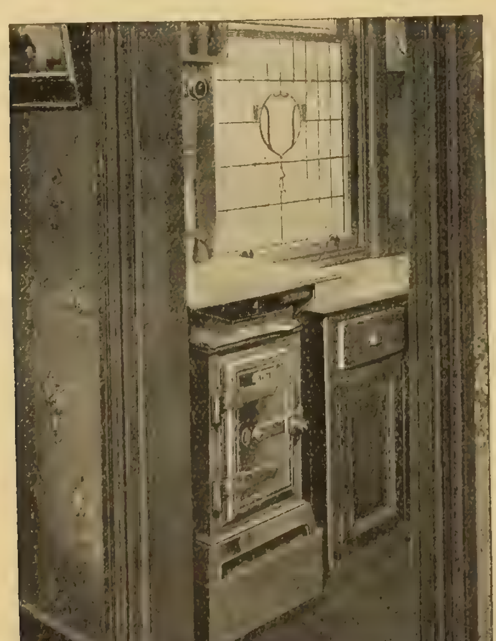


Fig. 2.—Kitchen of one of the Model Homes at "Hazlewood" Estate, Dumbreck, showing a Carron Electric Cooker.

The fires in the principal rooms, particularly the drawing rooms, were supplied by the Carron Company, and comprise several of that company's newest types.

These fires give a rich red glow of heat almost as much like the natural fire as one could wish. The standardised elements, with which they are fitted, are easily interchangeable. Guard tumbler switches and earthing terminals are also provided. This type of fire is most reliable in action, portable, and inexpensive in first cost and maintenance, and, being artistic in design, considerably adds to the decorative effect of the room.

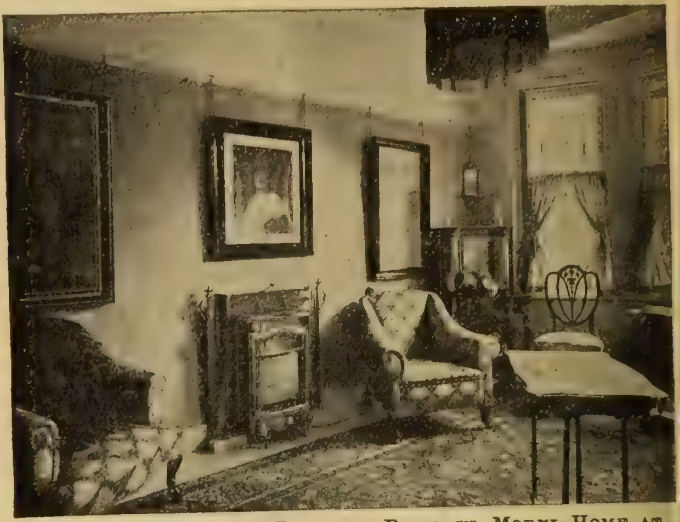


Fig. 3.—Corner of a Drawing Room in Model Home at "Hazlewood" Estate, Dumbreck, showing a Carron Electric Fire.

The cookers, which are by the same firm, embrace their popular Nos. 304 and 305 types.

The ovens in these cookers are double-cased and packed with heat-retaining material, the exteriors being of moss-green porcelain enamelled steel sheets. The interiors are mottled white and gray porcelain enamel lined, the raised parts, including the hob—which is fitted with boiling plates and grill complete—are ground and polished, and all heating elements are standardised and removable. Indicating switches, fuses and pilot lamps are supplied to each cooker, the pilot lamps indicating at a glance whether the current is on or off, thus avoiding waste of electrical energy.

Hot-water heaters are placed in the bath-rooms immediately over the taps, and, being near the delivery, loss of heat by long pipes is obviated.

As some indication of the economy and efficiency of electric cooking, it might be mentioned that a breakfast can be prepared and served in the time usually required to make up a coal fire, and according to tests taken by Mr. Hamilton during the month of June, the cost for cooking, lighting and heating for six persons worked out at 8d. per person per week.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Staff Engineers and Labour Exchanges.

With reference to your correspondent's letter on the above subject in your last issue, I would inform you of my own experience.

A few weeks ago I made an application for a post for which I thought my training and experience would be useful. I handed my letter of application, together with copies of testimonials, &c., to the clerk in charge at one of the Exchanges. My letter, &c., was returned to me with a card which I was requested to fill in. This I declined to do, and consequently my application was void.

I have heard from friends that they have been deterred from applying for posts owing to these conditions.

Surely, without in any way being guilty of snobbishness, some discrimination should be exercised at the Labour Exchanges between the inquiry for a job from a casual labourer and the application for a staff appointment from a trained and educated engineer.

I am quite certain that inquirers are being deprived of the replies from the best men, and applicants are discouraged from further attempts by the methods now in vogue.

Staff.

London, S.W., *August 20th*, 1915.

With reference to "Alcor's" letter in the Electrical Review of August 20th, I should like to inform staff engineers, and, indeed, all employés working for a salary, in distinction to "workmen" paid by the hour, that they are at liberty to seek and accept any position they like. This also applies to those working on war munitions. In this connection I would quote from a letter from the Ministry of Munitions, now before me, in reply to a communication as to whether salaried employés were entitled to a war bonus when employed on "munition" work, and also if they were at liberty to seek other employment. This letter reads as follows :—

"In reply, I am to state as regards the first point, that the matter is one to be settled with your employers, and as regards the second point, that the Munitions of War Act, 1915, imposes no restriction in this respect on employés other than workmen in regard to changing employment."

This extract makes the position of salaried employés quite clear, I think.

Salary.

London, *August 21st*, 1915.

Units from Refuse.

It would be very interesting to have the opinions of refuse destructor engineers on the point so strongly raised by Mr. Abraham, namely, the setting of the boiler directly in the combustion chamber, next to the grates themselves.

At first sight, it would undoubtedly appear to be an advantage, but I am of opinion that in actual running there would be no real gain. It seems that the great secret of efficient destruction of the refuse—and by efficient I mean freedom from noxious fumes, dust, &c.—is the provision of an adequate space in which all fumes can be thoroughly cremated, and ample room provided for the settlement of dust. To do so the fumes must, therefore, be brought into intimate contact with the red-hot surface, and by placing the boiler tubes on the top of the combustion chamber, a certain amount of red-hot surface is displaced by the cooler surface of the metal tubes. Further, the excellent steaming results we obtain are undoubtedly due to the large thermal storage system provided by the red-hot brickwork of the combustion chamber, as well as the brickwork of the boiler setting. It is well known that the great efficiency of mechanical stoking is largely due to the fact that no cold air is allowed to enter the boiler setting during the process of stoking. If the boiler tubes were set immediately over the combustion chamber of a destructor there would indisputably be much more chance of cold air getting to the tubes when clinkering a fire. In our type of destructor, even when steaming on a good load, there is no appreciable drop in the pressure when clinkering, and this is no doubt due to the equalising effect of the large heat storage in the brickwork chamber lying between the grates and the boiler setting.

I have experimented with burning cheap dust coal mixed with the refuse, and it certainly is a great help, but my experience has proved that it does not pay us, owing to the cost of carriage between the pits and our works, which, in our case, amounts to something like 12s. per ton.

I quite appreciate Mr. Abraham's remarks about the price of house coal in Wales, but what I meant to imply was that I was under the impression that the miners were able to obtain a certain amount of coal at a very cheap rate for home consumption, hence there would not be the drastic economy exercised in the houses with regard to the burning of kitchen fire cinders.

I hope these points raised by Mr. Abraham and myself will induce destructor builders to enter into the question more seriously, because, as I have already stated, under the present prices of coal, it behoves us all to exercise all our engineering ingenuity in utilising every source of heat possible. We at Horsham are burning saw-mill refuse on the coal grates of our boilers without any special re-arrangement of the fire-bars, with every success.

John B. Morgan,
Electrical Engineer.

Horsham Electricity Works,
August 23rd, 1915.

From the Dardanelles.

A few lines to thank you for your continued kindness in sending out the copies of the good old Review for the information of electrical readers in the Royal Naval Divisional Engineers—the unit which, as you will probably remember, the Institutions of Civil, Electrical and Mechanical Engineers were instrumental in recruiting in September and October last. It enables the fellows to keep in touch with the commercial and scientific world, which would be difficult, if not impossible, in any other way, so that when that long-looked-forward-to day of returning to civil life arrives, we shall not feel so awfully strange and ignorant of all that has transpired during our absence.

[The writer proceeds to give a short diary of the work of the unit from March 1st to May 6th.]

From the latter date down to the time of writing we have been in every advance, engaged chiefly on construction and improvement of fire trenches and communication trenches, roads, pumped and gravity water supplies, bomb-proof dug-outs for hospitals, wire entanglements, redoubts, and similar things, so that many members of the Institutions who joined, thinking that their technical and scientific knowledge would be used, now subscribe themselves M.Inst.M.S., which, being translated, reads :—Member of the Institution of Muck Shifters, the coat of arms of the said Institution being a pick and shovel rampant !

Ten of the fellows names have already been published in orders for special zeal and devotion to duty, and we have yet hopes of netting some D.C.M.'s or D.S.O.'s. Forbes Jackson, of the B.T.H. Co.'s railway department at Rugby, who joined the R.N.D. as seaman and transferred to the unit as sapper, subsequently becoming Sergeant, is now Lieutenant. Stuart Aynsworth, of the Great Central Railway Co.'s electrical staff, is now a Corporal. G. Spittle, of the Great Western Railway Co.'s electrical staff Railway Smith's Department), is major and O.C. signals. The writer, who joined the Old Public Schools and University Men's Team as a private, subsequently transferring to the unit as sapper, was promoted, on July 7th, from lieutenant to captain.

One or two of us feel that, although we are doing our best out here, yet, as trained mechanical and electrical engineers, we should do more useful things on the manufacture of shells, for, after all, muck-shifting takes about two months, and skilled mechanic's work years, to learn ; but I suppose this is the British way—muddle through and get there by sheer weight of £ s. d., men and munitions.

Again, with many thanks for your generosity.

M.Inst.M.S.

Royal Naval Divisional Engineers,
British Mediterranean Expeditionary Force,
c/o G.P.O., London, *August 6th*, 1915.

WAR ITEMS.

The Copper Reserves of Germany.—An official statement has been published in Germany regarding the stocks of copper existing in the country and the requirements of the military authorities. The statement is intended for domestic consumption, and very probably also for the information of other nations. Nevertheless, it deserves attention at the present time. The Teutonic commercial metal companies estimate that the stocks—which are held to include all copper that has been worked up into manufactures in past years—will meet the army needs for a long time to come, quite apart from the native production of copper, which is declared to have been largely increased since August, 1914. It is calculated that copper contained in manufactures exceeds 2,000,000 tons, or a tonnage sufficient for a war of 10 years' duration. A certain quantity of the metal is in use for domestic utensils and roofing purposes, but the greatest tonnage is to be found in industry and trade, particularly in electrical engineering. The former is readily accessible, but the latter is not in the same situation, and it has therefore been decided to collect statistics on the subject.

The collection of copper will present no obstacles in establishments which may be at a standstill, and where copper appliances seem at present to be superfluous, as the full value will be paid for the metal. In other cases, and in order to prevent disturbance in the economic life, it is proposed only to take the copper manufactures when substitutes are simultaneously provided as by the use of another metal (iron or zinc wire in place of copper, iron or steel in lieu of copper distilling appliances, &c.), or by making alterations in working as by increasing the working pressure in electrical mains, the change over from direct current to three-phase current, the linking up of different generating stations, &c. It is therefore considered that with the application of technical knowledge, combined with self-sacrifice on the part of the population and of industrial establishments, it will be possible to supply the army authorities with all the copper requisite for any period over which the war may extend.

If we turn to the international metal statistics which have been issued for many years past by a Frankfort company, it is shown that the consumption of copper in Germany amounted to 225,000 tons in round figures in 1911, 231,000 tons in 1912, and 259,000 tons in 1913, whilst the figures for 1914 are now stated to have equalled the combined consumption of Great Britain and France, which was 244,000 metric tons in 1913, and was probably higher last year. Now, if Germany has annually exported, say, 60,000 tons of copper in manufactures, and has utilised a similar tonnage in the production of munitions of war, it seems quite possible that the stocks or, rather, the internal resources of copper, in copper goods and in manufactures in which copper has been used, may amount to 2,000,000 tons. Certainly the copper cables and overhead conductors for lighting and tramway purposes, together with the plant in the numerous generating stations which have been erected during the past 20 years, must represent a considerable proportion of this tonnage. The native production of copper, which was 38,900 tons in 1912, rose to 41,100 tons last year, and is said to have been largely increased, but the latter assertion may be taken for what it is worth for the comparatively short period concerned. In addition, the Germans found large stocks of copper in Antwerp, which were appropriated.

The requisitioning of domestic copper utensils, and of industrial copper articles, brass and nickel, in Germany, appears to suggest that the resources of Belgium, and of that portion of the North of France in enemy occupation, have been exhausted, in the same manner as all machinery and plant, iron ore, and iron and steel likely to be of use to German firms in the manufacture of munitions of war, have been removed from Belgium and France to Germany. It is, however, impossible to say whether these appropriations include the copper consumed in the Belgian and Northern French electrical industries during the present century. At any rate, we think that, regarded from the standpoint of the great tonnage of copper consumed in Germany's home industries in the past 15 or 20 years, the idea that the country does not possess ample reserves of copper for a long time forward may be dismissed on the ground of having no foundation in fact, provided that the dismantling of electrical plant and installations is proceeded with, although there is no present intention of adopting a measure of this kind. At the same time there is no doubt that a considerable tonnage of copper reached the country through neutral nations until two or three months ago, and thus strengthened the resources of the enemy.

The War and Trade Movements Abroad.—We read in the *Financial Times* that the French Mission to South America arrived at Bordeaux on August 16th. The aim of the journey was the development of commercial, maritime, and financial relations between France and the Republics of South America, and to protect French interests in countries where the untiring German propaganda had gained some success. A Franco-Argentine Committee was appointed in Buenos Ayres. M. Baudin, a former Minister of Marine, gave an account of the immense resources of Argentina. In regard to the territory hitherto known as German South-West Africa, both the Standard Bank of South Africa and the National Bank of South Africa announce the opening of branches at Windhuk, the capital. The same financial contemporary also quotes the annual report of the Committee of the British Chamber of Commerce for Spain emphasising the desirability of some old-established British foreign banking concern opening an establishment in Barcelona and Madrid or Bilbao, "in order to deal with the large volume of banking business which . . . . would at once be passed through its hands." Without such a branch British business is placed at a serious disadvantage. The matter seems to be of particular importance looking to the future when we remember that the German hold on electrical business in Spain was largely due to the efforts of German electro-financial-industrial organisations. If those organisations are weakened, as they well may be, as an effect of the war, the need for British banking organisations there will be greater than they are even now.

The Royal Society's War Register.—The Royal Society is compiling a register of scientific and technical men in Great Britain and Ireland, who are willing to give their services in connection with the war. The Register is classified into subjects, and will ultimately constitute a large panel of men of standing, whose services will be available whenever any Government Department or similar authority requires specialist assistance. The Register is being co-ordinated with those independently compiled by other societies and institutions, but the Royal Society would be glad to have applications for forms from such members of the staffs of colleges and technical institutions as have not yet been registered by any society. The Royal Society is also drawing up, with the co-operation of the principal societies and institutions, a list of scientific and technical men actually on active service in His Majesty's Forces. Any names, with rank and unit, for this list will be gratefully received by the secretaries at Burlington House. The task of forming this Register has been much facilitated by the assistance of many universities, university colleges and scientific societies, whose help the Royal Society gratefully acknowledges.

Electrical Volunteers.—An interesting scheme has been initiated by the Birmingham Volunteer Electrical Engineers, by which it is hoped to assist in the Territorial recruiting movement. This corps arranged to open premises at 56, Digbeth (joining their central depôt), as a recruiting office from Saturday, 21st inst., and with the assistance of Major Walduck and his staff, will recruit men for the Territorial and Volunteer Forces. A feature of the recruiting scheme is the acceptance of men between the ages of 17 and 19 who wish to join the Army. The Volunteer Force will give such men an elementary military training and a certain amount of technical work, so that when they join the Regular Forces they may be quickly fitted for service abroad. The recruiting authorities attach some importance to this venture, as they recognise that the early training of youths just below military age under Volunteer conditions gives them a liking for military work, and makes them of more use to the authorities, who, above all things, require men who can be quickly drafted to the various fighting units.—*Birmingham Daily Mail.*

Australia and Enemy Companies.—The High Commissioner for Australia has received information that a Proclamation was issued in the Commonwealth, dated July 7th, prohibiting trading with any company, the shares of which are wholly or mainly owned by persons of enemy nationality or resident or carrying on business in an enemy country, or which has been notified by the Attorney-General in the *Commonwealth Gazette*, as managed or controlled directly or indirectly by, or under the influence of, or carried on wholly or mainly for the benefit or on behalf of persons of enemy nationality or resident or carrying on business in an enemy country. It is intimated that exemptions from the provisions of the Proclamation may be granted by licence.—*Financial Times.*

Board of Trade Inquiries.—During the week ended August 14th, the Board of Trade Commercial Intelligence Branch received inquiries for manufacturers or producers in the United Kingdom of the following :—

Electrical apparatus.—Brass shells (without insulation) required for making electric lamp caps. Pea lamps, with cord and adapters complete.

Small brass-cased pressure gauges. Mica.

Suspending the Eight Hours Act.—On 18th inst., according to the Press, the Coal Mining Organisation Committee met at the Home Office, under the chairmanship of Sir Richard Redmayne, Chief Inspector of Mines, and decided to convene a conference of representatives of the Mining Association of Great Britain and the Miners' Federation to consider the desirability of suspending the Eight Hours Act in whole or in part.

Electricity Works' Employés and War Badges.—The Stirling Corporation electrical engineer has made application to the Ministry of Munitions for war badges for the employés of the electric station.

ELECTRIC RAILWAYS AND THE LAW OF NEGLIGENCE.

[FROM OUR LEGAL CONTRIBUTOR.]

For some reason, which admits of several explanations, accidents on electrical railways—in a good hour be it spoken—are few and far between. Accidents do, of course, occur, but they are relatively few because electric railways are not very numerous; and the elements of danger are considerably reduced by the extensive use of automatic signalling apparatus. The liability of the electric railway company, however, is precisely the same as that of any other company; and in view of the fact that persons injured are not slow to bring actions it may be convenient to set down a few notes upon the legal aspect of the matter.

Leaving out of the consideration for the moment employees of the railway company, and others who have business on the permanent way, the first question is to consider whether the company can be held liable for injuries sustained by a trespasser on the rails. In finding the solution to this question a sharp distinction has to be drawn between a tramway and an electric railway.

In the case of a tramway or light railway company who suspend naked conductors over streets and roads, there is a clear obligation to protect those of the public who are making lawful use of the road. If a wire were to fall and injure a passenger or other person by electric shock, the company would be held responsible. The position of a railway company is very different. They are using their own property, and they lay the live conductors in a position to which none save their own servants have any right of access. In these circumstances, if an accident takes place, is the company under any liability?

In order to decide the question, it is necessary to consider the liability of an ordinary railway company for injuries sustained by trespassers on their line. Take the case of a person crossing the line who is knocked down by a passing train. As he is a wrongdoer himself, and is guilty of culpable negligence, the law appears to be that he cannot make any claim. Strange to say, we have not been able to find any case which expressly decides the point, but the principle can be deduced from the following considerations:—

In the first place, it is provided by Sec. 23 of the regulation of Railways Act, 1868, that: "If any person shall be or pass upon any railway, except for the purpose of crossing the same at any authorised crossing, after having received warning by the company which works such railway, or by any of their agents or servants, not to go or pass thereon, every person so offending shall forfeit any sum not exceeding 40s. for every such offence." This section clearly makes a trespass upon a railway an illegal act, if the trespasser has received warning by notice or otherwise. It is conceived, however, that the absence of notice or warning would not be a sufficient justification for any person crossing the permanent way. In a case which was tried many years ago, an action was brought to recover damages for the death of a person who was found injured upon the line. There was no evidence to show how he got there. The company were held not liable (Singleton *v.* Eastern Counties Railway Co., 7 C.B.N.S., 287). Again, even assuming that the company can be held liable where one of their servants is injured, this liability cannot be artificially extended. So in the case of Woodley *v.* Metropolitan District Railway Co. (2. Ex. D. 384), a railway company was held not liable to the plaintiff, the servant of their contractor, for injury occasioned to him by their alleged negligence in the course of his employment on their line, the plaintiff knowing the danger of the employment.

There is one other aspect of the matter under discussion which merits attention. If stray cattle are injured on a railway, can the company be held liable? The answer to this question appears to depend on whether the company have discharged their statutory obligation to fence the line. Under 8 & 9 V. c. 20, s. 68, a railway company is bound to maintain sufficient fences for separating the land taken for the use of the railway from adjoining lands not taken, and protecting the cattle of the owners and occupiers from straying thereout. Hence, if a railway runs close to a highway, the separating fence must be so maintained as to prevent cattle lawfully passing along the highway from straying on to the line.

It may be noted, however, that if cattle stray from a field on to the highway, and from thence on to a railway, and are injured, their owner cannot prefer a successful claim, as the statute only compels the company to fence against cattle lawfully on the highway (Manchester, etc., Railway Co., *v.* Wallis 14 C.B., 213).

Assuming, then, that an ordinary railway com- any is under no liability to a trespasser, it is diffi- ult to see why any greater degree of liability should e imposed upon an electric railway. Near a level rossing, of course, or at any point where a public ootpath runs across the metals, the company would ot only have to place warning notices, but they vould probably have to attach wooden guard rails o the live conductors in order to relieve themselves rom any charge of negligence. Owing to the fact hat electric railways have been only comparatively ecently introduced in this country, we have not been ble to find any English case which bears upon the oint. Certain American decisions, however, may be sefully referred to. They seem to accord with the rinciples above enunciated, and they certainly ollow the well-known rule of English law that he ho has the least chance of avoiding an accident is *rima facie* the person liable therefor.

In a case which was decided in America a few ears ago the defendants were the owners of a ower station which was situated in grounds where ere were certain naked conductors. Notices were osted on this ground to the effect that it was dan- erous for persons to enter thereon, and there was o right-of-way across it. The plaintiff was the wife a man who went to the power station one even- g and met his death through coming in contact ith a naked conductor. In an action brought by e widow to recover damages for the death of her isband, it was held that the company owed no ity to the deceased to guard the premises, and that e Judge was right in directing a verdict for the fendants.

In another case (Thomas *v.* Western Union Tele- aph Co., 100 Mass. 156), it was held that if a live gh-pressure wire sags down in a street and occa- ons injury to passers by, this is a *prima facie* idence of negligence; but the conduct of the per- n injured—such, for instance, as his voluntarily uching the wire—may have been such as to con- bute to the injury. In that case he could not cover.

As carriers of passengers those who are respon- le for electric railways are under the same liabili- s as ordinary railway companies.

Panama-Pacific Exhibition.—A Reuter dispatch from Francisco states that attendance at the Panama-Pacific Exposi- n has passed the 10,000,000 mark, according to an announcement the Exposition directors. The daily average attendance is 000, and up to this time the receipts have been more than icient to pay all expenses. This is the first American exposi- n to pay its way and show a surplus since the Columbus position in Chicago in 1893. The diversion of tourist traffic, ng to the war, is partly the cause of the success.

IMPORT TRADE OF CHILE.

The following statement, showing the imports of electrical and similar goods into Chile during the year 1913 is extracted from the recently-issued trade statistics. The figures for 1912 are added for purposes of comparison, and notes of any increases or decreases are given :—

	Pesos. 1912.	Pesos. 1913.		Pesos. Inc. or dec.
Gas and electricity meters.—				
From Great Britain ...	10,000	10,000		—
,, Germany	34,000	37,000	+	3,000
,, United States ...	3,000	2,000	−	1,000
,, Other countries ...	4,000	3,000	−	1,000
Total	51,000	52,000	+	1,000
Copper wire.—				
From Great Britain ...	30,000	201,000	+	171,000
,, Germany	159,000	26,000	−	133,000
,, United States ...	17,000	21,000	+	4,000
,, Other countries ...	24,000	24,000		—
Total	230,000	272,000	+	42,000
Lamps (other than copper or brass).—				
From Great Britain ...	14,000	16,000	+	2,000
,, Germany	95,000	74,000	−	21,000
,, United States ...	8,000	11,000	+	3,000
,, Other countries ...	4,000	5,000	+	1,000
Total	121,000	106,000	−	15,000
Telephones.—				
From Great Britain ...	18,000	15,000	−	3,000
,, Germany	130,000	121,000	−	9,000
,, United States ...	6,000	2,000	−	4,000
,, Other countries ...	3,000	3,000		—
Total	157,000	141,000	−	16,000
Telegraph apparatus.—				
From Great Britain ...	3,000	3,000		—
,, Germany	—	1,000	+	1,000
,, Other countries ...	—	1,000	+	1,000
Total	3,000	5,000	+	2,000
Materials for telegraphs and telephones.—				
From Great Britain ...	96,000	102,000	+	6,000
,, Germany	34,000	42,000	+	8,000
,, Belgium	—	5,000	+	5,000
,, United States ...	3,000	6,000	+	3,000
,, Other countries ...	1,000	2,000	+	1,000
Total	134,000	157,000	+	23,000
Cranes.—				
From Great Britain ...	139,000	662,000	+	523,000
, Germany	91,000	47,000	−	44,000
,, United States ...	30,000	30,000		—
,, Other countries ...	26,000	32,000	+	6,000
Total	386,000	771,000	+	385,000
Machinery and apparatus for electric lighting.—				
From Great Britain ...	211,000	312,000	+	101,000
,, Germany	1,031,000	1,351,000	+	320,000
,, France	4,000	17,000	+	13,000
,, Belgium	7,000	13,000	+	6,000
,, United States ...	76,000	110,000	+	34,000
,, Other countries ...	4,000	4,000		—
Total	1,333,000	1,807,000	+	474,000
Electrical machinery and apparatus.—				
From Great Britain ...	132,000	147,000	+	15,000
,, Germany	716,000	904,000	+	188,000
,, France	4,000	7,000	+	3,000
,, Belgium	47,000	17,000	−	30,000
,, United States ...	239,000	123,000	−	116,000
Total	1,138,000	1,198,000	+	60,000
Motors.—				
From Great Britain ...	2,801,000	1,353,000	−	1,448,000
,, Germany	836,000	732,000	−	104,000
,, Belgium	150,000	148,000	−	2,000
,, United States ...	224,000	395,000	+	171,000
,, Other countries ...	21,000	70,000	+	49,000
Total	4,032,000	2,698,000	−	1,334,000
Insulators.—				
From Great Britain ...	10,000	23,000	+	13,000
,, Germany	162,000	207,000	+	45,000
,, United States ...	15,000	15,000		—
,, Other countries ...	3,000	21,000	+	18,000
Total	190,000	266,000	+	76,000

[N.B.—Peso = 1s. 6d.]

THE ARBITRATION CLAUSE.

[By our Legal Contributor.]

There are probably few contractors who have never had occasion to regret the practice which has grown up of inserting the arbitration clause in construction contracts. In many cases where there is no dispute the question of arbitration is of no importance; but when trouble arises, the contractor may find that in order to obtain redress he must submit to the decision of some one with whose capacity for arriving at a just decision he may be wholly unacquainted.

Under the stress of competition, a man signs a contract containing an arbitration clause. It is only when it is too late that he finds out his mistake. "But," one can hear the layman asking, "is there no release from the arbitration clause?" The lawyer's answer is that there are certain rare cases in which the Courts will allow a party to a contract to have recourse to the ordinary tribunals of the land, notwithstanding that he has entered into a contract containing a clause under which all disputes are to be referred. In the first place, the matter is regulated by Sec. 4 of the Arbitration Act, 1889. It is there provided that—

> If any party to a submission, or any person claiming through or under him, commences any legal proceedings in any Court against any other party to the submission, or any person claiming through or under him in respect to any matter agreed to be referred, any party to such legal proceedings may at any time after appearance and before delivering any pleadings or taking any other steps in the proceedings apply to that Court to stay the proceedings, and that Court or a judge thereof if satisfied that there is no reason why the matter should not be referred in accordance with the submission, and that the applicant was at the time when the proceedings were commenced and still remains ready and willing to do all things necessary to the proper conduct of the arbitration, may make an order staying the proceedings.

This clause is generally used to obtain the stay of proceedings in an action where one party desires to insist upon his rights under the arbitration clause. For instance, suppose a contractor made a claim for extras, and the employers' contention was either that nothing was due for extras or that they had already been paid for in the final certificate, this would be a dispute under the contract which the Courts would refuse to consider. Accordingly, were the contractor to bring an action, it could and would be stayed by order of the Court. The Court, however, has a discretion. Thus if the conduct of the engineer—designated as arbitrator in the contract—were in dispute, reference to arbitration would be obviously undesirable, and would not be enforced.

To enumerate the cases in which the Court will refuse to stay an action *in the exercise of its discretion* is not our present purpose. What we desire to point out is that there are certain classes of dispute which may arise between contractor and employer which do not come within the arbitration clause at all, and which cannot therefore be referred to arbitration.

A favourable example is afforded by a recent case, Monro *v.* Bognor Urban District Council. (Reported in the *Justice of the Peace*, July 10th, 1915.) That was a case of a sewerage contract. Disputes arose during the progress of the contract as to the nature of the ground in which the works were to be carried out, which the contractor alleged was different from what he had by the specification been led to expect, and accordingly he brought an action against the Council, claiming, *inter alia*, damages for fraudulent misrepresentation. The Council thereupon sought to stay the action because of the arbitration clause. It was held that as the action was for fraudulent misrepresentation, there could not be said to be a question, dispute, or difference upon, or in relation to, or in connection with, the contract, and as such referable to arbitration within the meaning of the clause. The action had reference to matters wholly outside the powers of an arbitrator, and there was no power to stay proceedings.

This, of course, was a somewhat unusual case. Charges of fraud cannot be lightly made, and they are generally difficult to sustain. But the case will suffice to show that where the dispute is outside the contract altogether, the plaintiff is not restricted to arbitration, but can seek redress in the ordinary tribunals of the land.

BUSINESS NOTES.

Sequestration.—Archibald Baillie Gillespie, electrical engineer, 499, George Street, Aberdeen.—Estate sequestrated by the Sheriff of Aberdeen, August 16th. A meeting to elect the Trustee and Commissioners is called for August 30th. A composition may be offered at the meeting.

Catalogues and Lists.—Messrs. Dugdell's Patents, Failsworth, Manchester.—Large poster card illustrating a varied collection of patterns of their patent adjustable electric light fittings.

General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—New edition (between 60 and 70 pages) of their catalogue of electric light fittings and accessories. This is the fourteenth edition, and it brings together for the use of electrical engineers, contractors, architects, &c., illustrations, brief particulars, and prices of a large number of established types of accessories, as well as novel designs, the ground covered including cord grips, hooks, screw eyes, nozzles, ceiling plates, anti-vibrators, cord shorteners, galleries, shade carriers, tilters, ball fittings, counter-weight fittings, candle fittings, wire guards, switchplates, wood blocks, reflectors fo shop-window and showcase lighting, shop window signs, lantern fittings for workshop and open space lighting, cast-iron shi fittings, various types of hand lamps, including motor-car inspection lamps. There is a section devoted to different types of glassware, also fancy silk and glass shades, some new types being shown In the chain section a new pattern rectangular link chain, thre patterns of Cash's ornamental patent chain, and several new type of "S" hooks appear.

Messrs. Ozonair, Ltd., 96, Victoria Street, London, S.W.—16-page pamphlet containing very full matter relating to th Ozonair system of food preservation and the application of th apparatus to domestic and general, also to commercial and industrial service. A number of types are illustrated and priced, and collection of testimonials is given.

British Thomson-Houston Co., Ltd., Rugby.—Descriptiv list, No. 2,142a (24 pages) containing very full illustrated information, together with dimensional diagrams and particulars, concerning their two and three-phase induction motors.

Bankruptcy Proceedings. — Vernon George Cobb electrical engineer, trading with William Longdon as Longdon an Cobb, at 101a, Derby Road, Nottingham.—An application wa made at the County Court House, St. Peter's Gate, Nottingham, o August 19th, for the discharge from bankruptcy of the abov named debtor, Vernon George Cobb. It was stated that a first an final dividend of 1s. 4¾d. in the £ was paid, on proofs of the partnership, amounting to £243. The firm had practically been presse by creditors ever since the commencement, and the books had neve been balanced. The discharge was granted, subject to a suspensio of two and a half years.

Arthur F. Hawdon, electrical engineer, Yetholm, Elmfield Garden Gosforth, Northumberland.—Receiving order made August 16th on creditor's petition; first meeting, September 1st, at the office o the Official Receiver, Newcastle-on-Tyne. Public examinatio October 7th, at the County Court, Newcastle-on-Tyne.

W. H. Pease, electrical engineer, of Scarborough and Doncaste Trustee (Mr. J. C. Clegg, 14, Figtree Lane, Sheffield, Offici Receiver), released June 24th.

Dissolutions and Liquidations. — The Phœni Electric Heating Co. (1914), Ltd.—This company is windin up voluntarily with Mr. A. E. Tilley, of 8, Staple Inn, Holbor E.C., as liquidator. A meeting of creditors is called for September 1st.

North-Western Cables Co., Longford Road, Stretford.—Messrs. John Drennan, Jas. K. Cooper, and A. E. Garbutt, carryi on business under the above style, have dissolved partnershi Debts will be attended to by Messrs. Drennan & Cooper.

Turbine Development Co., Ltd.—A meeting is called f September 22nd, at Finsbury House, Blomfield Street, Londo E.C., to hear an account of the winding up from the liquidato Mr. G. D. Price.

Leskole Co., Ltd.—A meeting is called for September 27t at 31, Great James Street, Bedford Row, W.C., to hear an accou of the winding up from the liquidator, Mr. A. H. Crowe.

Book Notices.—"Electricity for the Farm." By F. Anderson. London: McMillan & Co. Price 5s. 6d. net.

"Specification and Design of Dynamo-Electric Machinery." Miles Walker. London: Longmans & Co. Price 32s. net.

City and Guilds of London Institute. Department of Techn logy, South Kensington, S.W. Programme for the session 1915-London: John Murray. Price 9d. net.

"The Rare Earth Industry." By Sydney J. Johnstone. Londo Crosby Lockwood & Son. Price 7s. 6d. net.

"*Bulletin* de la Société Internationale des Electriciens." Vol. No 44. July, 1915. Paris: Gauthier-Villars. Prix 3 fr.

Proceedings of the Incorporated Municipal Electrical Asso tion, 1915. London: Wyman & Sons, Ltd. 5s.

Trade Announcement. — The Automobile A Electrical Equipment Co., of 2, Kingly Street, Regent Stre W., have transferred their office and showrooms to Grafton Hou Golden Square, Regent Street, W., with works and garage situa in Bridle Lane, Golden Square, W. The telephone num remains: "Gerrard 1701." The change is consequent u increased business.

E.C.C. Horticultural Show. — The second annual Exhibition in connection with the E.C.C. Works' Institute Horticultural Society was held on Saturday, and was open to all servants of the Electric Construction Co., Ltd., Bushbury, near Wolverhampton. The Exhibition was held in the messroom of the works, and in accordance with war times, it was confined, so far as regards prizes, to a vegetable display. In this the society was successful, for the exhibits were a credit to the employés. Mr. W. M. Furniss, president of the society, delivered a brief address. Mr. James Gray, the managing director of the company, took the opportunity of expressing the thanks of the directors for the way in which the employés of the E.C.C. had responded to the recent demands made upon them. Many of the workmen had been subjected to taunts and sneers for remaining at home, but by doing so they had been doing their bit for their country just the same as the heroes in the trenches. A programme of sports was decided on the recreation ground during the afternoon.

LIGHTING and POWER NOTES.

Australia.—For the year ended December 31st last, the returns of the Newcastle (N.S.W.) municipal electricity works show that 1,598,663 units were sold, the consumers numbering 880, and the H.P. of motors connected, 2,270. The plant capacity of the works was 962 K.V.A., an increase of 300 K.V.A. during the year, and a further 625 K.V.A. is being added; some 115 miles of mains were in use, and seven sub-stations, with a transformer capacity of 1,030 KW.

The Melbourne (Victoria) City Council has reduced the rent of consumers' meters from 1s to 6d. per month.

The Kyneton (Victoria) Shire Council has adopted plans for the installation of electric light, instead of gas, and a loan of £10,000 is to be obtained from the Commonwealth Bank.

At Balaklava (South Australia), a meeting of ratepayers has approved of the installation of electric light, and the Council has been instructed to carry out the work.

The Coolangatta (Queensland) Municipal Council has obtained an Order in Council to supply electricity under the Electric Light and Powers Act of Queensland.—*Tenders.*

Perth (W.A.).—The report of the Council's electrical engineer for the six months ended April 30th, shows that the units sold were 1,790,658, an increase of 3½ per cent. over the corresponding period of last year; the total number of consumers connected was 6,769.—*Commonwealth Engineer.*

Bath.—Price Increase.—The T.C. has increased the price of current by 10 per cent. after the taking of the meter readings for the Michaelmas quarter.

Belfast. — Fire in Power Station. — On Saturday morning a rather serious fire took place in the power station; on the arrival of the fire brigade it was found that the roof over the boilers and coal bunkers was well alight. After an hour's hard work the fire was got under control. Fortunately the electrical machinery escaped injury, and the electrical supply was in no way affected.

Belturbet.—E.L. Contract.—At a meeting of the Council, called to consider the electric lighting contract for a period of three years, it was decided to postpone the question of a new contract, and to continue the present arrangement for a period of six months.

Bridlington.—Restricted Lighting.—The T.C. has received a letter from the military authorities to the effect that the lighting of Bridlington was still too bright, and threatening to cut off the electric and gas light at the mains before dusk if there was not forthwith a reduction effected. Further measures, therefore, are now being taken to reduce public and private lighting.

Canada.—The surveys of the Dominion Water Power Branch of the water powers of the Winnipeg River in the Province of Manitoba, and of the storage possibilities in the upper waters of this river in the Province of Ontario, show that it is economically feasible to develop, at eight power sites, over 409,700 continuous 24-hour W.H.P., all within 80 miles of the City of Winnipeg, and within feasible transmission distance of all the commercial centres of the present settled portions of the Province of Manitoba. Of these eight power sites, there are three now under development, representing a total power capacity of 199,024 H.P. One site is completely developed by the Winnipeg Electric Railway Co., producing 28,000 H.P. The municipal plant of the City of Winnipeg at Point du Bois Falls has at the present time an installation capable of producing about 47,600 H.P. This plant is capable of extension to a maximum of nearly 80,000 24-hour H.P. Development at the third power site, at Great Falls, with a maximum possibility of 99,500 24-hour H.P., is now under way though temporarily delayed. At the two completed power developments there is therefore about 75,000 H.P. produced at the present time, and which can be increased to 108,000 24-hour H.P. The six remaining sites on the Winnipeg River are under the absolute control of the Dominion Government, and can furnish a further amount of 24-hour power to the maximum extent of 210,700 H.P. In addition there are several important power sites on the Winnipeg and English rivers, within the Province of Ontario, within easy transmission distance of the City of Winnipeg. Considering all the water power sites on these two rivers in the Provinces of Manitoba and Ontario, there is within transmission radius of the City of Winnipeg, a grand total of 570,000 24-hour H.P.—*Canadian Electrical News.*

The Canadian Light and Power Co., a hydroelectric undertaking owned by the Montreal Tramways and Power Co., is making arrangements to supply power to the Tramways Co., and will ultimately be able to develop 75,000 H.P. at its plant at St. Timothee, 28 miles from Montreal. This power is supplied to the company's sub-station on the outskirts of Montreal over a duplicate three-wire steel-tower transmission line. The company has the perpetual right to distribute and sell energy in Montreal and several adjacent counties. In 1913 the entire distribution system in Montreal City was taken over by the Montreal Public Service Corporation.

Electric Cooking.—In Winnipeg the city authorities give a rate of 1 cent per KW.-hour, less 10 per cent. discount, with a minimum charge of 75 cents per KW. installed, for cooking and heating purposes, and it is believed that there are some 3,000 cooking apparatus installed, including complete range equipments in eight apartment blocks. Fort William has from four to five hundred ranges in use, with one apartment block completely equipped. Saskatoon has 200 ranges, with four apartment blocks equipped. Edmonton has 100 ranges, with one apartment block and one electric baker's oven for 60 loaves; while Calgary and Selkirk each have 50 ranges. There are, of course, numerous other completely equipped public institutions in Western Canada, and quite recently a large capacity baking oven was placed in service in a western University.

Cork.—Price Increase. — The Corporation Public Works Committee has been informed by the Cork Electric Tramway and Lighting Co. that it is proposed to increase the rates for electricity by 10 per cent., as from July 1st. The matter was referred to the city solicitor for report.

Croydon.—The B. of T. has issued an order enabling the County of London Electric Supply Co. to supply current in bulk to the South Metropolitan Electric Tramways and Lighting Co., Ltd., whose order affects the R.D.C.

Denby.—E.L. Proposal.—The U.D.C. has decided to invite a representative of the Yorkshire Electric Power Co. to meet it with reference to the application of the company to supply energy for lighting and other purposes in the district.

Erith.—Price Increase.—The U.D.C. has advanced the price of current from, and after, October 1st by ½d. per unit for lighting, and by 10 per cent. for power.

King's Lynn.—Year's Working.—During the last financial year 615,803 units were sold by the electricity undertaking, a decrease as compared with the 669,874 units of the previous year. The consumers increased to 1,007, and 766-H.P. of motors were supplied. The total income was £9,000, and the gross profit £4,227, the net balance being £1,350, after meeting capital charges, &c. A balance of £3,908 brought forward was transferred to capital account (extinction of debt account). The total generating plant capacity was 920 KW.; maximum load, 515 KW.; and load factor, 14·5 per cent., as against nearly 17 per cent. in the preceding year.

Lerwick.—E.L. Proposals.—The question of electric lighting for the burgh has again been revived. Full consideration will be given the matter at the next meeting of the Town Council.

Reigate.—Street Lighting.—The Highways and Works Committee has recommended that 15 lamps on the Redhill Gas Co.'s mains and eight lamps on the Reigate Gas Co.'s mains be converted from gas to electricity, the Electric Lighting Committee to carry out the extension on the usual terms before March 31st next. The Council, however, decided that the work should be deferred until the months of February and March next.

South Africa.—In the tenth annual report of the Rand Water Board, Mr. W. Ingram, the chief engineer, gives some interesting comparative data relating to the pumping plant in use by the Board. Thus the Zwartkopjes reciprocating steam sets (380 H.P.) cost £26·7 per pump H.P., as compared with £14·18 per pump H.P. for the turbo-driven centrifugal set (189 H.P.) at the Villiage Main Reef pumping station. The steam consumption is less in the former case, but allowing for size, saving in cost of buildings, plant, &c., Mr. Ingram considers that the latter type of plant will probably supersede the former for surface pumping. Another comparison can be made at Springs where electrical pumps are in use, and electrically-driven three-throw horizontal reciprocating pumps cost £14·23 per pump H.P. (95 H.P.), while an electrically-driven centrifugal pump of the same size cost £3·62 per pump H.P. The space required by the latter was 735 sq. ft., as against 1,890 sq. ft., but the combined efficiency is lower, 69 as against 76 per cent. A summary shows that prime movers (pumping plant) represented 3,938 pump H.P.; prime movers (generators, &c.), 3,490 electrical H.P.; and H.P. driven electrically from the Board's generating plant, 2,814. The total number of stops due to electrical disturbances for the year to March 31st last was 46, and the time involved totalled 148 hours; these figures compare with 34 stops and 64 hours in the previous year. Damage was done to electrical machinery on 20 occasions, repairs costing £84. The report contains a variety of information regarding water supply on the Rand.

Stretford.—The Trafford Power and Light Supply (1902), Ltd., has had plans passed by the D.C. for a sub-station in Elevator Road, and for H.T. mains in Trafford Park Road.

U.S.A.—ELECTRIFIED FARMING.—Already 125 farmers in Lancaster County, Pa., are taking electric service from the lines of the central station companies which cross the county, and of this number 30 have installed motors. So many inquiries have been received from farm owners in the section that one of the Lancaster electric companies is considering the installation of a special department to look after farm business.—*Elec. World.*

TRAMWAY and RAILWAY NOTES.

Belfast.—The Corporation has rejected the recommendations of the Tramway and Electricity Committee to increase the fares, except on the Glengormley route, and an amendment was carried instructing the Committee to investigate the working expenses, and revise these so as to meet whatever portion of the deficit will not be met by the proposed alteration of fares.

The city accountant's estimate of revenue for the coming year of the tramway undertaking was :—Revenue, £270,000 ; expenditure, £275,400 ; deficit, £5,400. Mr. Nance (the general manager) estimated the revenue at £283,000.

Bingley.—The Electricity and Tramways Committee has appointed a deputation to interview the Bradford Corporation tramways department with reference to the price of current supplied for tramway purposes.

Blackpool.—The receipts on the Blackpool and Fleetwood electric cars, up to date for the current year, amount to £22,450 against £25,974 12 months ago. Curiously, the weekly returns show the receipts to be £2,342 against £1,711 last year.

Continental Notes.—SPAIN.—Electric lighting has just been adopted on the trains running on the lines of the Compania del Ferrocarril Cantanabrico.

BELGIUM.—According to the *Engineer*, in Belgium the Germans are running storage battery cars on the short lengths of railway which lead up to the trenches behind their lines. They are being run singly to remove the wounded and bring up supplies.

Glasgow.—TRAMWAY BREAKDOWN.—Owing to the breakdown of one of the turbines in the Pinkston power station on Wednesday, last week, a complete stoppage of the car traffic all over the T.C. system was brought about. The spare machinery at the station was at once brought into requisition, but only progress in sections was secured, until after the lapse of about a couple of hours when the service returned to normal.

Huddersfield.—PROPOSED EXTENSIONS.—The Tramway Committee has decided to postpone until next year the promotion of the Parliamentary Bill providing for extensions to Brighouse, subject to this course being agreeable to the Brighouse Corporation. In regard to a proposed extension to Meltham, that Council is to endeavour to arrange terms with the South Crosland Council. The tramway employés recently raised a number of points in regard to increased wages, the employment of women conductors, &c., but eventually withdrew all their points and simply asked for a war bonus. The Tramways Committee has decided to pay a war bonus of 1s. per week to tramway employés receiving over 30s. per week wages, to take effect as from March 17th last, but not to apply to the clerical staff and females.

L. & S.W. Railway Electrification.—It is now announced that the first section of this company's line to be opened for electric working will be that between Waterloo and Wimbledon, via East Putney.

Portsmouth.—YEAR'S WORKING.—For the year ended March 31st last, the total revenue of the tramways undertaking was £123,991 (12·2d. per c.m.) as against £116,990 in the previous year ; the net balance after meeting interest and sinking fund charges, &c., was £24,075, as compared with £19,042 in 1913-4. The balance, together with £10,703 brought forward, was appropriated for various purposes, including £10,000 for rate aid (as against £5,000 in 1913-4), £7,186 to renewals and £3,000 to reserve ; £3,302 was devoted to purchasing property and £3,000 reserved for a road improvement, and, finally, a balance of £6,568 was carried forward. The number of passengers carried was 27,554,194, an increase of 1,287,852. Apparently the war only had a temporarily depressing effect on the undertaking during the year under review.

Salford.—FEMALE LABOUR.—The number of women tramway conductors employed has been increased from 16 to 55, and according to a statement the experiment of employing women on the cars has succeeded beyond expectations.

Wigan.—WAR WAGES.—The Committee on Production, which has been dealing with the application of the tramway workers for an advance of wages, issued its award on the 18th inst. The men originally asked for an advance of ½d. per hour on the existing rate of pay for motormen, conductors and depôt employés, and for an advance of 1d. per hour for the electricians in the tram depôts. In April last the Corporation decided to pay a war bonus to employés, and approximately 95 per cent. of the men benefited. Later the men made their further demand, and struck work on August 2nd. The Committee on Production states that, having regard to the present scale of pay, and the war bonus which has been granted, the wages of conductors should be advanced in accordance with the offer of the Corporation, ¼d. per hour, as from the first full pay week following the date of this decision, the wages of the other grades to remain unaltered.

Wolverhampton.—FEMALE LABOUR.—As 75, out of a staff of 220 of the Corporation tramways, have enlisted, and owing to the difficulty of obtaining men, the Tramways Committee is considering the question of employing women as conductors, and in other capacities.

TELEGRAPH and TELEPHONE NOTES.

Canada.—The financial statement of the Dominion Telegraph Co. for the year ended June 15th shows a balance to the credit of profit and loss account of $291,961.88.

Mexico.—Large forces of linemen are at work on the telegraph lines in Mexico to restore communication to Mexico City. Thousands of messages have accumulated. The first cable message reached Mexico City on July 12th, and the first through train from Vera Cruz arrived at the capital the same day.—*T. and T. Age.*

New Cable.—The Telegraph Construction and Maintenance Co.'s cable steamer *Colonia*, on July 23rd, successfully completed the laying of a second cable between New York and Colon, *viâ* Guantanamo, Cuba, for the Mexican Telegraph Co. and the Central and South American Telegraph Co. This duplicates the cable laid by the same company in 1907 and completes the duplication of the whole "*viâ* Colon" system from New York to Buenos Ayres, Argentina.

The first adjustment of the duplex balance on this new cable indicates that when the balance is perfectly adjusted a speed of fully 200 letters per minute will be obtained.—*Telegraph and Telephone Age.*

New York Telephone Directory.—The new edition of the New York telephone directory consists of 1,750,000 copies. It contains 345,000 names and has a circulation of 865,000 copies in New York City and vicinity. There are 193,000 names in the general suburban directory, which has a circulation of 617,000. The combined distribution in metropolitan territory will reach 1,750,500.—*Telegraph and Telephone Age.*

Secret Wireless.—It is reported from Rome that the police have arrested several persons who had a wireless telegraph installation concealed in the suburbs of the capital. The accused, who belong to the Engineering Corps, will be tried by court-martial.

Suit Against American Marconi Co.—Mr. Nikola Tesla has brought a suit against the Marconi Wireless Telegraph Co. of America for the annulment of the principal Marconi patents, also a suit for infringement of his patents. Mr. Tesla bases his action on the allegation that his two patents were granted in 1900, and that the Marconi patent was not granted until 1904. The Marconi Co. denies that the Marconi patent covers the invention or combination of apparatus described by the Tesla patents.—*T. and T. Age.*

United States.—It is reported from Washington, U.S.A., that a certain rich German-American, who is the possessor of a powerful wireless apparatus, has picked up messages which were intended for the Navy station at Arlington, and transmitted them immediately to Count von Bernstorff.

Wireless News.—The *Wireless Press* announces that it has made arrangements for the regular reception of the Italian Official Communiqués by wireless telegraphy direct from Italy, in the original language. These will be translated, censored and passed to the Press in the regular way. The advantages derived from reception in Italian are obvious.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—ADELAIDE.—September 1st. Condensers, testing sets, rheostats, Morse sounders, and Wheatstone transmitters, for the P.M.G. See "Official Notices" July 23rd.

October 6th. Portable direct-coupled internal combustion engine and dynamo ; extension to storage batteries at Central Exchange, for Deputy P.M.G.*

BRISBANE.—October 6th. Tinned-copper wire, porcelain pothead insulators, for the P.M.G. See "Official Notices" August 20th.

PERTH.—September 29th. Telephone switchboard parts, for the P.M.G. See "Official Notices" July 30th.

SYDNEY.—September 13th. Council. A.C. and D.C. electric motors. Specification (10s. 6d.) from E.L. Department, Town Hall.*

September 6th. Metropolitan Board of Water Supply and Sewerage. Centrifugal pumps and electric motors at Richmond pumping station.* Acting Secretary, 341, Pitt Street, Sydney.

September 23rd. Condensers, galvanometers, relays, and sounders, also incandescent electric lamps, for the P.M.G.'s Dept. See "Official Notices" August 13th.

October 25th. Six electrically-operated wharf capstans, for the Sydney Harbour Trust. Forms of tender from the Engineer-in-Chief, Harbour Trust Offices, Circular Quay.*

October 25th. For the Commonwealth Department of Defence (Navy Office). Supply, delivery and erection of power-station plant and equipment for the Commonwealth Naval Dockyard, Sydney.*

Melbourne.—September 8th. Transformers and relays for point indication for automatic signalling (Contract No. 28,918), and electric point and lock detectors (Contract No. 28,951), for a period of five years, for the Victorian Railway Commissioners.

September 29th. Fuse blocks (complete and spare porcelain bases and fuse clips), for the Victorian Railway Commissioners. Particulars at the Contractors' Room, Spencer Street.

September 7th. Supply and delivery of telephone parts (Schedule No. 1,243), for the Deputy P.M.G.

September 14th. Supply and delivery of telephone switchboard parts (Schedule No. 1,220), for the Deputy P.M.G. Specifications from the office of the Deputy Postmaster-General, Melbourne.*

Hawthorn.—November 30th. Refuse destructor plant, for the Hawthorn-Malvern-Camberwell and Kew Destructor Trust. Specification from the Trust Engineer's Office, Town Hall.

France.—Paris.—September 10th. The Administration de Chemins de Fer de l'Etat invites tenders for the supply of three-phase static transformers for the railway station, workshops and depôt at Mans. Particulars of the Bureaux du Service Electrique (2e Division), 43, Rue de Rome, Paris.

Kirkcaldy.—September 6th. Installation of electric light at the new Sanatorium and Fever Hospital buildings. Specifications, &c., from the Burgh Electrical Engineer.

New Zealand.—September 1st. Public Service Stores Tender Board. Supply and delivery of (1) 92 miles of air-spaced, paper-insulated, lead-covered telephone cable, and (2) 100 miles of insulated and braided wire. Controller of Stores, Post and Telegraph Department, Wellington.*

Dunedin.—November 3rd. City Council. Supply and delivery of insulated and bare copper wire in quantities for a period of two years. Specifications at Electrical Engineer's office, Market Street, Dunedin.—*New Zealand Shipping and Commerce.*

Portsmouth.—August 31st. Corporation. Six months' supply of stores, for the Tramway Committee. See "Official Notices" August 20th.

Shanghai.—September 24th. Municipal Council. One turbo-generator, 5,000 KW., and one or two of 10,000 KW., complete with condensing plant, &c. See "Official Notices" August 20th.

September 29th. E.H.T. switchgear, static transformers, and underground cables for 22,000 v., for the Municipal Council. See "Official Notices" to-day.

South Africa.—Johannesburg.—September 25th. For the T.C. Two turbo-alternator sets, condensing plant, switchgear, &c. Specification, &c., on deposit of £2 2s., from Mr. J. H. Dobson, General Manager.*

September 25th. Municipal Council. 1,595 electricity meters and 50 time switches.*

October 9th. Municipal Council. Water-purifying plant with a capacity of 75,000 gallons per 24 hours, for the generating station.*

Spain.—September 1st. The municipal authorities of Balza (Province of Jaen) are asking for tenders for the concession for the electric lighting of the town during a period of five years.

Tenders have just been invited by the municipal authorities of Cullera (Province of Valencia) for the concession for the electric lighting of the town.

The Spanish Government has just invited tenders for the establishment of electricity-generating plant in the State Arsenals at Carthagena and La Carraca. It has been decided that offers from Spanish concerns will be considered.

Taunton.—August 31st. Coal for the Corporation electricity works for three, six, or twelve months (approximately 900, 1,500, and 2,700 tons respectively), preferably washed beans or peas suitable for use on a chain-grate stoker. Mr. A. J. Howard, Electrical Engineer, St. James's Street.

West Ham.—September 2nd. Three months' supply of electrical fittings, for the B. of G. of the West Ham Union. Forms of tender from the Clerk, Union Road, Leytonstone, N.E.

York.—September 6th. Supply of coal (approx. 15,000 tons) to the Electricity Department for 12 months ending September 30th, 1916. Prices may be sent for unscreened beans, pea slack, rough slack, or small peas quality, and must include free delivery. Mr. J. W. Hame, Engineer and Manager, Clifford Street.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The following tenders have been placed :—

Victorian Railways.

Overhead equipment for St. Kilda-Brighton electric street railway, at rates.—B.I. & Helsby Cables.

Steel tramway rails, at rates.—R. W. Cameron & Co.

Lead-covered, impregnated, paper-insulated, twin wire cable, at £62 per mile of 1,760 lineal yards, at rates.—Western Electric Co (Aust.), Ltd.

Switchgear and accessories, at rates.—Siemens Bros. Dynamo Works, Ltd.

Motors and spare parts for same, for electrical equipment of the Ballarat and Bendigo workshops.—Crompton & Co., Ltd.

Static transformers, 50 KW., complete, for Arden Street and Spencer Street shops, at £68 10s. each ; incandescent electric lamps for 12 months.—Aust. General Electric Co.

Sulphate of copper. S. R. O. Allen.

25 tons of H.D. copper wire, at £98 15s. 10d. per ton.—Elder, Smith and Co., Ltd.

Municipal Council of Sydney.

Two 5,000-volt feeder panels, two 5,000-volt transformer panels, two 415-volt transformer panels, and two 415-volt distributor panels, £844.—Aust. General Electric Co.

Two 10,000-volt feeder panels, and two 70,000-volt transformer panels, £652.—Noyes Bros.

Steel towers for 88,000-volt transmission line, £9,300.—Poole & Steel.

P.M.G.'s Department, Victoria.

Two miles of paper-insulated, lead-covered cable, 13 pairs, £68 per mile ; two miles ditto, 26 pairs, £110 per mile.—Lawrence & Hanson Electrical Co.

P.M.G.'s Department, South Australia.

Power board and apparatus, £478.—Newton, McLaren, Ltd.

1,100 yards of paper-insulated conductor cable, 416 pairs, £1,297.—Western Electric Co. (Aust.), Ltd.

P.M.G.'s Department, Tasmania.

1,259 yards of paper-insulated cable, 312 pairs, £1,080.—Siemens Bros. Dynamo Works, Ltd.

—*Aust. Mining Standard.*

Commonwealth Defence Department.

Marconi-Telefunken type A 2 ship wireless telegraphy station, £585 ; Marconi 1½-KW. wireless telegraphy station, complete, £1,225.—Amalgamated Wireless (Aust.), Ltd.

Melbourne City Council.

Electrical stores for 12 months.—W. T. Henley's Telegraph Works Co., Ltd. ; Diamond Engineering & Trading Co. Pty., Ltd. ; Edison & Swan U.E.L. Co., Ltd. ; A. L. Campbell & Co. ; B.I. & Helsby Cables, Ltd. ; Warburton, Franki, Ltd. ; Lawrence & Hanson Electrical Co., Ltd. ; British General Electric Co., Ltd. ; Aust. General Electric Co.

Extension of pumping chamber at the supply station, £2,973.—W. Cerutty.

—*Tenders.*

Blackpool.—The General Purposes Committee has accepted the tender of Messrs. Jones Bros. for the electric lighting at the Convalescent Home, Clifton Park Racecourse, Squire's Gate.

France.—The results of the Paris adjudication of July 28th were :—For supply and erection of electric transmission equipment at the St. Lazare station, Société Anonyme de Force et Lumière Electrique, 45,900 fr. ; ditto at the Asnières sub-station, MM. Bergerot et Fils, 11,800 fr. August 4th.—Supply of 10-ton lorries, M. Otis Pifre, 4,300 fr. ; supply of three travelling bridges, Gaillard-Kessler, Argenteuil, 75,010 fr. ; supply and erection of bare copper bars joining the accumulators at the central station at Saintes to the switchboards of the battery groups, Compagnie Générale de Travaux d'Eclairage et de Force, 8,600 fr.

Glasgow.—The T.C. Electricity Committee has accepted the offer of the General Electric Co., Ltd., at £50, for the frontal sign in connection with the equipping and furnishing of the departmental showrooms at Sauchiehall Street. The following offers have been accepted by the Tramways Committee :—

Storage battery for Kinning Park sub-station.—Chloride Electrical Storage Co., Ltd.

Motor-generator and switchboard.—Mavor & Coulson, Ltd.

Vulcanised rubber cables.—Pirelli-General Cable Works, Ltd.

Holywell.—The B. of G. has accepted the tender of Messrs. Summerscales, Ltd., of Keighley, for electric plant for the laundry, at £300.

London.—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for the supply of Wotan lamps to the Great Central Railway has been accepted.

Messrs. Napier-Kimber, Ltd., have secured the contract for electric lighting at H.M. Stationery Office, Loman Street, E., for H.M. Office of Works.

New Zealand.—The Public Service Stores Tender Board, Wellington, has received the following tenders for 120 miles twin-twisted rubber-insulated wire :—

P. R. Baillie & Co.	(accepted)	£1,931
Lawrence & Hanson Electrical Co.		1,976
Richardson, McCabe & Co.		2,124
Gollen & Co. Prop., Ltd.		2,479
A. & T. Burt, Ltd.		2,547
Turnbull & Jones, Ltd.		2,610
Samuel Brown, Ltd.		3,928

The Wellington City Council has accepted the under-mentioned tenders :—

Switchpanels and instruments.—British General Electric Co.

Meters —P. R. Baillie & Co.

—*New Zealand Shipping and Commerce.*

Stirling.—The following offers have been accepted in connection with the new municipal buildings :—

Electric lighting.—Lockhart & Macnab.

Telephones and bells.—W. & T. Marshall.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, September 4th. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "Ball and Roller Bearings," by Mr. A. H. Hindle.

REVIEWS.

The Electrical Conductivity and Ionisation Constants of Organic Compounds. By H. Scudden. London: Constable and Co. Price 12s. 6d. net.

This is a reference book of data for electro-chemists, and its aim is to supply them with a bibliography of all the measurements in the field designated by the title, between the years 1889 and 1910. Beginning with the latter date, full data of the entire periodical literature are published in the "Tables Annuelles Internationales de Constantes et Données Numériques," while previous to the former date, little work of value at the present time had been published.

The book, therefore, fills a gap, and so supplies a definite want. It may not at present appeal to a very large circle of workers, for, outside the limited number of purely scientific investigators, its chief use will be to the chemists who are working out in detail problems pertaining to the application of the results of electrochemical research to the furtherance of existing chemical industries, and the founding of new ones.

Hitherto this field has been scarcely more than nibbled at in this country, so that while the author's work was being done and the work was going through the press, the prospects of reward for his monumental industry and for the courageous enterprise of his publishers, must have appeared remote indeed. The more honour, therefore, to both parties for providing us with so practical and effective a refutation of the German taunt that we are unable to produce such work for ourselves and are compelled to call upon the aid of our foes.

If, as we may perhaps venture to hope, with only too little encouragement, one of the results of the present European cataclysm should be to arouse the British chemical industry from its deadly lethargy, these rewards may materialise sooner and to a far greater extent than either author or publisher would have been warranted in anticipating. Some idea of the magnitude of the author's task may be found from his statement in the preface that seventy-eight of the journals and about five thousand dissertations have been examined page by page, besides the less important ones examined only by index and table of contents.

The book is divided into a set of tables arranged according to the names of the compounds, containing all the data that may be given, with a bibliography of all the references to each compound; a formula index to the compounds; a bibliography arranged according to the names of authors; a subject index to certain subjects; and a journal list giving the names of all journals examined, with the number and date of the last volume examined.—G. W. de Tunzelmann.

Electrical Instruments in Theory and Practice. By Murdoch and Oschwald. London: Whittaker & Co. Price 10s. 6d. net.

This book concerns itself chiefly with the theory of electrical instruments. A list of chapter headings will indicate the scope of this volume, which is to be followed by a volume dealing with oscillographs and various other A.C. instruments. There are ten chapters. The first is an historical summary; the second is devoted to electromagnetic damping, and deals with the equation $d^2\theta/dt^2 + a \,.\, d\,\theta/dt + b \,.\, \theta = 0$ in the general and in the more important particular cases. Chapters III to VII deal with moving coil, electrostatic, hot wire and dynamometer instruments; Chapter VIII treats of supply meters; Chapter IX of magnetic testing instruments; and the final chapter gives a brief account of P.O. box and potentiometer methods of measurement.

After the first chapter the treatment is naturally mathematical, but, by taking typical results of practical instrument tests, instructive comparisons are made between theory and practice. In the section on damping, for instance, the theory is compared with the results of experiments on an ordinary Kelvin galvanometer and a Grassot fluxmeter. The section on moving-coil instruments contains a very complete account of the theory and practice of such important instruments as the Megger, Ducter and vibration galvanometer, together with useful notes on the sensitiveness and design of moving-coil ammeters and voltmeters. Considerable attention is given to iron-cored instruments, and particularly to the use of such for A.C. measurement as proposed by Dr. Sumpner.

Supply meters are dealt with very thoroughly in a chapter which occupies more than a quarter of the book. Some paragraphs are devoted to the discussion of meter brake-disks, a subject about which very little has been written. The authors have apparently made an important series of experiments on the action of eddy currents in brake-disks, and the results as given here should be useful to designers of motor meters.

Chapter IX provides in less than 40 pages a neat summary of all the standard magnetic tests. All the time-honoured instruments and methods are given together with the more recent work of Ewing, Drysdale, Campbell, Murdoch, Wild and Kapp.

In this book Messrs. Murdoch and Oschwald have collected together much valuable information for which we have hitherto had to rely on the scanty treatment in electrical text-books or the scattered papers and journals of the various learned societies—a service for which advanced students, designers and engineers ought to be devoutly thankful.—P.H.S.K.

NOTES.

Educational.—Northampton Polytechnic Institute.—The last day for receipt of applications from candidates for the Aitchison Memorial Scholarship who desire to be examined at a Local Centre is September 1st, and for those who wish examination in London, September 15th. Application should be made to the Hon. Secretary of the Trustees, Mr. Henry F. Purser, 35, Charles Street, Hatton Garden, E.C.

South-Western Polytechnic, Manresa Road, Chelsea.—This Polytechnic will reopen on September 27th for day and evening classes. The Engineering Courses include lectures in Electrical and Mechanical Engineering, Physics, Chemistry and Mathematics, and practical instruction in the fully-equipped laboratories of the Institute. Students are prepared by recognised teachers of the University of London for the B.Sc. Degree in Engineering of the University, for the examinations for admission to the various Engineering societies and the examinations of the City and Guilds of London Institute. The evening courses include besides the Engineering Courses as above, also classes in Electrical Wiring, Building Construction, and other trade subjects. In the Electric Wiring Department an advanced course has been arranged for the preparation of candidates for the final wiremen's examination of the City and Guilds of London Institute. Arrangements have been made for placing students who have passed satisfactorily through the three years' day course in positions with large engineering firms, and hitherto such firms have offered more vacancies than the Institute has been able to fill with its students. The prospectus may be obtained on application to the Secretary, Electrical Engineering Courses.

Goldsmiths' College, New Cross, S.E. — Engineering and Building Department. New session commences September 20th.

Royal Technical College, Glasgow.—Day Classes begin on September 28th; Evening Classes begin September 23rd.

University College (Faculty of Engineering), London.—Session begins October 4th.

Particulars are given in our advertisement pages.

Canadian Water Powers.—The latest statistical statement respecting Canadian water powers shows that within the provinces of the Dominion, and excluding the North-West Territories, practically all of the Yukon and the northern and eastern portions of Quebec, it is estimated that 17,764,000 H.P. are available, this amount being inclusive in the case of Niagara Falls, Fort Frances and the St. Mary's River at Sault Ste. Marie, of only the development permitted by international treaties, and, further, does not contemplate the full possibilities of storage for the improvement of capacities. The developed powers, which are inclusive of all water powers, whether for electrical production, pulp grinders, for milling or for the great many other uses, aggregate 1,712,193 H.P. as developed by turbines. This amount is distributed over the provinces, as shown in the following table:—

Nova Scotia	21,412
New Brunswick	13,390
Prince Edward Island...	500
Quebec	520,000
Ontario	789,466
Manitoba	56,730
Saskatchewan	45
Alberta	33,305
British Columbia	265,345
Yukon	12,000
Total H.P.	1,712,193

—*Canadian Electrical News.*

Electrical Trade in Russia.—Mr. Consul Stevens, in his annual report on the trade of the district of Batoum for 1914, refers to electrical machinery, appliances and accessories, as follows:—"The trade in electrical machinery has very largely, in fact, I may even say altogether, fallen into German hands, but certain activity exhibited by manufacturers at home should succeed in gaining a part of the trade for British-made goods." He says that no trade in the district was so severely hit by the war as that of manganese. Later, in referring to electric supply matters, he says that he does not suppose there are many countries in the world in which so many rivers exist, the waters of which are adaptable for furnishing the energy required for working hydro-electric installations, as in the Caucasus, and yet up to now only about a dozen or so power stations exist. "In the Northern Caucasus a power plant developing up to 1,000 H.P. exists at the railway station of Beli Ugol on the River Podkumok, between Kislovodsk and Essentuki. At Gagri, on the Black Sea coast, Prince Oldenburg's climatic station possesses an electrical power plant, the water for which is taken from the River Joekvar. At the monastery of New Athos the monks also have erected a small electric plant. The Soukhoum Electric Co. have built a power station on the River Besletk, about five miles distant from the town. At Batoum Mr. Fefelov owns a water-power plant, situated six miles from the town, for furnishing electricity to house consumers. Messrs. Ananov Brothers have a small water-driven electrical installation in the Government of Kutais for working their saw mills. V. G. Shah-Paronian possesses a small electrical power station for driving machinery at Akhalkalaki. Another electrical water-power installation of comparatively speaking small capacity, is erected at Borjom on the estates of the Grand Duke. At Sanain a hydraulic station of 700 H.P. exists for generating electricity. It is situated at the railway station of the same name and belongs to the Caucasus

Metallurgical Co. At Gori a small electric power plant is owned by Prince I.H. Amilahvari. The town of Erivan boasts of two water-power stations for electrical purposes; and lastly, similar power stations exist at the copper mines of Katar in the district of Zangezur and on the property of the Caucasus Copper Co. at Dzansoul. The latter is a station of some importance, as it develops over 1,000 H.P. A concession was granted by the Russian Government in November, 1912, to a British firm, the main features of which were the erection of power houses to accommodate turbines and generators for furnishing electrical energy for lighting and commercial purposes to cities, towns and industrial centres of the Northern and trans-Caucasus. With this object in view the concessionaires obtained permission to harness the waters of the River Terek at Kazbek on the Georgian military road, and those of Lake Goktscha near the village of Elenoffka in the Government of Erivan. The apparent object of constructing two stations so wide apart is to prevent the stoppage of supply of current in case of shortage of water in the River Terek, which at certain seasons of the year does occasionally occur. Some progress was made with the scheme during the first half of the year 1914. I understand all preliminary works connected with the project have been completed and plans prepared; but the financial side of the question has still to be solved, and it would be unreasonable to expect that this can be achieved before the close of the war, during which all further progress in maturing the scheme has had to be suspended."

In his concluding remarks, the Consul says that few countries exist which offer so much scope for the development of certain branches of British trade as the Caucasus does, and this in spite of strong outside competition, provided of course efforts are made to fall in with methods of business, which, although they may seem novel and adverse to British manufacturers and firms, are nevertheless so deeply rooted here that they have become a long established custom impossible to abolish and are, therefore, readily accepted by tradesmen and industries outside the United Kingdom. "Adaptability to the requirements of the markéts, frequent periodical visits from commercial travellers knowing Russian, small stocks of goods in the hands of reliable agents, catalogues in the Russian language, low initial cost, cheap sea freights by direct steamers without transhipment to and from Caucasian ports between London, Liverpool, Glasgow, and one or two other of the more important harbours of the United Kingdom, mutual assistance in the maintenance of good relations and a system of credit freely—but carefully—granted, are all important points which should not be overlooked in the endeavours of British firms and manufacturers on the conclusion of peace to capture enemies' trade. Given these conditions the prospects for British commerce and industry are decidedly good."

Fatalities.—On August 19th, the Westminster Coroner held an inquiry into the death of a district messenger employed as lift boy at the offices of the Crown Agents for the Colonies. Apparently the boy was standing with one foot on the landing and the other foot on the lift, when a passenger, who entered the lift, accidentally touched the lift handle with his arm, and the lift ascended a little way. The boy slipped, and, falling between the landing and lift floor, dropped into the well. A verdict of "Accidental death" was returned.

On August 19th, while a tramway-car with 20 passengers was ascending a steep gradient in Barkerend Road, Bradford, the controller fused (according to the *Morning Post*); several passengers made a rush to leave the car while it was in motion, and one woman who jumped off sustained fatal injuries, others complaining of shock.

On the same day a signaller of the London Welsh Battalion was knocked down and killed by an electric car in Llandudno, the wheels passing over his body.

While a number of workmen were engaged in repair work at Bardyke's Colliery, Cambuslang, one of them, John McDougall, Blantyre, came in contact with the electric cable, and was killed instantaneously.

A coroner's inquiry was held at Jarrow on August 16th, into the death of John Stanton, a South Shields labourer, who died from injuries received in a tram accident on the 12th inst. While a car from South Shields was proceeding up Church Bank into Jarrow the current failed, and the car, running backwards, collided with a second car which was travelling in the same direction, and apparently caused a panic among the passengers. The motorman of the car which got out of control, said when the current went off he shut off the controller, gave the hand brake a turn, and applied the electric brake. The latter had no effect, and owing to the manner in which the men crowded upon him, he had not freedom to work the hand brake, but by the time the car reached the bottom of the bank he had the brake tight. If he had been able to get full control of the hand brake he could have stopped the car at the first flat. In regard to the second car, a witness said the driver reversed the controlling gear to run the car back, but the gear-box caught fire. Mr. A. G. Shearer, electrical superintendent of the Newcastle-on-Tyne Electric Supply Co., which supplies the current, said the supply on the Church Bank feeder was interrupted by some internal cause. All was in order at the sub-station. A verdict was returned that deceased died from injuries accidentally caused by falling from a disabled tramcar upon which he was a passenger.

Volunteer Notes.—Engineering Institutions' Volunteer Training Corps.—*Headquarters*, Marconi House, Strand, London, W.C. *Drill centre* (by kind permission of Lieut.-Col. A. E. Le Rossignol), Headquarters of London Electrical Engineers, 46, Regency Street, London, S.W.

Company Orders.—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week ending September 4th, 1915:—

Monday.—Drills, 6.30 to 7.30. Section 1, Technical instruction; Sections 2, 3 and 4, Squad drill, musketry or signalling.

Wednesday.—No drill.

Friday.—Drills, 6.30 to 7.30. Section 2, Technical instruction; Sections 1, 3 and 4, Squad drill, musketry or signalling.

Saturday.—2.30. Promotion class. Members wishing to join Signalling class are requested to give in their names to their Section Commanders.

Musketry.—Arrangements are being made for the various Sections to go through a course of instruction at the Miniature Ranges in Greycoat Place—final particulars will be published later in Supplementary Orders.

E. G. Fleming,
Company Commander and Acting Adjutant.

Through Mr. A. Campbell Swinton, who is a director of Messrs. Crompton & Co., Ltd., this firm has offered to the Corps a 24-in. projector barrel and stand, which has been accepted.

The Corps is still open for suitable recruits, either from members of the Engineering Institutions, or from others who desire to join an engineering unit and take advantage of the training available at the Headquarters of, and under the staff of, the London Electrical Engineers (T.F.), who have kindly given every facility to this Corps. Applications to Lieut.-Col. C. B. Clay, V.D., M.I.M.E., M.I.E.E., Marconi House, Strand, W.C.

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, August 26th, 1915:—

Captain of the Week, Captain Eastwood; Orderly Officer, Mr. G. T. Campbell.

Week-end Parades.—Saturday.—The Battalion will parade as strong as possible at Baker Street Station at 2.30 p.m., and proceed by march route to Wembley Park, *viâ* Gladstone Park. Rucksacks will be carried. Members can use their own discretion as to what they carry in the rucksacks, but the total weight of these articles should not be less than 20 lb.

Sunday, 7 a.m., Réveillé; 10 a.m., Church Parade; 10.20 a.m., Parade under Company Commanders; 2.15 p.m., Battalion Parade.

Appointment.—Mr. Brough Gurney-Randall to be Camp Quartermaster, *vice* Mr. Oliver Onions, dated August 5th, 1915.

Lecture.—There will be a lecture on Field Sketching delivered by Duncan H. Montgomery, Esq., on Sunday next, the 29th inst., at 10.30 a.m., in the ante-room of the Officers' Mess. All Officers not on duty will attend.

Musketry.—There will be firing at both Acton and Bisley Ranges on Saturday next, the 28th inst. Men who have sent in their names will parade at the usual times.

A. G. Joiner, *Captain and Adjutant.*

Appointment Vacant.—Depôt hand for Dover Corporation tramways. See our advertisement pages for particulars.

Radium in the United States.—It is announced by the United States Bureau of Mines that Government experimenters have succeeded in producing 1 gramme of radium metal at a total cost of £7,220, the previous selling price having been £22,400 to £23,200 a gramme.—*Chem. Trade. Jnl.*

Inquiry.—Makers of insulated zinc-covered tubing are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. G. Leslie Dennis has resigned his position of switchboard attendant under the West Bromwich Corporation to take up a similar post in H.M. Dockyard generating station, Devonport.

At the Parish Church, Wray, Hornby, on August 14th, the marriage took place of Mr. John Wm. Butterfield, late of the Oldham municipal electricity staff, and now serving in the 5th King's Own Lancs. Regiment, and Miss A. J. Stephenson, third daughter of Mr. J. Stephenson, Above Beck, Wray.

Mr. W. W. Lackie, city electrical engineer of Glasgow, has been appointed President of the Institute of Shipbuilders and Engineers at Glasgow. The Session opens in October, when he will deliver the inaugural lecture.

Mr. R. H. Lee, engineer-in-charge at the borough of Islington electricity works, has resigned in order to take up a similar appointment with the North Metropolitan Electric Power Supply Co.

General.—The following announcements appear in the *London Gazette*:—Territorial Force, Royal Engineers.

Electric Light Company, Renfrewshire (Fortress) Engineers; the undermentioned to be Second Lieutenants. Dated July 30th, 1915:—
Ian Cleland Napier.
Robert Norman Adam.

Electric Lights Company, East Riding (Fortress) Engineers; the undermentioned to be Second Lieutenants. Dated August 10th, 1915:—
Stanley Scott Allderidge.
Vyvyan James West.

4th Electric Lights Company, Kent (Fortress) Engineers.
Private James Wheatley Kilby, from London Electrical Engineers, to be Second Lieutenant. Dated July 31st, 1915.
Lieutenant Arthur P. Isard, A.M.I.E.E., to be temporary Captain. Dated August 10th, 1915.

Mr. P. J. S. Tiddeman has been appointed by the War Office Electrical Engineer for the Western Command, Headquarters at Chester.

The staff and employés of the Lanarkshire Tramways Co. have presented a timepiece to Mr. Stuart Evans, on the occasion of his leaving after eleven years' service as chief assistant engineer. Mr. Glennie, the assistant manager, made the presentation. Mrs. Evans was the recipient of a silver tea and coffee service.

Mr. F. M. Feiker, who has been for the last three years chairman of the editorial board of the A. W. Shaw Co., of Chicago, has been appointed editor of the *Electrical World*, New York, in succession to Dr. A. S. McAllister, whose resignation took place as from August 1st.

Mr. Alfred Still, a passenger on the White Star liner *Arabic*, which was torpedoed last week, is stated to be on the teaching staff of Lafayette University, Indiana. After rendering special service for some months in the works of Messrs. W. T. Glover & Co., Ltd., Trafford Park, he was returning to his home at Lafayette. Mr. Still landed safely at Queenstown.

Roll of Honour.—Private John Cartledge, of the 1/10th Manchester Regiment, who is now officially reported killed in action at the Dardanelles, was employed in the Oldham Corporation tramways department. He is the seventh local tramway employé killed on active service.

Sapper John Fearnley, of the Royal Naval Division, R.E., formerly an electrician in the Manchester electricity department, has been killed in action in the Dardanelles. He was 31 years of age.

Drummer Charles Cawley, aged 34, an employé at the electricity works, Bolton, has been killed in action. He served through the South African war.

Corporal John Basnett, of the 8th Battalion, Rifle Brigade, of Salford, who is unofficially reported killed, was 23 years of age, and formerly employed at the British Westinghouse Works in Trafford Park.

William Longworth, of Farnworth, has been awarded a D.C.M. When the British submarine E 15 ran aground in the Dardanelles, Longworth was one of the men who volunteered from H.M.S. *Majestic* to go in the picket boat and blow the submarine up to prevent it falling into the hands of the enemy. During his career in the Navy Longworth learned the business of an electrician, and took up work at Lord Ellesmere's Brackley Pits on leaving. When the war started he rejoined as an electrician.

Sapper George Lewirs, of the 14th Signal Co., 14th Light Division Royal Engineers, who was a switchboard attendant at the Chesterfield Corporation Electricity Works, has been killed in action. He enlisted on September 7th, and was drafted to Belgium a few months ago.

NEW COMPANIES REGISTERED.

Runbaken Magneto Co., Ltd. (141,311).—This company was registered on August 18th, with a capital of £3,000 in £1 shares, to take over the business of magneto manufacturers carried on by J. H. Runbaken and Co., and to carry on the same and the business of manufacturers of spare parts for magnetos, ignition apparatus, and all kinds of electrical apparatus, electrical engineers and manufacturers, etc. The subscribers (with one share each) are: S. H. Flynne, Camp House, Broughton, Manchester, electrical manufacturer; J. H. Runbaken, 50, Nelson Street, Chorlton-on-Medlock, Manchester, manager. Private company. The first directors are J. H. Runbaken (managing director), H. P. Flynne and S. H. Flynne (all permanent, with £182, £39 and £130 per annum as remuneration). Qualification, 100 shares. Solicitor: W. J. Sharratt, 89, Fountain Street, Manchester.

Lindsay and Williams, Ltd. (141,305).—This company was registered on August 18th, with a capital of £2,000 in £1 shares, to take over the business of an insulating material manufacturer carried on by H. R. Williams at Medlock Works, London Road, Manchester, as "Lindsay and Williams." The subscribers (with one share each) are: H. R. Williams, 241, Upper Brook Street, Chorlton-on-Medlock, Manchester, analytical chemist; A. Weaver, 2, Mount Street, Manchester, accountant. Private company. The number of directors is not to be more than six; the first are not named. Solicitor: W. H. W. Menzies, 9, Albert Square, Manchester. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

Andover and District Electricity Co., Ltd. (141,280).—This company was registered on August 16th, with a capital of £10,000 in £1 shares, to take over from Messrs. Crompton & Co., Ltd., the transfer of and all benefits and rights under the Andover Electric Lighting Order, 1915, to carry out and work the undertaking authorised by such Order, or to apply directly for and acquire any similar or extended or other Electric Lighting Order, and to carry on the business of producers and suppliers of electric light and electrical currents or force, etc. The subscribers (with one share each) are: C. E. Sexton, Cofield, Redhill, Surrey, engineer; J. N. A. Houblon, Artillery Mansions, S.W., engineer; A. E. Mohring, Hurstpierpoint, Hornchurch, engineer; E. H. Arnold, The Lawn, Addleston, engineer; H. W. Braine, 25, Hamfirth Road, Stratford, E., clerk; C. R. Lee, 15, Cheveley Terrace, Chelmsford, clerk; J. W. Davies, Tyson Villa, Tyson Road, Forest Hill, S.E., assistant secretary to a public company. Minimum cash subscription, seven shares. The number of directors is not to be less than three or more than six; the first are T. Webb, 45, Market Place, Andover; Dr. E. A. Farr, Heath House, Andover; and J. A. Houblon, Artillery Mansions, S.W. Qualification, £100 shares. Remuneration, £25 each per annum (£50 for the chairman). Directors' borrowing powers restricted to £5,000. Registered office: 26, Bridge Street, Andover.

Electro Alloys, Ltd. (141,329).—This company was registered on August 20th, with a capital of £10,000 in £1 shares, to take over the existing inventions, rights and processes of E. B. Crombie relating to the precipitation of zinc and other metals, minerals and mineral oils, to carry on the business of metal merchants, metallurgists, metal separators and purifiers, engineers, electricians, consultants, plate makers, contractors, etc. The subscribers (with one share each) are: H. C. Mossop, 62-3, Queen Street, E.C., solicitor; C. E. Warren, Weybridge Cottage, Cannon's Lane, Pinner, secretary. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Qualification, £100. Remuneration, £50 each per annum. Secretary (*pro tem.*): C. E. Warren. Registered office: 62 and 63, Queen Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Ramsden Green, Ltd.—Particulars of £1,000 debentures, created August 4th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Electro Flex Steel Co., Ltd.—A memorandum of satisfaction to the extent of £37,500 on July 30th, 1915, of debs. dated from December 19th, 1913, to September 29th, 1914, securing £45,000, has been filed.—Particulars of £40,000 debentures, created July 30th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £15,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Banbury and District Electric Supply Co., Ltd.—Issue on March 2nd, 1915, of £900 debs., part of a series of which particulars have already been filed.

Brecknell, Munro and Rogers, Ltd.—Particulars of £2,500 debentures, created August 9th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Rawlings Bros., Ltd.—Charge on certain leasehold lands and messuages dated August 9th, 1915, to secure all moneys due or to become due from the company to London County and Westminster Bank, Ltd., South Kensington branch.

William Beardmore and Co., Ltd.—Bond and disposition in security dated Aug. 3rd, 1915, to secure £150,000 charged on certain lands in Kilpatrick, Dumbartonshire. Holder: Secretary of State for War.

Winscombe Electric Light and Power Co., Ltd.—Issue on July 17th, 1915, of £870 debs., part of a series of which particulars have already been filed.

Chloride Electrical Storage Co., Ltd. (35,389).—Capital, £135,250 in 62,000 pref. and 73,250 ord. shares of £1 each. Return dated May 26th, 1915. All shares taken up. £75,738 paid on 48,750 pref. and 26,988 ord.; £59,512 considered as paid on 13,250 pref. and 46,262 ord. Mortgages and charges: Nil.

Everett, Edgcumbe and Co., Ltd. (84,764).—Capital, £25,000 in 5,000 6 per cent. cum. pref., 19,997 ord., and 3 "A" shares of £1 each. Return dated July 29th, 1915. 3,300 pref., 19,043 ord., and 3 "A" shares taken up. £11,496 paid on 2,500 pref., 8,995 ord., and 1 "A."; £10,850 considered as paid on 800 pref., 10,048 ord., and 2 "A.". Mortgages and charges: £1,600.

Merthyr Electric Traction and Lighting Co., Ltd. (57,908).—Registered June 23rd, 1898. Capital, £100,000 in 6,000 pref. and 14,000 ord. shares of £5 each. Return dated May 31st, 1915. 6,000 pref. and 8,000 ord. shares taken up. £70,000 paid. Mortgages and charges, £48,400. Registered office: Electrical Federation Offices, 1, Kingsway, W.C.

CITY NOTES.

British Columbia Electric Railway Co., Ltd.

An extraordinary general meeting was held on Thursday last week, at Winchester House, Old Broad Street, Mr. E. P. Norton presiding. The Chairman, in proposing resolutions authorising the directors to carry into effect agreements made between the company and the Vancouver, Fraser Valley and Southern Railway Co., and the Vancouver Power Co., Ltd., remarked that the agreements were necessary in order to comply with the Dominion law. The company had to get certain franchises in different districts, and they were not always able, conveniently to themselves and profitably to the company, to take them out in the name of the parent company. They had, therefore, to be taken out in the names of the subsidiary companies. The two companies in question were the vested owners of certain of the lines which were operated by the parent company, and the Dominion law required that if one company operated the line owned by another company, there must be an agreement setting out the terms under which it operated, and the agreement must be ratified by the shareholders of the respective companies. As they held the whole of the shares in the subsidiary companies, there was no question of finance involved.

The resolutions were agreed to.

Replying to a shareholder, the Chairman said that the board had brought every possible pressure to bear upon the municipalities to control the Jitney traffic which competed unfairly with their cars, and shareholders who had interests in British Columbia could help by using individual pressure in the matter. There was no doubt that they were not being fairly treated by the municipalities, but they were hoping that they would soon get proper recognition.

Victoria Falls and Transvaal Power Co., Ltd.

The annual general meeting was held on Friday last, at Salisbury House, London Wall, Mr. Arthur E. Hadley (managing director) in the chair. In proposing the adoption of the report (p. 216), the Chairman, after referring to the absence of the Marquis of Winchester (chairman of the company), who is on active service, and to the death of Mr. Fricker (a director), said that the auditors' certificate was again satisfactory. With regard to the sum of £11,654 to which they referred, that sum included £3,500 deposited with the Dresdner Bank on behalf of the debenture trustees and £7,700 deposited on behalf of contractors' retentions, and was at their risk; the balance represented moneys which were remitted to Berlin prior to the war for payment of debenture interest in Berlin and which had, doubtless, been so paid out, but owing to the war it had not been possible for them to receive the discharged coupons. Turning to the balance sheet, the share capital and first mortgage debenture capital remained at the same figure, viz., £3,000,000, under each heading. The second mortgage debentures outstanding at the date of the balance sheet amounted to £1,543,920, and included the issue in February, 1914, of £650,000. £82,580 of the second mortgage debentures had been purchased and cancelled during the year 1914, the total amount redeemed by purchase to December 31st, 1914, being £106,080. The creditors amounted to £422,158. Of this amount, £224,025 owing to creditors in London included a sum of £117,458 due to sundry debenture holders for interest accrued during the half-year ended December 31st, 1914, but not payable until January 1st, 1915. With regard to the amount of £78,884 owing on contractors' retention and general accounts, £7,721 was placed to a special account at the bank, and the remainder was included in the amount of £707,414 standing at the company's bankers and on loan, as was also the amount of £51,360 owing on contractors' general accounts. The profit and loss account showed a credit balance of £266,447. Turning to the other side of the balance sheet, the items of leases of concessions and purchase of undertakings again showed a decrease on last year's figure, being £1,536,638, as compared with £1,561,302, the difference being accounted for by the usual charge for depreciation and by certain small items which had been written off or sold or transferred to other accounts. The next item was the expenditure on and in connection with power stations, buildings, equipment and land which had been increased during the year by £395,753, in connection with the extensions they had made to the Simmerpan station and the installation of the extensions at Brakpan together with the expenditure on consumers' sub-station equipments and transmission lines. Their investment in the Rand Mines Power Supply Co., Ltd., figured in the balance sheet at £3,492,494 after writing off reserve for depreciation. The amount at which this investment stood in the balance sheet at December 31st, 1914, showed an increase over the previous year's account of £130,366. The Victoria Falls Co. held 500,000 shares of £1 each in the Rand Mines Power Supply Co., Ltd., together with a first mortgage bond fully securing the loan. The debtors and debit balances amounted to £60,571, and were all good and had practically all since been received by the company. The cash at bankers and on loan amounted to £801,633. The preliminary expenses again showed a decrease upon last year's figure of £2,500, the difference having been written off, together with all the expenses incurred during the period under review in connection with the issue of £650,000 second mortgage debentures. Dealing with the profit and loss account, the year's operations resulted in an increased gross profit over the preceding year of £87,871. In 1913 they carried to the appropriation account the sum of £467,823, and in respect of the year 1914 they had been able to carry to the appropriation account the sum of £555,694. The interest charge on debentures had increased from £203,920 to £234,842. The directors had applied the sum of £150,083 towards depreciation and certain writings off, carrying forward to the credit of the profit and loss account the sum of £161,248, increasing that account to £266,447. Out of this sum the directors had paid a dividend at the rate of 6 per cent. per annum for the six months ended June 30th, 1913, and a further dividend at the same rate for the ten months ending April 30th, 1914. These dividends were paid on January 6th and June 21st, 1915, respectively, and accounted for £160,000, thus leaving a sum of £106,447 remaining to the credit of the account as against £105,199 at December 31st, 1913. He thought they might take this increase, which enabled them to distribute an additional £40,000, as very satisfactory, since it showed the continued and growing prosperity of the undertaking. The monthly profits obtained so far during this year had again shown satisfactory increases, and they hoped to pay off the arrears of preference dividend in two equal instalments with the next two dividend payments. The heavy capital expenditure necessitated by the recent large extensions to the plant of the company and the Rand Mines Power Supply Co. had now practically terminated, but from next year onwards provision would have to be made for the redemption of the first debentures by annual instalments of £150,000. The sums arising from the provision made for depreciation had hitherto been required for extensions to the plants of both companies, but in future these annual provisions would be available for redemption of debentures. The times they were passing through made it a matter of extreme difficulty to forecast the future, but he might say that if the gold mining industry and their undertaking continued to work as at present, and every effort was being made in that direction, the board did not anticipate any difficulty in meeting those charges. Since the last meeting the extensions to the air compressing plant at Rosherville had been completed, and since the issue of the report information had been received that the whole of the extensions of 33,500 H.P. of electrical plant at the Brakpan station was now in commission. With the plant installed, they would be able to meet any normal increase in the business, which still continued to develop steadily, without encroaching on the specified reserve plant.

Replying to questions, the Chairman said that great strides had been made by the company, both last and this year, which, he thought, were leading on to the time within a year or two when the ordinary shares would receive a dividend. The published reports this year showed increases of between 20 and 25 per cent. over the same period last year.

The report was adopted.

Stewarts & Lloyds, Ltd.—Interim dividends for the half-year ended June 30th, at the rate of 6 per cent. per annum on the preference shares and 10 per cent. per annum on the preferred ordinary shares.

Crossley Bros., Ltd.—Interim dividend at the rate of 5 per cent. per annum on the cumulative preference shares and a dividend at the rate of 4 per cent. per annum on the ordinary shares.

Aberdeen Suburban Tramways Co., Ltd.—The profit earned during the past half-year amounted to £1,364, and there is a balance of £3,810 at the credit of the profit and loss account. It is proposed to add £1,500 to the amount at the credit of the renewal and depreciation account, which will then stand at £15,500; to pay a dividend at the rate of 5 per cent. for the past year; and to carry forward £716. Negotiations with the Corporation of Aberdeen for the purchase of the company's undertaking are still pending.

Manaos Tramways and Light Co., Ltd.—The report for the year ended April 30th, states, according to the *Financial Times*, that the gross receipts amounted to £110,420, a decrease of £22,457; the expenses were £84,240, a decrease of £12,608; and the net earnings £26,180, a decrease of £9,848. The fall in exchange has resulted in a loss of £6,180 on remittances during the year. After providing for interest, London charges, &c., placing £1,725 to debenture sinking fund and £300 to depreciation on furniture, there remains a profit balance of £4,002 to be carried forward. The State, Federal and Municipal Governments are still in arrears with their accounts, although as a result of strenuous efforts some collections have been made during the year, and it is hoped that further collections will be made in the near future.

Montreal Tramways Co.—For the year ended June 30th the gross earnings decreased $617,572, the operating expenses $492,118, and the net earnings $125,454. The ratio of operating expenses to earnings was 56·92 per cent., compared with 58·89 per cent. last year. The sum of $212,732 has been charged to contingent renewal account representing expenditures made for special renewals. In addition, $666,430 has been expended for the maintenance of plant and equipment, and charged to operating expenses, making the total expenditure during the year on upkeep $879,162. The gross earnings were $6,525,232; operating expenses, $3,713,996; net earnings, $2,811,235. There has to be deducted:—City percentage, $414,149; interest on bonds and loans, $825,415; interest on debenture stock, $800,000; taxes, $92,800; dividend (10 per cent), $278,880; contingent account, $275,000. Balance, surplus, $124,991.

STOCKS AND SHARES.

Tuesday Evening.

The excellent naval news of the beginning of the week had a marked effect upon the sentiment of the Stock Exchange. Prices were not greatly affected. Those who expected that advances would occur probably do not quite realise the conditions existing in the money markets at the present time. Without the aid of speculation to fan them, markets are bound to remain quiescent, dependent for their support upon what money remains over from the national subscription to the War Loan. Moreover, a large amount of capital is being held in reserve. All our economists and financial guides have told us that the country may need another loan soon after the end of the current financial year; and there is no doubt that reserves are being husbanded as much as possible, in order to conserve strength for the next requirements upon the national purse.

Germany is stated to be on the point of issuing a forced loan; and, from the details which have filtered through to this country, it is evident that drastic steps are to be taken with a view to replenishing the war chest—steps so drastic, indeed, that they may be fairly held to lead directly to the paths of peace, inasmuch as the adoption of a forced loan is about the lowest rung which can be reached by a nation before it drops off into bankruptcy.

The Electricity markets are steady enough, with the exception of Home Railway stocks, where prices continue dull. Central London ordinary is on offer in the neighbourhood of 72. Metropolitans and Districts are unchanged, but Underground Electric Incomes, after being up to 75¼, reacted to 74. The North-Western preference stock, issued a fortnight ago in order to complete the electrification of part of the system, has gone back a little to ¼ premium.

The question of exchange with the United States of America becomes daily of more pressing consequence, and all kinds of panaceas have been put forward in order to alleviate the situation caused by the enormous excess of American exports to this country over the imports received there from us. It is expected that a British loan of substantial amount will be placed in New York, with a view to correcting the exchange discrepancy. Without being accused of jobbing backwards, we may be permitted to repeat the opinion that, had a goodly slice of the June War Loan been offered to the United States, with the provision that interest would be paid free of income tax, the necessity would not have arisen for paying higher rates now.

New York Telephone bonds have risen to 99, so that this security is actually higher than the British War Loan, bearing the same rate of interest. The American gamble in "war specials," however, has received a sharp check, and prices came down with a jerk—due principally to the German outrage upon the *Arabic*, with its consequent loss of American life. Nevertheless, the Stock Exchange has firmly made up its mind that the United States is not likely to be drawn into the struggle—at all events, so long as she is making handsome profits out of munition orders; but apparently the apprehension of diplomatic relations being broken off between Washington and Berlin has been sufficient to scare some of the American gamblers, who have carried up munition prices to inflated levels.

In the Electricity Supply market, falls of 5s. have taken place in City of London ordinary and in Westminster preference, the price of the latter being reduced to 4¼. It is only when orders come in that prices get a practical test at all; so that the offer of a few Westminster preference at 4½, finding no immediate buyer, had the effect of putting the price down, just as others would probably give way if shares came to market. A well-known dealer in industrials put the case succinctly when he declared that all the 4 per cent. debenture stocks should be lowered to 80, the 4½ per cents. to 90, and preference shares to a standard at which the return would be approximately 5½ to 6 per cent. on the money. This generalisation is somewhat sweeping, but will probably be found to come true enough during the progress of the war. To return 5½ per cent. on the money, a £1 share would have to stand at 18s. 1½d., from which quotation other calculations can be easily worked out.

Great Northern Telegraphs are 2 higher at 35, but the rest of the Telegraph group is a trifle undecided. Eastern ordinary lost a point, and Globe ordinary at 9½ shed their improvement of the previous week. The hurricane in Jamaica has had no effect upon the cable market. The activity in Marconis has not been resumed, although the price of the shares keeps very firm at 39s. 6d. In consequence of the fall in American rails and "war specials," the price of Amercian Marconis dropped to 17s. 6d., from which there has been a small recovery. Canadians are scarcely moving, the price keeping about 6s. 3d.; while Marconi Marines are a shade harder at 24s. 6d.

At the meeting the other day of the Victoria Falls & Power Co., the chairman spoke with a cautious optimism, which had a strengthening effect upon the price of the shares. The preference continue to be done about 15s. 9d., and the 5½ per cent. second debentures at 85¾. At this price, the last-named pay £6 8s. 3d. per cent. on the money. There is a little business doing also in the ordinary at about the previous price of 4s. 9d.

Foreign electric issues are mostly easier again. Definite steps are still lacking in the direction of pacifying the Mexican chaos, so that the warning held out here against putting too premature a trust in peace rumours has, unhappily, proved to have been justified. Mexican Tramways first mortgage bonds lost 5 at 45, and the other Mexican descriptions have "dried up," to use the market colloquialism. Anglo-Argentine Trams have again suffered, though the 5 per cent. debenture stock is a point higher at 72; the first preference shares slid back to 3⅞.

The Northern Light & Power Co. is having its affairs overhauled on the spot at Dawson City by a member of the Stock Exchange; and it is quite possible that the concern may be set upon its legs once more, under his able direction. Canadian General Electric 7 per cent. preference stock is attracting some little attention at 107; and Shawinigan Water rights are dealt in pretty frequently every day, on the basis of ¾—1.

British Electric Traction stocks are changing hands at about 75 for the 6 per cent. preference, 44 for the 7 per cent. preference, 12 for the 6 per cent. preferred ordinary, and 8½ for the deferred; while the first debenture stock is nominally 78 and the 4½ per cent. second debenture stock remains at 60. London & Suburban Traction ordinary were dealt in a few days ago at 1s., and the 5 per cent. preference at 6s. 9d. In other Home tramway descriptions there is little doing. Brazil Tractions have gone back a little to 48½, on a shrinkage in the Rio rate of exchange; the 6 per cent. preference shares are steady at 85.

The Manufacturing group is firm. Callender's and Henley's debenture stock have been marked down to 92, and will probably shed two or three more points before they attract support. It is in cases such as these that a 4½ per cent. debenture stock has to be valued, in the light of the War Loan standard, at about 90, whereat the return on the money is the round 5 per cent. British Insulated ordinary are still offered, and the quotation is lowered nominally to 10⅝, although bids are wanted. Apart from these, the market is generally good. Electric Constructions were inadvertently marked down to 11s. in our lists of last week, the shares being confused with those of another company. The present quotation is firmer at 13s. British Westinghouse preference 1s. 6d., and various other shares connected with this market are distinctly on the mend. At the same time, it must be said that business is quiet and that public interest remains on a small scale. Babcock & Wilcox keep about 23s. 9d. The armament group on the whole is dullish, inclined to bend a little here and there. So far as rubber shares are concerned, orders are on a scale too limited to affect prices to any extent. The price of the raw material is the merest shade under 2s. 5d. per lb.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Aug. 24, 1915.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.				
Brompton Ordinary	10	8	—	£6 5 0
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4 xd	—	6 5 0
do. do. do. 4½ Pref.	4½	4 xd	—	5 12 6
do. do. City Pref.	4½	3⅞	—	5 16 2
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4⅜	—	5 14
do. 4½ Deb.	4½	88	—	4 17 10
City of London	9	12¾	— ¼	7 1 6
do. do. 6 per cent. Pref.	6	11	—	5 9 1
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10½	—	6 13 4
do. do. 6 per cent. Pref.	6	10½	—	5 14 3
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6¼ xd	—	7 4 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4¾	—	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	8½	2¾ xd	—	6 7 3
do. 4½ per cent. Pref.	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6¾	—	7 8 2
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 1/16	—	6 4 5
Westminster Ordinary	9	6¾	—	6 13 4
do. 4½ Pref.	4½	4¼	— ¼	5 9 0
TELEGRAPHS AND TELEPHONES.				
Anglo-Am. Tel. Pref.	6	98	—	6 2 6
do. Def.	1½	21¼	—	7 1 2
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8¼	—	6 1 8
do. Pref.	10	16	—	6 13 4
Eastern Extension	7	11	—	*7 5 6
do. 4 Deb.	4	79	—	5 2 1
Eastern Tel. Ord.	7	115	—1	*6 19 6
do. 3½ Pref.	3½	70	—	5 0 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	9½	— ½	*7 4 4
do. Pref.	6	10	—	6 0 0
Gt. Northern Tel.	22	35	+2	6 5 9
Indo-European	10	60	—	6 10 0
Marconi	10	1 31/32	+ 1/32	5 1 6
New York Tel. 4½	4½	99	+1½	4 11 0
Oriental Telephone Ord.	10	2	—	5 0 0
do. Pref.	6	1⅛	—	5 6 8
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5½	—	*8 6 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	11½	—	*6 19 0
do. 4 Deb.	4	81	—	4 16 5
HOME RAILS.				
Central London, Ord. Assented	4	72	—1	5 11 1
Metropolitan	1½	28½	—	5 6 5
do. District	Nil	14	—	Nil
Underground Electric Ordinary	Nil	1½	—	Nil
do. do. "A"	Nil	5/9	—	Nil
do. do. Income	6	74	— ¾	*9 5 0
FOREIGN TRAMS, &c.				
Anglo-Arg. Trams, First Pref.	5½	3⅞	— ⅛	7 1 11
do. 2nd Pref.	5½	8½	—	7 17 2
do. 4 Deb.	4	71	—	5 12 7
do. 4½ Deb.	4½	72	—3	6 5 0
do. 5 Deb.	5	72	+1	6 19 0
Brazil Tractions	3½	48½ xd	— ½	7 2 10
Bombay Electric Pref.	6	10¼	+ ¼	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds	—	45	—5	Nil
do. 6 per cent. Bonds	—	85	—	Nil
Mexican Light Common	Nil	25	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	40	—	—
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0
do. 5 Deb.	5	98	—	5 2 0
MANUFACTURING COMPANIES.				
Babcock & Wilcox	14	2 3/16	—	6 8 5
British Aluminium Ord.	5	1 1/16	—	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	10⅝	— ⅛	7 1 2
do. Pref.	6	5⅞	— ⅛	5 2 2
British Westinghouse Pref.	7½	82/6	+1/6	9 7 6
do. 4 Deb.	4	68	—	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref.	5	4½	— ¼	5 11 3
do. 4½ Deb.	4½	92	—3	4 17 9
Castner-Kellner	15	8¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	60	—	6 13 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	+2/-	9 4 8
do. do. Pref.	7	19/-	—	7 7 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	14	—	*8 8 8
do. 4½ Pref.	4½	4¾	—	4 14 9
do. 4½ Deb.	4½	92	—3	4 17 9
India-Rubber	5	8¾	—	5 14 3
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

Ryland's Electro-Plating Co., Ltd. — The report states that, after making the requisite provision to cover discounts on outstanding accounts, bad and doubtful debts, &c., the profit for the year is £41. The directors regret that the year's trading has resulted in such a small profit, but considering the special circumstances they trust the shareholders will not be disappointed. —*Financier.*

LAMP AND LIGHTING DEVELOPMENTS IN THE NEAR PAST AND FUTURE.

By L. CROUCH.

(*Concluded from page* 228.)

Tungsten lamps have made concealed or indirect lighting on various systems economically possible and, particularly in the case of half-watt lamps, practically essential for interiors owing to the high brilliancy of the source. Purely indirect lighting gives extraordinary uniformity of illumination and absence of shadows—to a degree which is not obtained in any other system of lighting and which is, in the writer's opinion, neither desirable nor agreeable for ordinary purposes. A certain percentage of diffused direct lighting greatly increases the efficiency and utility of the lighting, and certainly makes it more lively and less oppressive. Psychological effects vary with every subject, but most people appear to experience a more or less depressing effect from entirely indirect lighting and a sense of being confined and "on show." The lighting obtained may resemble daylight very closely in diffusion and colour, but no one would for a moment think that the lighting was really natural.

This raises the whole question of whether perfect uniformity of lighting and "daylight effect" is really desirable in ordinary interiors by night. For any work involving colour matching it is, of course, essential, and artificial daylight can be approached more accurately the more one is willing to spend on light wasted in special colour filters. Perfect uniformity of lighting is not natural; it is essentially artificial, and to most people it is more or less depressing and certainly not restful. The only completely successful way of imitating daylight illumination (assuming the latter to be worth imitating, which it is not always), is to allow artificial and natural light to enter by the same openings, the amount and quality of each being the same. The cost of such artificial lighting is usually prohibitive.

Closely associated with the effectiveness of lighting is that of colour. The number of strongly coloured light sources is so limited that outspoken remarks are apt to be given an application which is not intended. Yellowish and rosy light is the most suggestive of ease and comfort, and there is every reason to support the common preference for these tints, for artificial lighting in streets and homes is generally required during hours when most people are "off work." The cold light of efficiency is naturally more appropriate to offices, shops and workshops. On going towards the blue end of the spectrum, colours become (to the writer at least) more depressing and finally produce a sort of aggressive morbidity. Undoubtedly yellow-green light is that to which the human eye is most sensitive, but its psychological effect is not pleasant. It is well expressed by a line in a certain book on stage effects—"For weird or murder scenes—green light!"

The high intrinsic brilliancy and mechanical concentration of source in tungsten lamps makes the latter eminently suitable for a variety of optical applications, such as lighthouse, motor-car and locomotive projectors, "magic" lanterns and cinematographs, signalling purposes and examination by translucence. The efficiency and almost point-focussing of small half-watt lamps undoubtedly gives them a great future in all of these applications, and in headlights for motor-cars, the smallness of the source should favour the elimination of dazzle by baffle disks, partial obscuration of bulb and so on.

Progress is slow in our endeavours to secure high efficiency lamps of low intrinsic brilliancy. Useful as the principle of intermittent, super-incandescence (applied a year or two ago by a certain French scientist) may be in special signalling, photographic, cinematographic and other services, it does not provide a cold light, and its limiting efficiency would appear to be necessarily less than that which can be approached in gas-filled tungsten lamps (as they are worked nearer the melting point of tungsten) owing to the loss in intermittently heating and cooling a number of filaments which cannot, under any circumstances, be worked even momentarily above that limiting temperature.

Much is still to be hoped for from tube lamps, and something in the way of a super-Geissler tube would fulfil most of our ideals. The mercury lamp is far from a cold light, and in its latest form—the quartz lamp—it follows the trend of all incandescent lamps towards higher temperatures and more intense incandescence. The green mercury arc seems to have a field of permanent utility in photographic work and as a rectifier. The quartz lamp is undoubtedly valuable for sterilising purposes (though recent researches with the oscillating spark threaten its position in this field), and, as an illuminant, it has good industrial prospects, particularly for direct connection to 400-600-volt circuits (in conjunction, possibly, with iron wire variators steadying the terminal P.D.).

The Moore lamp does not seem to gain the popularity to which its merits entitle it. On the plain basis of watts per candle, it is not an efficient lamp, but, allowing for all losses, an overall consumption of 1·5 to 1·7 watts per C.P. is obtainable, and this compares very favourably with the corresponding *overall* efficiency of most direct and semi-direct systems using high efficiency lamps in conjunction with such fittings as to produce diffusion and soft shadows comparable with those of the tubular lamp, which yields only 50 C.P. per yard run as against 450 C.P. for the neon and 1,000 C.P. for the mercury lamp. Three-phase lamps can be conveniently arranged. The writer believes that careful quantitative investigation of the possibilities of the Moore lamp is well worth while in a variety of services. In lighting facades, long corridors and large rooms it gives excellent results well worth a slight sacrifice in efficiency.

The neon lamp has the advantage of higher efficiency, lower working voltage, and smaller electrode loss (making practicable shorter tubes). Its intrinsic brilliancy is considerably greater than that of the Moore lamp, but still very low, and consumption down to 0·5-0·6 watt per spher. C.P. is claimed as overall efficiency. The light is entirely deficient in blue rays, which makes it very useful for photographic "dark" rooms where plenty of non-actinic light is required. It may yet prove possible to blend satisfactorily light from neon and mercury lamps, but the rosy light of the neon lamp is one of the most acceptable monochromatic lights for many classes of interiors.

The chief obstacles in the way of tube lighting on low brilliancy systems are: (1) The first cost of installation, which should be reducible; (2) relatively low efficiency in candles per watt, which efficiency is materially increased when overall efficiency from supply mains to eye is considered; (3) considerable length of lamp necessary to reduce the specific importance of the electrode loss. In the latter respect neon lamps are much superior to the Moore type, and there is no reason to suppose that yet better results cannot be obtained. If it be attempted to get really extensive application of tube lamps, a service would probably have to be organised to clean and refill them *in situ*, at intervals. This need not be a costly matter; indeed, it should reduce maintenance costs to an unprecedented level.

Supposing that they enjoy no wider field, low brilliancy tube lamps are likely to find increasing application in advertising, decoration and display lighting of all kinds, and it would be a pity were their possibilities overlooked till too late by firms in this country. Some 50 years ago experiments were carried out in lighting mines by Geissler tubes, and it does not seem improbable that modern tube lamps could find very useful application in this service, at any rate, in the main galleries of pits.

Drawn wire is established standard material for tungsten-filament lamps; there is little left to desire in its mechanical strength and durability in service, and by following present lines of development, we may hope to approach 0·33 watt per candle efficiency, corresponding to the melting point of tungsten. The working temperature of the present half-watt lamp is about midway between that of the ordinary tungsten lamp and the melting point of tungsten. Due to the direct and definite connection between filament dimensions, resistance and candle-power, low voltage supply is inherently more favourable than high voltage to filament lamps in respect of durability and efficiency. Vacuum tungsten lamp manufacture has been so far perfected as to remove the disabilities of high voltage lamps in these respects almost completely, and the use of auto-transformers is only persisted in in odd cases. Where still used their light load current costs the consumer more than his saving on load, as compared with high-pressure lamps (unless he puts up with the appreciable inconvenience of switching out the transformer last thing at night*), and the effect of a number of auto-transformers on the power factor of a lighting network is very objectionable.

Although the auto-transformer is obsolete as an accessory in ordinary tungsten lighting, there is likely to be a marked recrudescence in its use with half-watt lamps. It may fairly be assumed that a big demand for 200 and 100-C.P. gas-filled lamps will arise in the next few years—probably soon after the declaration of peace and directly lamp manufacturers start the demand by advertising the possibilities of such lamps. At present manufacturers are taking no steps to "boost" the low candle-power half-watt lamp (much to the relief of central station engineers!), but the time will come, and may come soon, when the demand for such lamps will rise rapidly and irresistibly.

At present 50 and 100-C.P. half-watt lamps are available only up to 10 or 20 volts,† and if auto-transformers be used at the distribution box, wiring troubles are in store. A house wired none too liberally for carbon-filament lamps can employ 1-watt lighting with a large factor of safety, but, even at 25 volts (which represents the probable limit of voltage for 50-100-C.P. half-watt lamps for some time to come),† the current to be carried is 1½ to 2 times as great as for 200-250-volt carbon lamps of the same candle-power, and 5 times as great as for corresponding 1-watt lamps. The position is that wiring troubles are ahead, if fractional reductions in watts per candle are obtained at the cost of lower working voltage and auto-transformers are used to feed a wiring system designed closely for use with lamps of somewhat poorer efficiency but considerably higher voltage. Consumers on low voltage A.C. systems will be the first to benefit (and their station engineers the first to suffer) by the extensive use of half-watt lamps in domestic lighting. When so used these lamps must, of course, be half frosted, or used in an appropriate diffusing fitting, but there is no difficulty therein, and the writer believes that half-watt lamps will be used extensively in small interiors (from A.C. supply) directly the makers care to start the ball rolling.

The wiring difficulty and the poor power factor of ordinary auto-transformer installations can be overcome by using a small auto-transformer for each lamp, mounted near the latter and forming part of the local switch circuit. Under the name "reductor," such auto-transformers are much better known on the Continent than here. The writer believes large numbers will be used in connection with low voltage half-watt lighting, and that it would be worth our while to take up their manufacture and marketing.

But very little, if any, low-pressure wiring is required where reductors are used, and the transformer is only in circuit when operating on full load; power factor from 96 per cent. to practically unity is then obtainable according to wattage of the apparatus. For ordinary tungsten lamps, reductors have often been incorporated in the lampholder, but this is undesirable for half-watt lamps, owing to the heat developed by the latter. If circumstances call for the use of a number of sizes of lamp, the high candle-power units may be connected directly to the mains and reductors (not necessarily all for the same secondary pressure) used with the smaller units. Already there are available 1,000-5,000-C.P. nitrogen-filled lamps for direct operation on pressures up to 240 volts. Lamps of 400 C.P. are available up to 130 volts,† but 10 per cent. saving in consumption is effected by working at 25-60 volts. For 200-candle-power lamps, a reductor giving a secondary pressure somewhere between 15 and 50 volts is suitable; for 100 C.P., between 10 and 20 volts, and for 50 C.P. only 6 or 8 volts. There is no apparent obstacle to the wholesale use of such lamp and reductor combinations, and it would be worth while installing a small converter in many cases where D.C. supply is alone available.

There are two categories in which reductors should be specially useful: (1) Shops, &c., where best results are desired from 600-1,500-C.P. lamps. (2) Small users wishing to realise the economy of half-watt lamps in 50 and 100-C.P. units. The shopkeeper could use reductors of ½-1-KW. output measuring 6 to 9 in. all ways, weighing 20-25 lb., and giving a secondary pressure of 50 or 60 volts. Though only 3 to 5 per cent. loss would occur in transformation, which loss would be covered by the higher lamp efficiency and greater filament strength, it is doubtful whether the relatively costly and heavy reductors required are worth using, since surprising guarantees are already given with the higher candle-power high voltage half-watt lamps. The second case is, however, very different. Small candle-power half-watt lamps are available only for 20 volts and under, and suitable reductors for 25 to 150-C.P. lamps measure 2½ to 4 in., and weigh 1½-2 lb. for 50 C.P. up to 4 or 6 lb. for 200-C.P. lamps. About 10 per cent. loss occurs in transformation, but an overall efficiency of 0·6 watt per candle can be secured, and this is worth the cost of the reductor, which requires no special installation or wiring alterations. A 10 or 20-volt half-watt lamp is quite a robust article, and it is likely to be some time before 50 and 100-C.P. units are available for higher pressures.

Filament lamp manufacture is now in the hands of a limited number of manufacturers—with great advantage in price and quality to the consumer. So considerable is this advantage that it would be ungrateful to lay too much stress on the use of watt ratings instead of candle-power and other little matters in which manufacturing convenience and not public preference is the predominant factor. After all, it is only by this means that so good and cheap lamps are available, and in the particular case of "watts *versus* candle-power rating," the number of sizes are so numerous that the changing C.P. of various wattages can usually be covered nearly enough by the use of another wattage.

There is, however, a risk that where lamps are sold by wattage, a man will go on using, say, a 50-watt lamp long after the candle-power obtained from that wattage has become objectionally high.

The voltage at which filament lamps are operated affects the degree of realisation of the whole of the maker's rating—life, efficiency, candle-power, and watts. An admirable example of the dangers of a little knowledge is to be found in the case of the layman who, being advised some years ago to buy lamps for 5 volts higher pressure than the service volts, continues to do so to this day. At one time fairly good policy, the practice is now unnecessarily wasteful in light efficiency. If the service pressure be below rated, the effect is the same as if the consumer buys an over-voltage lamp, and if both conditions exist together, there is soon a dissatisfied consumer. Many central station engineers still overlook the fact that, where *energy* meters are used, low supply voltage means proportionate loss in revenue; if only ampere-hour meters are used, it means corresponding gain.

A matter in which the interests of all parties coincide is that of the three voltage rating of lamps. Central stations continue to be erected at an extraordinary rate in this country (unfortunately often to gratify parochial pomposity where bulk supply from an adjoining area is dictated by every other consideration). In either case—whether generating or transforming down from a H.T. line—it would be very advantageous from the lighting point of view to keep off 100, 110, 200, 220 and other "overcrowded" pressures. By arranging supply at 105, 115, 205 or 225 volts, lamp manufacturers could be given a means of economising manufacture and benefiting consumers thus directly, and also by closer and more uniform rating.

Problems connected with the home supply of lamp-cap stampings, glassware of all kinds, and other lighting materials and accessories, have already been dealt with in these columns. The standardisation of small lamp manufacture is a reform which has been slowly developing for some time past, and which ought to take definite shape at this juncture. There is no reasonable justification for the present multiplicity of voltages, candle-power, filament arrangements, bulb sizes, and so forth. One of the most interesting and valuable applications of small filament lamps is to miners' hand lamps. Some types on the market, though conforming to Home Office requirements, are obviously foredoomed to failure. Though the official tests are severe, they do not discriminate completely between lamps which are a sound engineering job and those which, as a whole, are not.

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* The writer has the privilege of knowing several careful people who habitually switch off at the main each night and go to bed by candle-light.

† The above article was written prior to the advent recently of new sizes of both high and low-voltage half-watt lamps, referred to in our issue of July 9th; 60-C.P. 50-volt, 120 C.P. 100-volt, and 200 C.P. 200-volt lamps are now available.—Eds. Elec. Rev.

On the other hand, certain of the official tests, particularly the apparently crude dropping tests, are often ridiculed, though they approximate closely to misuse, which may easily arise by carelessness or accident. With hundreds of lives literally depending on the prevention of a spark, one should not hesitate to insure against the grossest misuse or folly. Ribbed or corrugated cases of anti-corrosive steel alloy are likely to become standard, and though there is still room for advance in battery construction, it is the charging and testing arrangements which make much of the difference between success and failure in wholesale practical application. Not the least of the advantages of electric lamps for miners is the possibility of switching off all but one or two lamps in the event of a number of men being imprisoned by a fall, so that, by using lamps in turn, instead of all at once, the horrors of darkness are not added to the victims' ordeal. To prevent use of such a switch (and consequent irregular discharge of the various batteries), except in case of emergency, a simple lead seal may be provided, so that the switch will only be used when really necessary.

In concluding these somewhat disjointed remarks, the writer trusts that due attention will be paid to some at least of the problems and developments he has mentioned, before regular routine is again adopted in the lighting industry.

BRITISH ELECTRICAL TRADE WITH EGYPT.

By "ANGLO-EGYPTIAN."

The present war has disorganised the majority of our electrical manufacturing concerns. The export of supplies is curtailed; stocks abroad are becoming depleted and, in the present circumstances, are difficult to replace. At the termination of hostilities a rush for electrical supplies may be anticipated. Stocks must be replenished, temporarily discontinued works will be resumed, and many important schemes awaiting the opportune moment will be embarked upon. Foreign competitors will be shut out of our Colonial markets, and British manufacturers will lay themselves open to take advantage of the new commercial situation from which they alone should reap the benefits.

Amongst others of the overseas markets which are already looked upon with an optimistic eye, is Egypt, which has hitherto been largely exploited by the important German and Austrian electrical houses, and also in a measure by the French; indeed it may be truthfully stated that during the last 10 years only a very small percentage of the total electrical material which has been imported into that country has been manufactured in Great Britain. For this sad state of affairs I am prepared to say that the fault largely lies at home.

Let "by-gones be by-gones," and let us prepare for the future, for the time will come when we may start afresh without the fear of foreign competition, as it is to be assumed that home competition alone will have to be dealt with. One must not, however, lose sight of the fact that practically the same circumstances will govern the conditions under which business will be carried out in the Egyptian market, the difference being solely that foreign competition will be eliminated.

I trust that in making this latter statement I shall not be regarded as too optimistic, for is it not one of the great great advantages that we are fighting for at the present moment? It is but a natural sequence to the satisfactory termination of the war.

As to what steps the enemy will take to circumvent this I am not prepared to say. But if one may judge from the thoroughness of their business methods, and the results obtained by them in the past with regard to our Colonial markets, we may safely anticipate a revival of their business tactics after the war.

Various English electrical manufacturing companies have already announced their intentions of slipping into the breach caused by the recession of their antagonists from the Egyptian market. Several of these concerns are capable in all ways as regards manufactures, of supplying fully the requirements in that part of the world. But there are few amongst them who manufacture the complete range of electrical supplies catalogued by such firms as the A.E.G. and the Siemens combinations. And there are fewer still who have brought to bear upon the Egyptian market that system of organisation and thoroughness of business methods which have won for them practically the whole of the Egyptian trade. I speak with some knowledge of the Egyptian Government and other contracts which have been placed during the last 10 years, and I have in mind, in nearly every case, the reasons why contracts were awarded to foreign firms in preference to British manufacturers.

The question which now arises is this: What was the reason for our failure in the past? The answer is that it was simply a question of price and organisation—two words which count enormously and which have a paramount influence in a sales department. In the majority of cases where British manufacturers have failed to capture Government contracts during the last nine years, I am of opinion that it may be attributed to one of the two foregoing reasons. Excessive cost may be traced to defective organisation as regards want of intimate knowledge of the market in which the goods were to be sold. The following will explain this fully.

Government tenders as regards electrical plant usually call for the plant to be erected on site and handed over in working order.

Payments are effected partly against shipping documents erection and tests on site, the balance, which is usually 20 per cent., being paid after satisfactory working for, say, three months, or other pre-determined period.

It is feasible to believe that it is in the unknown factor that the manufacturer meets his pitfalls. That is to say, he is in many cases at a loss to define correctly his real expenses after the goods arrive at the unloading port, which is usually specified as Alexandria. To meet this deficiency he covers his estimate with a margin which would be unnecessary if he understood thoroughly the procedure and numerous items of expenditure to which the goods were subject on landing; in addition, the intricate questions of supervision, labour, railway freight, cartage, cost of excavation and materials for erection, all generally form very important items in the estimate.

These difficulties may be met by the appointment of a reliable and experienced commercial engineer as agent, who should assume responsibility for all goods after their reception at the unloading port. In this manner the home estimating office will calculate all charges up to and including c.i.f. Egyptian port, and will call upon their agent for a supplementary estimate concerning Customs' duty, dock dues, inland freight, if any, cartage to site, storage, also supervising expenses, excavations, labour and materials, if the plant is to be handed over in running order. The usual procedure is for the agent to sublet the contract for excavations, foundations and brickwork. These vary considerably, depending upon the locality and cost of materials. In the case of large and important plants it is advisable to send out a supervising erecting engineer. Less important erections may be carried by European erectors, whose services can be obtained locally at an expense of £12 to £20 per month, depending upon the capability of the individual. Assistance in the shape of Italian or Greek assistant engineers may be secured at £5 to £6 per month, but they are rarely to be relied upon for very accurate work, such as erecting engines, &c. Native labour is to be had for £3 to £4 per month, but workers of this class are little better than labourers.

German, Austrian and French competitors go further than this. With the exception of the A.E.G., who do business through a firm of old-established agents having branches at Cairo and Alexandria, such firms as Siemens and Halske, Siemens Schuckert, Ganz & Co., and the French Thomson-Houston Co. are represented by branch house under the control of technical commercial managers, aided by competent staffs. Each branch comprises also a retail department replete with large stocks of all classes of electrical supplies. Expenses are paid by retail sales and small contracts for electric light and wiring installations. The bulk of the stocks are on consignment, and are paid for in accordance with arrangements made with the parent firms.

It seems, that with the exception of a few firms in this country who manufacture a complete line of electrical supplies, the branch system of doing business would be inadvisable on account of the diversity of material required to maintain an efficient stock. An easy method of getting over this difficulty would be for a number of firms to collaborate for opening a branch and subdivide the expenses and profits in accordance with their proportionate interests.

If it is desired to cater only for the requirements of the various Government departments, then a local agent residing at Cairo is all that is necessary. Here it may be stated that all Government contracts involving machinery to be erected entail an agent with a local address. If, on the other hand, a general electrical engineering business is sought in addition to Government requirements, an agent carrying a complete stock of supplies, or a branch house, is necessary.

The representative must be of good address and calculated to make himself acceptable to such Government officials as he will interview in the course of business. English is the official business language in Government circles, whilst the metric system is principally employed for weights and measures. A knowledge of French and Arabic is also necessary in Egypt, the use of the latter language being absolutely essential in the Provinces.

It may be useful to terminate these notes by giving some idea of the present situation in Egypt as regards our competitors. At the commencement of hostilities the British authorities carefully segregated the German and Austrian branches from their parent houses. The A.E.G. agents discontinued their representation and opened up negotiations with an important English manufacturing concern.

The management of the Ganz & Co. and of the Siemens branches was taken over by certain of their English and Swiss employés. This step was taken with the approval of the British authorities who exercise control over their financial transactions.

Goods of proved enemy origin coming into Egypt through neutral countries are confiscated, so that there is no possibility of stocks being replenished from sources which are prejudicial to British interests.

THE USE AND ABUSE OF OILS ON MINING PLANT.

By T. C. THOMSEN, B.Sc.

(*Abstract of paper read before the* Association of Mining Electrical Engineers.)

The owners of many large plants have seen the advantage of having an engineer responsible for the lubrication of their engines and machinery, and in plants which are not large enough to justify the employment of an engineer for this particular work, it has been found advantageous to have a lubricating engineer to inspect the plant occasionally, report on the lubricating conditions, and offer suggestions as regards economy and saving in power.

Many important institutions controlled by Government, or large concerns, also electric supply authorities, when inviting tenders specify certain chemical attributes in the oil. This practice is wrong, because chemical readings do not show the lubricating properties of an oil, for the reason that it is possible to duplicate a high-grade oil on the basis of chemical tests by means of an imperfectly manufactured and inferior article. Although the chemical tests may be the same for the two oils, the results can be widely different in actual work.

The only accurate way of testing lubricants is to try them under working conditions, where they are to be actually used.

The question might be asked whether introducing a higher grade of oils would not increase the total cost of lubrication. In reply, experience has proved that in a large number of plants the costs of lubrication over a period may even be lower than with lower grades of oil in use. In other cases the cost may possibly work out a little higher, but this increased cost will be balanced by other benefits. It is here that the services of a lubricating expert become desirable. He should select high-grade oils for the portion of the plant where such oils could be used to advantage, and if the lubricating conditions are not favourable to the introduction of high-grade oils, he may suggest ways and means by which better lubricating appliances or better methods of handling the oil can be introduced, so as to make the introduction of better grades of oil possible.

When talking to men directly interested in the successful running of machinery, one is often assured that they have no trouble; the idea being that the machinery is operating without any unusual heating of bearings or engine parts. In many such plants, however, the mere change from low-grade oils to better grades has effected a saving in power of 20 per cent., and it is now realised that there is something beyond having "no trouble."

A troublesome bearing in nine cases out of ten will not indicate that the oil is unsuitable, but that some mechanical defect exists in its construction. It is not an occasional hot bearing, but the few degrees of unnecessary frictional heat that are wasted in hundreds and hundreds of bearings that determine the real standard of lubrication.

The actual testing of the influence of better lubrication on the power of mining machinery or power-house plant is a difficult matter, as there are so many other conditions that may influence the results.

By means of accurate temperature tests it is, however, possible in nearly every case to make a comparison between the lubricating qualities of different oils, and it is recommended to make such tests as thorough and as careful as possible on specially selected important bearings. These temperature tests should be repeated from time to time, with a view to controlling the quality of the oils in use. If the mechanical conditions do not change, the rise in temperature of the bearings above the surrounding atmosphere should remain very nearly constant.

When a new motor exhibits a tendency to develop heat in one bearing, the bearing should, of course, be examined. If it is found in good condition, the cause of the heating will probably be found in the thrust of the armature shaft against the bearing, which may result from either of two conditions: First, the machine may not be level and the armature shaft may dip towards that end. Second, the magnetic centres of the pole-pieces and armature may not be in line.

Where low-grade mineral oils, or oils with mineral base but compounded with animal or vegetable oils, are employed they will develop gumminess in the bearings, and necessitate frequent cleaning. Such cleaning is unnecessary when high-grade dynamo oils are employed; cases have been known where such oils have been in use for years without any necessity for cleaning the bearings and oil wells. However, it is desirable to empty the bearings every three or four months, and put the oil through a suitable filter. It will then be as good as new, and can be used over and over again, being mixed with a little fresh oil to make up for loss.

The leakage of oil from a ring-lubricated bearing may be due to several causes. Sometimes oil leaks through the horizontal keep joint of the bearing. The best remedy for this is to place a lead wire as packing in the joint. Bearings on large motors and generators often have a deep groove in the bottom half of the bearing, which groove, at both ends, communicates with the oil reservoir and returns such oil as may have reached the joint by splashing out from the well through the motion of the lubricating rings.

Sometimes leakage will be observed along the shafting. It is important that there should be a good clearance between the outer lip and the shaft, and if it is too close a fit it should be eased.

If the oil still has a tendency to creep along the shaft, an oil-thrower can be made in halves and fitted on the shaft, or it may simply be a piece of steel wire bent round the shaft and clinched so that it will keep its position. Grooves in the bush will arrest the greater part of the oil, whilst the remainder is thrown off the collars. The keep may be fitted with an internal lip, which prevents oil splashing out through the joint.

Ring lubrication is very effective, as the oil is continuously lifted by the ring or the rings over the shaft, and finds its way into the oil-distributing groove, whence the film of oil between the shaft and the bearing is kept amply renewed. Care should be taken that the oil-carrying grooves are well rounded in the direction of rotation, to facilitate the entrance of the oil between the frictional surfaces. If the motor is built to rotate either way, it is necessary to have two oil-carrying grooves, one on each side of the centre line.

Sometimes lubricating chains are employed instead of lubricating rings, the idea being that the chains touch the shaft through a longer arc, and, therefore, are supposed to be kept in motion more surely than plain rings. It must be remembered, however, that the part of the chain immersed in the oil bath offers greater resistance than a plain ring, so that in actual practice there is not much difference between the working of chains and the working of rings. At high speeds there is the disadvantage with chains that the links, when passing through the oil, churn it up. This makes it more difficult to prevent leakage of oil from the bearings.

Satisfactory lubrication of dynamo bearings, *i.e.*, cool running and inappreciable wear, is very important. If wear takes place, this means that the rotor is lowered, and the magnets will then exert a pull on the rotor in a downward direction, which further increases the pressure and accordingly the wear of the bearings.

The question of the internal lubrication of steam engines is of great importance. Nothing is more capable of destroying the good effects of high-grade cylinder oil than applying it in a wrong manner, or through unsuitable lubricators.

The tallow cup still used by some firms generally feeds the oil direct to the cylinder or to the valves, or to both places. When the tallow cup is filled with oil and the dose thrown into the engine, most of it is exhausted at once. Then the engine runs on what little oil may be left and, after a few minutes, it is running without any oil until such time as a new dose is given. It has been found that the steam itself, which goes from the steam main into the engine and touches every part of the frictional surfaces, is the best medium to carry the oil to the places where it is needed.

It is important, however, for the steam to be impermeated with the oil. This can best be done by the use of an atomiser. Fig. 1 illustrates a form which was designed by the author, and of which about 10,000 are known to be in regular use. It has been freely copied by engine builders and others, not being patented. The cylinder oil will enter the spoon-shaped open end of the atomiser, which is placed in the centre of the steam pipe, where the velocity of the steam is greatest, and every drop of oil which appears in the open end will be broken up into small particles, and be distributed in the body of the steam, making the steam itself a lubricant. The steam, on its way through the engine, will therefore carry along particles of oil which will come in contact with all surfaces needing lubrication; and, assuming that the cylinder oil is a good one, specially selected for the class of work, perfect lubrication will be ensured.

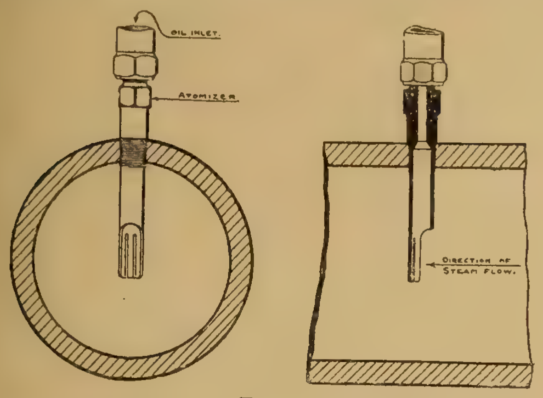

FIG. 1.

Where compound engines are lubricated by feeding the cylinder oil into the high-pressure steam main, it is quite evident that, as the oil gets thoroughly broken up into the steam, the latter may often arrive at the low-pressure cylinder having sufficient lubricating properties to effect full lubrication. In many cases, therefore, it is not necessary to have oil fed direct to the lower stages.

Where superheated steam is in use, it is absolutely essential that only the highest grade of oil be employed, also that the lubricator should be of a first-class make of the mechanically-operated forced-feed type, capable of furnishing a very sparing and uniform feed of oil into the main steam pipe, the oil being introduced into the central flow of steam, by the means already mentioned. The characteristics of a cylinder oil for use with a superheat should include a fairly high flash-point, and no tendency to carbonisation. On occasions cylinder oil has been used for superheated steam having a flash-point lower than the temperature of the steam, and giving good results. This may appear somewhat contradictory, but the secret is that the flash-point of cylinder oils is determined in the laboratory under atmospheric pressure. If the cylinder oil were to be tested under the high pressure existing in the steam pipe, the flash-point would undoubtedly be shown to be considerably higher, just as the boiling point of water, which at atmospheric pressure is 212 deg. F., increases with any pressure above that of the atmosphere. Furthermore, there is no air in the steam to affect the oil.

Most of the cylinder oil introduced into a steam engine will be carried through with the exhaust steam, and in the case of surface-condensing engines, or where open feed-water heaters are installed, there is a great probability of the oil getting into the boilers, which would decrease the boiler efficiency considerably, and increase the danger of boiler explosion or furnace collapse.

Cylinder oil can be made which will separate readily from the feed-water in the hot well, presenting itself as float oil, which can be skimmed off. Sometimes feed-water filters are installed, which are supposed to prevent the oil from getting into the boilers. These filters are, as a rule, of very little use, whereas suitable-sized oil extractors in the exhaust steam line will, in many cases, extract nearly all the cylinder oil.

Electrical treatment of the feed-water will extract every trace of oil. In the case of jet-condensing engines, the possibility of oil getting into the boilers is very much less than in the case of surface-condensing engines, as the oil is mixed with such large quantities of water.

When the boiler feed-water is hard, and softened by boiler composition, and the boilers "prime," the solid matters carried over to the steam engine will deposit themselves behind the piston rings, in the clearance spaces of the cylinders, and in other places, amalgamating with the cylinder oil and forming deposits, the presence of which is often put down to carbonisation of the cylinder oil. It is true that unsuitable or low-grade cylinder oils may form deposits and carbonise, but in many cases the deposit can be traced back to the boiler conditions.

In combined reciprocating engine and turbine plants it is most essential that the highest-grade cylinder oil be used, in order that the quantity of such oil for the engine lubrication may be cut down, to reduce the chance of oil being passed on to the turbine.

In the forced lubrication system of high-speed enclosed steam engines the oil is forced by a pump under pressure to all bearings, draining back to the oil suction chamber, and in this way circulating continuously. Oils for this purpose should be made to withstand the action of water and air, and must not deteriorate with long use. Water gets into the crank chamber owing to the presence of ill-fitting glands or "scored" rods. Where the rods enter the crank-chamber top, scrapers are preferable to soft packing. The oil which is carried up from the crank chamber and scraped off, together with the water, should be drained outside the crank chamber. Metallic packings are preferable in such engines, as there is less danger of "scoring" the rods than with soft packing.

The oil pump should be of ample capacity, so that the pump pressure, by means of an adjustable relief valve, with an overflow to the oil suction chamber, can be kept at any desired point. Too small an oil pump or slack bearings decrease the oil pressure, or make it necessary to use exceedingly heavy oils, which oils reduce the friction less than might be. The oil pump should be placed with its suction strainer elevated to leave room below for the water to accumulate. Otherwise water is drawn together with the oil into the pump and forced through the bearings, which may cause the oil to thicken. The crank chamber should be systematically drained at suitable intervals. Slightly superheated steam is an advantage, as less condensation occurs in the cylinders; therefore less water finds its way through the glands.

A drain cock of preferably 1½-in. bore, but not less than 1-in. bore, should be fitted at the lowest point in the crank chamber, and if the water can be drained off while the engine is running, this should be done at frequent intervals. Where the draining cannot be accomplished while the engine is running, it should be done before starting up every time the engine has had a rest.

Every plant (this also refers to turbine installations) should have a steam filter, so that from one to six gallons of oil per day (according to conditions) may be removed through the drain cock for treatment in a steam-heated separating tank, and afterwards in a good filter. The purified oil should be returned to the crank chamber at the same time as the corresponding quantity is drawn off for treatment. In this way the vitality of the oil can be maintained at a high standard. If the oil tank capacity in the system is small, it is particularly desirable to follow this treatment. Sometimes a "water-leg" can be fitted with good results to the crank chamber of a steam engine where the leakage of water into the crank chamber is considerable.

Only small turbines, from 5 to 300 H.P., have ring-oiled bearings; larger turbines employ the circulation system. In the circulation system the lower portion of the governor spindle drives a rotary oil pump, which takes oil from the oil tank, and delivers it, through the oil cooler and oil-supply pipes, directly to the bearings, or to an elevated tank. If more oil is delivered to the elevated tank than is required for the bearings, the surplus oil overflows through a pipe into the bottom oil tank.

From the elevated tank the oil is fed through the distributing pipe into the various bearings of the turbine, and having done its work in the bearings—the oil throwers preventing the oil from creeping out along the shaft—the oil returns through the return pipes to the bottom oil tank, through the strainer. The main bearings are frequently cast with inside cavities for water-cooling purposes.

The elevated tank is only used in very large installations. Generally, the oil passes from the oil cooler directly into the distributing pipe; it then becomes necessary to have a spring-loaded relief valve in the delivery pipe, near the bottom oil tank, in order to maintain an adequate oil supply at a steady pressure. The surplus is returned to the bottom oil tank.

It is good practice to insert in the return oil pipes sight-feed arrangements by which the actual flow of oil from each particular bearing can be examined; frequently test cocks are fitted in the middle of the bearing tops, which, when opened, will show whether the bearing is being adequately supplied with oil. In both the elevated oil tank and the bottom oil tank are fitted drain cocks, through which water and sludge can be drained away.

The oil pressure, where the oil is used for lubrication only, varies between 3 lb. and 35 lb. per sq. in. Frequently, the oil is also used for operating the governor gear. For this purpose, oil is introduced into the various parts of the governor gear operated by the oil under a pressure of from 25 lb. to 80 lb. per sq. in. If, for any reason, the oil pressure falls below that required, a piston in the governor gear, held up by the oil pressure, falls and causes the steam supply to be shut off.

Where an elevated tank is employed, sufficient oil is usually assured to lubricate the turbine for at least 30 minutes, should the oil pump fail to work.

Where turbines are lubricated by means of a circulating oil system, the oil is in constant circulation and comes in contact with more or less air and water. In passing through the main bearings, the oil is churned with the air, water and impurities present, with the result that the oil breaks down gradually, due to the high temperature and great speed of the revolving shaft.

The chief cause of water leaking into the oil is usually the gland packing. Steam passes from the gland packings into the main bearings and condenses on their surfaces. In cases of exhaust and mixed-pressure turbines, it is particularly difficult to prevent leakage of condensed steam from the glands to the bearings, and the engine attendant should use great care to keep this leakage as low as possible. Water may also leak into the oil from the water-cooling coils in the oil cooler, or from the water jackets of the main bearings.

Where leakage of water into the oil system cannot be avoided, a water-trap consisting of, say, 4 ft. of vertical 2-in. pipe with a 1-in. drain cock at the bottom, and fitted to the bottom oil tank or main oil return pipe, has been found of great service. The water, circulating with the oil, will separate from it and drain into the trap; once there it cannot mix with the oil again. This water-trap should be drained twice every 24 hours, letting the water and sludge run until clear oil appears.

The drain cocks on the oil tanks should be opened before starting up the turbine, and twice every 24 hours, to remove water and impurities. The suction of the oil pump should be from 4 to 6 in. above the bottom of the oil tanks, as otherwise any separated water will be immediately taken up by the pump, churned with the oil, and passed into the oil system.

It is good practice to have a large quantity of oil in circulation, with large oil tanks in which the oil has time to rest and separate from the air, water, dirt and other impurities it collects in the system.

The continuous circulation of oil in the system results in a final breakdown of the oil itself, due to the action of heat, moisture and air. The evidences of breakdown are, increase in viscosity and gravity, the development of considerable acidity, and the deposit of sludge, or sediment. The length of service of an oil and the character of the breakdown are dependent upon the quality of the oil. An unsuitable oil breaks down quickly and goes to pieces badly. A high-grade oil, under normal conditions, will give good service for 10,000 working hours at least; but under severe and very unfavourable working conditions, for 3,000 working hours at most.

A sample of "broken-down" oil, when heated, will separate into three distinct layers: At the top, clear oil; at the bottom, clear or somewhat cloudy water; between the two, a slimy mixture composed of a number of indeterminate elements. This slime represents the "broken-down" oil, and may be due to its unsuitability or incorrect manufacture, or to some chemical or electrical action on the oil in service.

"Broken-down" oil accumulates in the most dangerous places, namely, the oil pipes which lead the oil from the distributing pipe into the main bearings. Partial stoppage of the pipes may result. "Broken-down" oil also accumulates, as a slime, on the water-cooling coils in the oil cooler, thereby decreasing the efficiency of the cooler; the circulating oil assumes a temperature higher than the normal, which in extreme cases greatly impairs the life of the oil.

If "broken-down" oil forms in the oil pipe leading to the governor, or inside the governor gear, the governor may stick and fail to act; in consequence, the turbine either will slow down gradually, or gradually increase in speed much above the normal.

The parts of the governor gear with which the oil comes in contact are very sensitive, and the oil must be absolutely clean and of high quality to ensure their smooth working. With an unsuitable grade of oil, the bearing temperatures are always high. The rate of oil oxidisation—generated by the great heat—is thus increased, so that frequently the life of an ordinary oil in a turbine is only a few months.

High-grade oil, correctly refined and manufactured specially for turbine lubrication, is less affected by the presence of air, water and other impurities than ordinary oil. High-grade oil clears quickly, and is not so liable to breakdown. It will prevent high bearing temperatures and will provide a greater margin of safety.

The "make-up" for lost oil, due to leakage and vaporisation, will vary according to the size and operating conditions of the turbine; and when high-grade oils are used, this replacement is usually sufficient to keep the oil in satisfactory working condition for a long time. When, however, the limit of the oil's capacity has been reached, entire replacement with fresh oil is recommended.

When starting up a new turbine for the first time, there are always present in the circulating system impurities, such as cotton waste, rust, sand and dirt, packing material, etc. It is, therefore, good practice to run the turbine for one or two weeks, then remove the entire supply of oil from the system and re-charge with new oil. The oil taken out should be allowed to rest in a large tank to separate it from the impurities. The separated good oil can then be used as "make-up" for the turbine.

Should the charge of oil first removed from the turbine be badly affected by abnormal quantities of impurities, the oil should be heated and, after separation from the bulk of impurities, should be passed through a good filter before use.

After a turbine starts running, the temperature of the oil gradually increases and finally becomes constant; in a small turbine, after four hours' continuous running, and in a large turbine after nearly a whole day's continuous running.

The bulk of the heat absorbed by the oil is removed by means of the cooling coils in the oil cooler. The resultant temperature of the oil depends partly upon the temperature of the cooling water used, but principally upon the capacity and size of the coils in the oil-cooler. Where the main bearings are water-cooled, the temperatures are lowered about 10 deg. F.

The temperatures are very important in judging the efficiency of the lubrication and cooling, and it is a wise precaution to take temperature records every half-hour, or every hour, as follows:—(*a*) Temperature of each main bearing (or of the oil return from each main bearing). (*b*) Temperature of the oil before entering oil cooler. (*c*) Temperature of the oil after leaving oil cooler. (*d*) Temperature of the cooling water entering oil cooler. (*e*) Temperature of the cooling water leaving oil cooler. If any abnormal condition arises in one of the bearings or in the oil cooler the temperature records will immediately locate the place of trouble. By introducing high-grade oils where lower grades have been in use, a reduction in temperature above room of more than 20 per cent. has been obtained, all other conditions being the same.

On occasions, oil vapours come from the bearings and oil tanks, notwithstanding the fact that the bearing temperatures are quite normal. These vapours are drawn into the electric generators from the bearings and may cause disastrous results. The cause of the vapours is the heavy charging of the oil with tiny air bubbles, due to the high speed at which the oil is circulated through the bearings and oil pipes. When the air bubbles burst in the bearings or in the oil tanks, the resultant very fine spray of oil produces the vapours.

The oil will be found creeping over the outside of the main bearings and the turbine frame in a very fine film, and the oil loss may be considerable per 24 hours. The oil return pipes from the bearings should be large enough to carry away the oil, the oil foam, and the oil vapours.

If the pipe is not large enough for this purpose, a remedy for the escape of oil vapours from the bearings is secured by the addition of a vent pipe, venting the oil reservoir of the bearing at a higher level than the original pipe.

As shown in the preceding paragraphs, the oil used in horizontal steam turbines is subjected to severe strain. The general belief among engineers in the past has been that petroleum lubricating oils were indestructible. This is very nearly true in practice, where the older methods of lubrication are employed. Where, however, the turbine is lubricated by means of a circulating system, in which the oil is forced to the bearings under pressure, thence collected, filtered, cooled, and repeatedly returned to undergo the same severe service, deposits may form, due to the breaking down of some portions of the oil from the following causes:—(*a*) Water. (*b*) Solid impurities. (*c*) Air and heat. (*d*) Electric action. (*e*) Adding new oil.

Water has an emulsifying effect on the oil, particularly if the water contains impurities. Where considerable quantities of water leak into the system and emulsification takes place, the mixture becomes yellow or brownish-yellow in colour. If a sample is taken out and heated, it will separate into clean oil at the top, more or less milky water at the bottom, and a spongy sludge separating the two. The clean oil will be found darker in colour than the original, with a strong characteristic odour. It will have a higher viscosity and will contain a percentage of petroleum acids as a result of the breaking down of the oil from oxidation.

These petroleum acids must not be confused with sulphuric acid, which is sometimes found in mineral oils that have been treated with this acid during their manufacture. Most chemists, following the European custom, now report the acidity of used oils in terms of "sulphuric anhydride (SO_3)." The normal alkali used is of such strength that when 25 cubic centimetres are required to neutralise the petroleum acids in 100 grammes of oil, the result is expressed as "1.0 per cent in terms of SO_3," and this equals "7.05 per cent. in terms of oleic acid."

The petroleum acids do not attack the metals ordinarily used in the construction of steam turbine lubricating systems, but they do slowly dissolve zinc or alloys consisting largely of that metal. The nature of the sludge in the oil, produced by the water, is most objectionable, as it tends to clog the oil strainers, oil inlets to the bearings, and oil inlet to the governor. The oil pressure also will be reduced, if the oil pump fails to deliver the requisite quantity of oil because of the partial choking of the strainers.

Owing to the high temperature at which the oil passes through the circulating system, the oxidising effect of impurities such as iron oxides, dust and dirt, etc., is very considerable, particularly where ordinary oils are in use. The effects produced are the quick darkening of the colour of the oil, a considerable increase in viscosity, the production of a large percentage of petroleum acids, and the breaking down of the oil from oxidation. The oil in this condition smells "burnt" and throws down a slimy deposit which lodges particularly in the oil cooler.

In addition, if there is even a slight leakage of water into the system, the oil will emulsify badly, owing to its already weakened condition from the oxidising effect of the air and solid impurities. This will explain why, when starting up a new turbine for the first time, emulsification of the oil may occur as a result of the combined effects of the water, air and dirt present, even though the oil may be of high quality.

Occasionally, the inside of the oil tank is painted, and in most cases the oil, in time, dissolves and decomposes the paint, with the result that, in mixing with the oil, the ingredients in the paint cause heavy oxidation of the oil, and in the presence of water emulsification takes place. It is better to keep the inside of the oil tanks scrupulously clean and scraped free from surface rust and dirt, rather than try to cover up the bad surface with a paint that is not "oil-proof."

The circulating oil always contains more or less air, and when the temperature of this oil is above normal, say, higher than 140 deg. F., the air has an increasingly strong tendency to oxidise the oil. This will be realised when it is remembered that the oil film in the bearings is very thin, and that the air is present in very fine bubbles, which are intimately mixed with the oil. The result is that the oil darkens considerably in colour. In extreme cases, a very dangerous black carbon deposit develops, which may choke the oil inlets to the bearings and cause the oil-worked piston in the governor gear to stick.

If there is a leakage of electric current from a direct-current generator, the current will pass through the shaft down through one of the main bearings, through the bedplate, and up through another main bearing back into the shaft. In the case of an alternating-current generator, in which the magnetic field is out of balance, a so-called induced current is produced in the turbine shaft.

In either case, the oil will quickly darken in colour, increase in acidity, and throw down a deposit which will coat all parts of the turbine with which the oil comes in contact, lodging particularly in the oil cooler. This deposit is of a fairly hard, brittle nature, and of a dark chocolate colour; it is exceedingly difficult to remove and is, therefore, very objectionable.

The remedy is to electrically insulate one of the generator main bearings completely from the turbine bedplate, including the connections between the oil pipes and that particular bearing. Such insulation will prevent the passage of an electric current, and, consequently, the formation of deposit.

On rare occasions, local galvanic currents may cause corrosion of the oil tubes in the oil cooler, or of the turbine shaft and bearings, and even corrosion in the governor, causing the oil-operated piston to stick.

Where practically no water enters the circulating system, and where there is practically no waste or leakage of oil, so that the amount of new oil added to the system per week is very small, the oil will, in time, become very dark in colour with considerable increase in acidity. In such cases it has been found that when adding new oil a dark deposit is thrown down throughout the system, due to the action of the old oil on the new; and more particularly is this the case with heavy oils than with light oils.

In reviewing the various causes of the formation of deposit, it will be observed that decomposition of the oil is invariably followed by a darkening in colour and an increase in the percentage of acidity. Therefore, both these features can be taken as standards by which to judge how far the oil has deteriorated; no oil should be used in a turbine if the acidity has reached 0.3 per cent. of petroleum acids in terms of SO_3.

Castor oil is still used in marine practice, and also in case of emergency in many plants ashore. It is a great waster of power, increasing the oil friction about 100 per cent. above what a high-grade engine oil will produce. Also, it produces a gummy deposit throughout the circulation system, due to oxidation. On the main bearings of a steam engine where castor oil was fed through an oil-circulating system, the rise in temperature of the bearings above room temperature was 17 deg. F. By gradually introducing a high-grade engine oil the temperature rise was reduced to 8 deg.

In changing over from castor oil, or any other vegetable or animal oil, to an oil largely mineral in character, it is necessary to exercise care and make the change gradually, as deposits which have accumulated from such oils are loosened, and, if loosened too quickly, cause trouble.

The wear and tear of coal-cutters is very great, due to the rough conditions under which they usually operate, and also to the fact that the men operating them do not, as a rule, give the attention to lubrication that is really most necessary in order to prevent too frequent breakdowns. As a rule, the machines require two different oils, one for the gear case, which should be a heavy oil which does not leak out easily from the gear case, and another oil for the motor bearings, in the case of electrically-operated coal-cutters, or for the air-worked engine in the case of an air-worked machine.

The troublesome bearings to lubricate are the vertical disk bearings (disk cutters), the long sleeve surrounding the base of the bar (bar cutters), and the bearings supporting the chain wheel operating near the coal face (chain cutters).

Where machinery works in a dusty atmosphere, dust is apt to cling to the oil, and for this reason ring-oiling bearings have only been a qualified success. The oil wells must be cleaned frequently in order that the oil may render satisfactory service. Oil siphons are easily choked by the dust, but glass-bottle-needle oilers have proved very reliable and satisfactory in a good many cases. They are, however, liable to be broken off and smashed.

Lubricating grease is frequently used either through Stauffer screw-down cups, or through spring grease-cups, and has given good service under a variety of conditions. The grease fills up the bearing completely and forms a protective fillet at either end, which prevents the entrance of dust to the bearing surface.

There is a marked tendency to introduce ball or roller bearings for colliery screening plants and the like, using grease as a lubricant, and filling the bearings completely with grease, so as to prevent the entrance of dust. When oil is used, felt dust-catchers are fitted in the bearings at either end, and when well designed are quite successful. It would seem as if roller bearings or ball bearings could also be introduced with advantage for coal-cutters in connection with the bearings particularly exposed to coal dust.

It is probable that within a few years transformers will undergo material improvements in design. The troubles that have been experienced in the past with sludging of the oil used in transformers, or the "burning out" of the coils, have largely been due to the fact that the transformers have been exposed to the open, allowing impurities of all kinds to enter the transformer casing and mix with the oil.

Furthermore, transformers have been worked more continuously at their full load, and at higher temperatures than was the case formerly when the electric-lighting load was the chief factor to deal with, allowing the transformers to have a rest and cool down between the peak loads.

Transformers are now being made with "breathers" attached above the oil level, provided with traps to extract the moisture from the air which is inhaled as the transformer cools and the oil shrinks. In other cases an expansion chamber is provided, in which the oil can expand or contract, but where no new air is introduced during the normal operation of the transformer.

Not counting the cases where sludge has been produced by impurities mixing with the oil (open-type transformers), or where the sludge has been due to bad insulating material (which has been affected by the oil), the deposit produced by sludging is always the result of oxidation, and has only taken place where the working temperatures of the transformer have been above a certain critical temperature, which critical temperature is different for different oils. For these reasons it is obvious that if the transformer casing is hermetically closed, and no renewal of air can take place, the danger of sludging will be very greatly minimised.

As to general characteristics of transformer oils, they should be possessed of good dielectric strength and high specific resistance in order to perform their functions as insulating mediums. A low viscosity is always a great advantage, also a great coefficient of expansion, as these two features combined mean quick circulation of the oil, enabling the heat from the windings to be dispersed quickly into the body of the oil, and finally to the transformer casing, from which the heat eventually radiates into the surrounding air.

As regards oil switches, the conditions in D.C. switches are much more severe than in A.C. switches. The desirability of low viscosity is obvious for switch purposes, as the more mobile the oil, the quicker will the arc be quenched. The oil should produce as little carbon as possible, and oils in which the carbon quickly flocculates and sinks to the bottom are to be preferred to oils in which the carbon is kept more or less floating.

It is important that the oil level should be kept high in the switch case, covering the contacts to a sufficient depth, so that even with the strongest current there is no chance of the spark breaking through to the surface and igniting the gases that may be present. With reference to this latter point, the ventilation of the switch case is important, and it is also important that the switch case should be kept as full of oil as possible, leaving a minimum space for the gases to accumulate.

Electrical Trades Benevolent Institution.—In a circular letter the President of this Institution, Sir David Salomons, informs its friends that owing to the war, the annual Festival of the Electrical Trades Benevolent Institution will not be held this year. As the cancellation of the Festival deprives the fund of its chief source of income at a time when very heavy demands are made upon its resources, the Committee appeals to subscribers to renew their contributions upon an even more liberal basis than in past years, and expresses the hope that the urgency of the claims made upon the fund will bring a large influx of new subscribers. It is suggested that subscribers should add to their usual donations the guinea which would otherwise have been spent upon the ticket for the Festival. Whilst admitting that many calls are now being made for benevolent purposes, Sir David Salomons points out that this appeal is being confined to those who are actually engaged in the electrical industries, and is made on behalf of fellow workers whose needs are great and increasing. We cordially recommend the matter to the notice of our readers, assuring them, with the confidence born of personal knowledge, that the Institution is in every way worthy of their support, and that the continuous demands that are now being made upon its funds render it an urgent necessity that those funds should be greatly increased.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

11,443. "Spark gaps for wireless telegraphy." G. V. A. G. Mathieu. August 9th. (Complete.)

11,457. "Electricity distributing networks." M. Hochstadter. August 9th. (Complete.)

11,473. "Alternating-current motors." British Thomson-Houston Co., Ltd. (General Electric Co., United States). August 9th.

11,480. "Band resistance for use with electric pedal switches." R. Bosch (firm of). August 9th. (Divided application on 2,236/15. Convention date, July 29th, 1914, Germany.) (Complete.)

11,510. "Dynamo-electric machines." U.S. Light & Heat Corporation. August 9th. (Convention date, August 14th, 1914, United States.) (Complete.)

11,511. "Leclanche cells, and methods of and means for resuscitating the same when apparently exhausted." J. T. Fahy & A. E. Otway. August 9th. (Complete.)

11,512. "Electric connections for electrically-heated irons and the like utensils." C. Kretz. August 9th.

11,544. "Manufacture of incandescent electric lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States). August 10th.

11,553. "Electrically operating alarms and signals." J. R. Quain. August 10th

11,555. "Production of undamped or sustained electrical oscillations." F. K. Vreeland. August 10th. (Complete.)

11,566. "Explosion engines with dynamo-magnetic ignition." Soc. Anon des Etablissements L. Bleriot. August 10th. (Convention date, September 16th, 1914, France.) (Complete.)

11,568. "Electrical transformers." A. Schaanning & G. Harlow. August 10th.

11,598. "Electrical transmission gears." R. E. Raven. August 11th.

11,600. "Automatic telephone systems." Relay Automatic Telephone Co., Ltd., F. M. Ward, G. H. Bryant, & T. M. Inman. August 11th.

11,603. "Control of hydro-extractors." T. Broadbent & Sons, Ltd. British Thomson-Houston Co., Ltd., and W. L. Wise. August 11th.

11,655. "Telephone systems." Relay Automatic Telephone Co. & W. Aitken. August 12th.

11,658. "Pneumatically-operated controllers." British Thomson-Houston Co., Ltd. (General Electric Co., United States). August 12th.

11,660. "Arc lamp with enclosed voltaic arc." Allgemeine Elektricitats Ges. August 12th. (Convention date, August 13th, 1914, Germany.) (Complete.)

11,690. "Electric regulator or governor." B. O. Holm-Hansen. August 12th. (Complete.)

11,712. "Electric generators." D. Suchostawer. August 13th.

11,715. "Pivots and jewels for measuring-instruments and the like, and methods of manufacturing the same." British Thomson-Houston Co., Ltd. (General Electric Co., United States). August 13th.

11,723. "Lamp-holders for electric lamps." E. F. Guth. August 13th. (Convention date, January 21st, 1915, United States). (Complete.)

11,768. "Systems of control for electric motors." British Thomson-Houston Co., Ltd. (General Electric Co., United States). August 14th.

11,776. "Telegraphic transmitting apparatus." F. B. Dahl. August 14th.

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1914.

1,157. Telephone Systems. Siemens & Halske Akt. Ges., E. A. Laidlaw, and T. Pettigrew. January 15th. (Additions to 18,498/12.)

1,181. Method of Producing Movements of an Indicator or the like in Electric Apparatus for other instruments. W. Lubach. January 15th.

1,452. Overhead Conductors of Electric Railways. K. von Kando. January 19th.

2,424. Loud-speaking Telephones. Sterling Telephone & Electric Co., Ltd. (Telephon-Fabrik Akt. Ges. vorm J. Berliner). January 19th.

2,548. Electric Accumulators. Van Raden & Co., Ltd., and M. Metz January 31st.

3,209. Manufacture of Incandescent Electric Lamps. C. Gladitz. February 6th.

3,311. Protection of Electric Circuits against the Influence of Alternating Currents. K. von. Kando. February 7th.

3,658. Working or Controlling of Electrical Machinery. Siemens Bros Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.). February 12th. (Addition to 1,716/10.)

4,188. Electric Signalling Systems for Burglar and Fire Alarms. O. Reich. February 18th.

4,223. Signalling Apparatus for Mines. Sterling Telephone & Electric Co. (Telephon Fabrik Akt. Ges. vorm J. Berliner). February 18th.

4,233. Electrically-driven Vehicles. K. von Kando. February 18th. (Addition to 963/14.)

4,803. Alternating-current Motors. Phœnix Dynamo Manufacturing Co. and R. Pohl. February 24th.

7,342. Electric Motors. E. K. Kennard. March 23rd. (October 23rd, 1914.)

11,211. Register Circuits for Telephone Installations with Separate Setting and Speaking Paths. Siemens & Halske Akt. Ges. May 6th. (May 6th, 1913. Patent of addition not granted.)

11,621. Machine for Cutting Electric Bulbs for Regenerating them. Baron A. O. von Bátorkéz und Verinkház. May 11th. (May 10th, 1913.)

11,709. Antennæ for Wireless Telegraphy or Telephony. J. Schiessler December 20th. (Divided from 29,447/13, October 16th.)

12,259. Method and Means for the Production of Sustained Electric Oscillations, particularly for Radio-telegraphy and Radio-telephony. W J. Mellersh-Jackson (Fratelli Marzi di G.B.) May 18th.

14,746. Covers or Fittings for Electrical Conduits. H. H. Longbottom. and T. Farrar. June 19th. (December 21st, 1914.)

15,539. Electric Railway Systems. Right Hon. C. E. H. Hobhouse, W. Slingo, H. C. Gunton, W. H. Powell, and J. R. Kingston. June 29th.

17,455. Means for Cooling Electro-magnetic Friction Clutches, and more particularly Reversing Clutches. "Vulkan" Maschinenfabriks Akt. Ges. July 23rd. (August 16th, 1913.)

17,511. Electrically-operated Fastenings for Railway Carriage Doors and the like. J. E. Crossley. July 24th.

17,628. Electrical Dust Suction Apparatus. Bünte & Remmler (firm of) July 25th. (August 29th, 1913.)

17,920. Telegraph Circuits. A. Orling & Orling's Telegraph Instruments Syndicate, Ltd. July 29th. (Cognate application, 23,167/14.)

18,202. Step-by-step Mechanism suitable for Starting Electric Motors. Sir W. G. Armstrong, Whitworth & Co., Ltd., and W. H. Waddingham. August 1st.

18,353. Starters for Electric Motors. Siemens Bros. Dynamo Works and E. Schupp. August 7th. (Addition to 5,514/14.)

18,465. Excess Voltage Devices for Protecting Electrical Circuits and Apparatus. Siemens Schuckertwerke Ges. August 8th. (August 21st, 1913.)

18,751. Coherers. British Thomson-Houston Co. (General Electric Co., United States). August 17th.

20,137. Circuit Arrangements for Writing Telegraphs. A. G. Bloxam. (Telepantograph Ges.). September 24th.

20,322. Control of Electric Motors. Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). September 29th.

20,409. Fusible Filling and Insulating Material for Electrical Purposes. H. Grossman. October 1st.

21,643. Electrically-operated Alarm Device for use in connection with Door Locks and Catches. T. Kerr. October 28th.

21,676. Squirrel-cage Windings of Dynamo-electric Machines. British Thomson-Houston Co., Ltd. (General Electric Co., United States). October 28th

21,766. Electric Concertina. N. W. M. Holt. October 30th.

22,150. Electric Water-heater. J. F. Wheelock. November 6th,

22,248. Electric Transformers. O. Imray (Siemens Schuckertwerke Ges.). November 9th.

24,496. Apparatus for Cooling Electric Motors. J. W. Nolan. December 22nd. (February 2nd, 1914.)

1915.

1,006. Register Circuits for Telephone Systems. O. Imray (Siemens and Halse Akt. Ges.). January 21st.

1,973. Electro-optical Cells. C. Stille. February 8th. (February 6th, 1914.)

1,995. Means for Setting Selecting Devices by Electric Current Impulses. O. Imray (Siemens & Halske Akt. Ges.). February 8th.

2,093. Electric Wave Amplifying Apparatus. Western Electric Co., Ltd. (Western Electric Co.). February 9th. (Addition to 275/15.)

2,462. Arrangement for the practically Sparkless Interruption of an Electric Current. Fried. Krupp Akt. Ges. February 16th. (February 19th, 1914.)

3,213. Device for Anchoring or Attaching Unarmoured Electric Cables and Wires to Apparatus or Fittings. A. E. Foster. February 27th.

4,353. Thermic Telephones. Elektrotechnische Spezialkonstruktionen Ges. March 19th. (March 24th, 1914.)

4,912. Transmission of Sound Waves. E. M. Tigerstedt. March 30th. (March 30th, 1914.)

6,805. Apparatus for the Electric Transmission of the Energy of a Heat Motor to the Driving Wheels of a Vehicle or the like. P. Biles. May 6th. (Divided application on 10,275/14, April 25th.)

7,963. Telephone Instruments. G. G. Turri. May 28th. (June 1st, 1914.)

Utilising Scrap Nickel Anodes.—The loss on sale of worn-out anodes has always been a weak point in the electroplater's balance-sheet. Due to a variety of causes, the anode rods or plates dissolve more or less unevenly so as to become unsafe for use long before the weight of metal has been reduced to the limit theoretically imposed by consideration of current-carrying section and active surface area. The metal in the "worn-out" anode is every bit as good as that already dissolved away, but the scrap price obtainable for it is only about half the price per lb. for new anode metal. By inverting anodes after they have been in use for a time, something can be done to even out the distribution of wear, but a big wastage still occurs. Attempts have been made in the past to hold together a number of pieces of scrap nickel anode by drilling them and pressing a lead "rivet" through the holes. Sometimes the result is satisfactory, but more often it is not, since dependence has to be placed almost entirely on the lead rivet for interconnection, and imperfect contact means more or less of the built-up anode being ineffective.

The exact form of the anode is unimportant. All that is necessary is that it should be of sufficient superficial area, electrically continuous throughout, and free from any metal setting up local electrolytic action or (which would be more serious) dissolving in preference to the main anode and contaminating the deposit on the work. A certain American plating firm practises a method which is at once simple, economical, and electrochemically unobjectionable. Bar anodes of elliptical section are used in the first place, and when these become broken or too reduced in area, a number of those most worn are welded together to form an electrode, which is just as effective as a new bar. The brass hooks used to suspend the anodes in the first place are melted out of the ends of the scrap by aid of an oxy-acetylene flame, which is then used to weld together as many pieces of scrap nickel as may be necessary to form the equivalent of at least one new bar anode. No flux is required, the pieces of scrap being easily fused together, while holding another piece in the welding flame for "filling" purposes. So long as the joints are sound, their appearance is quite immaterial, and no particular skill is required to do the work. Between 100 and 150 cb. ft. each of oxygen and acetylene is sufficient to weld up a hundredweight of scrap bar anodes, the time required being six or seven hours. The cost of rendering the scrap fit for re-use is somewhere about 3d. a lb., and the effect of so doing is to double the actual value of the metal by converting it in effect, to new metal. With anodes at 3s. a lb. there should be a net gain of at least 1s. 3d. a lb. on all scrap welded up for re use. Only a negligible amount of metal need be sold as scrap, and the process certainly deserves to be generally known and adopted, for no special equipment or training is required to put it into practice, and just at present, in particular, any means of reducing the consumption of new metal is of particular importance, owing to high prices and delay in delivery.

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Vol. LXXVII.] CONTENTS: September 3, 1915. [No. 1,971.

Page
Coal Mining ... 289
German Scheming in China ... 290
Metropolitan Munitions ... 290
Copper ... 291
An A.E.G. Development ... 291
The Trend of Electrical Development ... 292
Trade Entente after the War ... 293
German Engineers in China: A Glance at their Methods, by Prof. C. A. Middleton-Smith ... 294
Correspondence—
  Wrinkles on the Operation of Alternators ... 295
  Extraction of Oil from Feed Water ... 295
  Units from Refuse ... 295
  London Electrical Trades Arbitration ... 296
  New Battery Signalling Bell ... 296
Legal... 296
New Electrical Devices, Fittings and Plant (*illus.*) ... 297
America and Argentine Trade ... 298
Trade Statistics of Egypt ... 299
War Items ... 300
Reviews ... 302
The Russian Electrochemical Industry ... 303
Business Notes ... 304
Notes ... 308
City Notes ... 310
Stocks and Shares ... 311
Share List of Electrical Companies ... 312
Market Quotations ... 312
Metal Market—Fluctuations in August ... 313
Encouraging the use of Electric Motor Vehicles ... 313
Progress in High-Frequency Alternators (*illus.*) ... 314
Third-Rail Construction on the L. & Y. Manchester—Bury Line (*illus.*) ... 315
Turbine Pumps for Colliery Pumping ... 316
Oil Circuit Breakers: Notes on Arc Phenomena and Tendencies in Design (*illus.*) ... 317
Foreign and Colonial Tariffs on Electrical Goods ... 320
New Patents Applied for, 1915 ... 320
Abstracts of Published Specifications ... 320
Contractors' Column ... Advertisement page xviii

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COAL MINING.

To the man in the street, a coal-owner is a very-much-to-be-envied person, and without doubt there are very many lucky individuals drawing handsome incomes from coal royalties, the coal having been discovered on their property by accident, or by some other person or persons risking their money in boring operations to find it. The owner of the coal does nothing, risks nothing, to obtain the coal, but he may, and often does, put certain restrictions and conditions on those who do take the risks. In effect the coal-owner really and truly "gets something for nothing." We agree with the man in the street that it does not seem right—to the collier working at the coal face it seems a "damnable wrong"—but it was ever characteristic of the British love of justice, that whatever it *allowed* to be, became a *right* to the individual, and while most of us may bemoan the fate that made us into common individuals instead of *coal-owners*, we have the good sense to bow to the force of circumstances and not to begrudge the coal-owner his good luck. There are other coal-owners, however, who bought the rights to the coal royalty, and they are, therefore, in quite a different category seeing that they have invested capital, and we suppose even the miner would admit the right of such an owner to charge a royalty. He (the miner) would admit the right, but possibly only on condition that he could have a satisfactory answer to the Socialist's poser, "Where did he get his capital?"

The colliery owner, however, is in a very different position. He does not own the coal—he works it. He risks his capital in sinking shafts, putting up plant, buying wagons, and laying railways, to enable him to get at the coal, bring it to the surface, and deliver it to the consumer. In this respect colliery owning is not different from any other industry, except that perhaps there is a good deal more risk, and there is certain to come a day when the yield is ended. A new mine in a new coalfield will attract much capital, and for the first years may give big returns—but there is sure to come a time when costs increase and the yield becomes less. There may, however, still be much valuable coal to be obtained—and in the days in which we are now living coal is as good as gold—but is it to be left, and finally lost to the nation, simply because the colliery owners, owing to the increased cost in obtaining it, cannot sell it at a profit? The old coalfields are always in competition with the new coalfields; the old nearly worked out colliery is struggling against the competition of the new up-to-date pit, fitted with its fine modern plant. The owners of the old pit would like to make improvements to reduce their costs—their own capital, however, is locked up in the old pit, and they cannot obtain new capital. Who, in fact, is going to put good money into an old concern? Only a fool.

The miner works at the face of the coal usually on a piece rate of so much per ton. Much of the work he does might be done with the aid of machinery—but this involves capital, which the old mines cannot obtain. It matters little to the miner to-day whether the pit he works at is an old or a new one; years ago, in the days when the miner was an individual, it did matter. There is, however, an end to the days of the individual, and now the individual miner has become merged in a mass called a Union. The Union has "leaders," who do what the mass tells them to do. These leaders become Members of Parliament, and finally get the ear of the Government; and the Government calls them fine fellows, and gives them all they ask for. They ask for an eight hours' day; they get it. They ask for a minimum wage; they get it. The wealthy owners, with a prospect of 2s. a ton profit can pay it, the poor owners, with a profit of 3d. per ton – How can they pay it? Only by raising the price of coal, which allows the poor owner to exist and the wealthy owners to do better still. The miners see reports of big dividends; small ones have, of course, absolutely no interest for them. They again instruct the leaders to ask the Government to give them a still higher wage, for now it is becoming the custom, not for miners and owners to settle their differences between them, but for the miners to appeal to the Government to force the owners to give them their demands.

War breaks out, every ounce of coal is wanted, thousands of miners are in the trenches risking their lives for their country, yet we have the miserable and disgraceful spectacle of miners at home seizing the opportunity of the country's peril to extort greater demands from the coal-owners. We are in agreement with the *Times*, that unless we are to suppose—and it is unthinkable—that these men actually desire to help the enemy, to sacrifice their fellow-countrymen and fellow-workmen who are fighting for them and the whole national cause, we must conclude that they do not know what they are doing in stopping the supply of steam coal at this time. Though great numbers of the more patriotic ones have gone, we cannot accept the ludicrous argument that this in itself proves the patriotism of those who have stopped at home. As our contemporary aptly puts it: "If somebody is drowning, and A takes off his coat and jumps into the water, his conduct hardly proves the courage of B, who sticks resolutely to the bank, comfortably seated on A's coat. Nor, when he refuses to give A a hand, would the excuse that he is busy keeping his coat warm for him carry much weight. People would say that the first thing is to get A out of the water, because if he is drowned the coat is not much good to him whether warm or cold. We cannot, therefore, admit the plea that men at home are doing their duty to those who are fighting by keeping up their trade position, when the process involves jeopardizing their lives." They want not only an increase in wages, but a new standard which shall embrace the higher rate and shall stand for all time. In other words, they want something for nothing. It matters nothing to them what trade may be like after the war, it matters nothing to them how the poorer collieries may suffer. They expect that the Government will fix matters in such a way that those wages can, and will be, paid. Surely if ever Ministers bought a rod to their own backs, certain Ministers of the late Government did so, and they are now experiencing difficulties which they themselves set up. What will they do in regard to the Welsh miners? What else can they do except settle the strike by enforcing the owners to grant the demands? Anybody can settle strikes on these lines. But what of the future? There lies a problem.

From the chief Mines Inspectors' report just issued we learn that the output of coal was reduced by 21,766,080 tons for the year 1914. We also learn that the number of persons ordinarily employed between January and July was 1,133,746, or an increase of 5,856 over 1913; but on the last pay-day in December of 1914 the number of persons employed had fallen by 152,482 (most of whom have joined H.M. Forces) to 981,264.

The country is passing through a terrible crisis in its history, and the handling of the coal trade by the Government is rendering it still more difficult, but we can only hope it will manage to steer clear of involving the owners in such a mesh that many of them at the end of the war may find it necessary to close down their mines, which is a contingency, however much it may be deplored, that is very likely to happen.

German Scheming in China.

A fortnight ago we published an article from one of our contributors in China on the electrical trade position in that country—vast in area, vast in population, and vast in possibilities. In the main the writer (Mr. G. R. Archdeacon) dealt with the Chinese character, showing how the British trader must needs shape his policy and his methods in order to be successful in winning his way with the Chinese purchaser. To-day we are enabled to publish a contribution from the same quarter of the globe from another esteemed contributor—Prof. C. A. Middleton-Smith, of Hong-Kong University. This writer, whose previous articles, written as the result of observations made from his own peculiar coign of vantage, are well remembered by British firms, touches upon a different aspect of the trade situation. Mr. Archdeacon described Germany as being for the moment "removed from active operations" there, and doubtless that had been his own experience; but he also alluded to their loud acclamations of joy indicating that they were in no doubt as to the future success of their past ventures. Prof. Middleton-Smith to-day shows how great has been the activity of German agents in doing everything possible to undermine British engineering interests there. Though he also describes Germany as "our late trade rivals," he shows that "Germans free to move about the Far East are working as industriously and as infamously against Great Britain as are those in the Fatherland." The "Gospel of Hate" still has its bases there, though Tsing-tao has been lost to Germany for ever. Years before the war we published information from English authorities in China on the methods of our rivals, so that our firms might see the pressing necessity for strong and combined action to counteract German influence. It was the need for such action that led us to make our appeals for the Hong-Kong University equipment, which appeals helped to elicit so excellent a response from British manufacturers. Prof. Middleton-Smith was himself criticised several years ago for speaking the unpalatable truth in regard to the situation, but his attitude, and that of other contributors and of ourselves, is more than justified in revelations that have since been made. Our daily newspapers have contained a good deal on such matters lately, and it is satisfactory to learn of the measures that Britishers on the spot are taking to prevent German traders gaining commercial success, either in the present or the future, from their intrigue. They will require all the support that firms at Home can give them. We commend the Professor's article to the attention of those who want information regarding the necessity of being prepared for what the future has in store in foreign markets. Reference to German after-the-war trade schemes is also made in our "War Items" to-day.

Metropolitan Munitions.

Between two and three months ago, as we announced in our pages at the time, a movement was set on foot for the purpose of utilising all available workshop and other suitable accommodation in the metropolitan area for the production of munitions of war. Since then a large amount of necessary work has been done to that end, and we learn from the authorities that the organisation is now complete, and it lies to the credit of the numerous eminent engineers and manufacturers who have concerned themselves with the matter that already, as we are informed, most excellent work is being done; to use Mr. Lloyd George's words, "the machine is beginning to move." Professional and working engineers alike, as well as those with works' accommodation in their possession or control, will read with interest the announcement concerning the matter that appears in our "War Items" to-day. The metropolitan area has been divided up into 10 sections and a district manager has been appointed with whom are associated an assistant and a munitions engineer. We believe that the electrical profession and industry have been as eager as any class of men or any industry to place themselves, their qualifications, and their specialised facilities, at the full disposal of their country. In some cases they have been disappointed because they appeared not to be needed, but both in the metropolis as well as in the provinces electricity supply "chiefs" have been conspicuously in demand for responsible offices in connection with munitions. Among the metropolitan district managers are to be found some of our leading electricity supply men whose names are most familiar to our readers. We may rest assured that these gentlemen will be found to be well able to make efficient use of the works and factory accommodation and plant which their investigations have shown to be available; also that they will, because of their knowledge of engineering life and training, be able to avoid the needless turning down of offers of competent service. The notice to which we allude indicates that those who have any information to impart which may assist the Committee in its operations may be assured that their help will be very acceptable, also that offers of premises, tools, plant, or services, &c., will be welcomed. Eager as has already been the desire of the metropolitan engineering world to assist, we believe that as the result of this announcement many more offers will be forthcoming from those who want to be turning their technical experience to good account in fighting the enemy.

Copper.

SINCE last writing the copper market has been in a particularly interesting mood, a continued succession of declines in the price of standard copper due to a succession of depressing incidents in the Eastern war region having been succeeded by a violent reaction which added about £6 a ton to the value of warrant copper within a couple of days. The excitement recalled some of the pre-war market days, and considering the critical times through which we are passing, matters almost assumed a normal appearance of activity. There is no doubt that leading interests had been waiting for some break in the monotonous regularity of depressing war news, and that they seized with avidity upon the very modest and temporary turn in the tide intimated by the Riga dispatches to start a bold buying movement in standard copper, recognising that without this their position as big and growing holders of refined would become untenable. A buying movement was certainly overdue judging from all external appearances, and this has been undoubtedly forced on by the sustained upward rush of prices. At the same time the more cautious spirits are of opinion that the movement can only be a temporary one, inasmuch as the conclusion is not to be resisted that the American production of fine copper is now proceeding at a rate distinctly in excess of the consumption. Not sufficient importance has ever been attached to the isolation of Germany from the world's markets. Under recent pre-war conditions, Germany was so far the largest individual consumer of American copper in Europe, and it is absolutely impossible for record output across the Atlantic to be absorbed so long as the German market is closed to United States copper producers. The sequence of events in the London market is merely a facsimile of what has occurred from time to time in past years, when for some reason or other producers have found themselves saddled with the growing accumulation, and when means had to be found to disperse holdings which were becoming weighty. If there is no large admitted surplus in America, it is probably either because considerable quantities of copper have been secretly stored on German account, possibly with the intention of embarrassing the Entente Powers, or with the object of providing a stock of copper immediately available for transference to Germany when the war ends. In either event, the cause matters little, so long as the fact remains. New buying has, of course, been stimulated, and to this extent the object of those who have been pulling the wires in the standard copper market has been attained.

An A.E.G. Development.

THE announcement that the Berlin A.E.G. proposes to assume definite control of the Berlin Electricity Works Co. can scarcely have come as a surprise, having regard to the more than friendly relations which have always existed between the two companies, although astonishment is manifested at the particular time chosen for proceeding with the scheme when it could have been easily undertaken in an earlier period of peace. The supply company was created by the A.E.G. about 30 years ago, and the company had almost a monopoly in the German capital—we say had advisedly, because the company's undertaking is to be taken over by the municipal council on October 1st as at present arranged. Not only was it established by the A.E.G., but the latter had the right of subscribing at par value for one half of the capital increases carried out by the supply company at any time, and it also enjoyed the privilege of being the sole manufacturing contractor for the machinery and plant required in the course of the development of the works over a long period of years. What these advantages have represented in money must be left to conjecture; certainly they must have implied hundreds of thousands of pounds, if not millions, in the course of years. A further factor in the situation has been the concentration of the management of both companies in the same hands, the A.E.G. having received a fixed sum for conducting the business of the supply company. It is now proposed to offer an interchange of ordinary shares whereby one A.E.G. share of £150 nominal would be exchanged for one of £200 nominal of the supply company; and the former intends to increase its share capital by £1,800,000 to £9,550,000, in order to carry the operation into effect. The preference shares of £1,000,000, which have been issued by the B.E.W., will not be affected by the transaction. It is quite possible that the absorption by the Berlin municipal council of the undertaking of the supply company may have exercised some influence in inducing the A.E.G. to strengthen its control over the other company, the continued existence of which, however, was foreseen and assured some years ago by the investment of capital in a number of supply works, and more recently by the acquisition of extensive lignite mines near Bitterfeld. Let us hear what the A.E.G. has to say on the matter. According to a report issued after a recent board meeting, the general situation places before the company the problem of providing compensation for the possibility of a transitory limitation of export activity by means of an increase and extension of its manufacturing branches, and economic generating stations occupy the first rank in connection with such developments. The lignite mines in the vicinity of Bitterfeld of the B.E.W. are intended for this purpose, and the extent of the property has now been enlarged. The report does not specify what work is in contemplation, but it is understood that the output of electrical current, which was originally intended to be transmitted to Berlin, will be utilised in regard to the manufacture of nitrates, both for explosives and for fertilisers, the production of electrolytic copper, &c. An interchange of shares as now projected will relieve the B.E.W. from certain risks in respect to those undertakings, but the A.E.G. feels ready and sufficiently strong to undertake those risks. We thus find the A.E.G. launching upon a fresh undertaking to provide, as it is amusing to read, compensation for the possibility of a transitory limitation of export activity. It would, perhaps, be more correct to say compensation for the certainty of a permanent restriction in the company's exports to the allied countries, even after the conclusion of the war.

THE TREND OF ELECTRICAL DEVELOPMENT.

An interesting presidential address was recently delivered before the American Institute of Electrical Engineers, by Mr. Paul M. Lincoln, on the occasion of the recent Deer Park Convention. He reviews the present position of electrical plant as regards efficiency, and discusses the possible directions of future progress; the following is a summary of his remarks:—

In the matter of efficiency, it has always been recognised that electrical apparatus is in a class by itself. Mechanical energy can be converted into electrical by a generator, or *vice versâ*, by a motor at an efficiency ranging up to as high as 97 per cent., or even more in the most favourable cases; it is safe to say that the average efficiency of conversion of mechanical energy into electrical by generators or electrical energy into mechanical by motors, including all sizes under actual operating conditions, will reach 90 per cent. Owing to the fact that the size of the average electrical generator is much greater than that of the average motor, and that it is possible to operate the generator at higher average loads than in the case of the motor, it must be apparent that the average efficiency for converting mechanical energy into electrical is higher than the reconversion of this electrical energy back into mechanical. The average generator efficiency is undoubtedly well above 90 per cent., while it is doubtful if the average motor reaches so high a figure. Our ability to convert mechanical energy into electrical, or *vice versâ*, has reached so high a value, that even if we could obtain perfection itself, we could add only a matter of 10 per cent. to what we have already accomplished.

The efficiencies of some of our larger transformers, for instance, exceed 99 per cent. The rotary converter, in which alternating current is changed into direct, attains efficiencies approaching 98 per cent. It is evident that perfection itself could not add greatly to existing performances, and hence nothing revolutionary may be expected along this line in the future.

When we come to consider the prime mover, we find a marvellous improvement in recent years. Taking first the water-wheel; the early attempts to develop power at Niagara Falls constitute a significant commentary upon the status of the water-wheel at that time (the late 60's and the early 70's). Of 215-ft. head these earliest wheels used only some 15 or 20 ft. for some of the least progressive, and from there up to possibly 40 or 50 ft. for the more progressive. To-day, water-wheels have no limit in head except that imposed by the strength of available materials, and efficiencies ranging up to 90 per cent. are expected as matters of course. Improvements in water-wheel design will, of course, continue, but perfection itself would add but a matter of 10 per cent. to the best of our modern practice, and not exceed 20 to 25 per cent. addition to the worst. No startling or record-breaking developments need be expected along these lines so long as the law of conversion of energy holds good.

In thermo-dynamic engines, too, the last few years have seen some marvellous improvements; the turbine has enabled us to attain efficiencies in thermo-dynamic conversion that were out of the question with the reciprocating engine of Watt. In the thermo-dynamic conversion the law of conservation of energy takes a peculiar form. If the heat contained in the coal is used to heat a fluid used in a thermo-dynamic engine, the maximum mechanical energy that can be taken from that engine can bear no greater a ratio to the total heat imparted by the fuel to the fluid, than the actual range of temperature used in the engine does to the maximum absolute temperature of the fluid as it enters the engine. Some of the best of our modern steam turbines have attained to as high as 75 per cent.—or possibly a little more—of this "Rankine cycle efficiency." In these most perfect engines, therefore, perfection itself would not add more than 25 per cent. or such a matter. It is only with prime movers of the largest size and most modern design and construction that so close an approach to the ideal can be attained. As capacity is reduced it becomes rapidly more and more difficult to attain the higher degrees of economy in thermo-dynamic machines. This must always remain one of the potent factors in the economics of power supply; it is, and undoubtedly always will be, one of the fundamental reasons why central station supply of electric service must prevail as against isolated plant supply for the same service. The central station can, of course, use units which are very large in comparison, and can be worked at much higher average loads than must necessarily be the case with an isolated plant.

One means that has been suggested to improve the efficiency of the thermo-dynamic engine, is to increase the temperature range through which the working fluid is used. The only two ways to extend this temperature range when using steam are to increase the super-heat or increase the pressure. Increasing the super-heat over the best modern practice does not promise results commensurate with the expenditure of heat to obtain this super-heat, since increasing the temperature at one end of the heat cycle simply involves a loss in the efficiency at the other end. There is a rather definite limit to superheating of steam, beyond which it is useless to go. Increasing the steam pressure does promise results, and it is probable that the tendencies for the future will be toward these higher steam pressures.

Another promising method of increasing temperature range is that, to which attention has been called during the last year or two by Mr. W. L. R. Emmet, of Schenectady, of using mercury as the working fluid in a heat engine for temperature ranges above those available with steam. After working the mercury through a given temperature range, the heat remaining in the mercury is transferred to water, and the steam thus made available is again worked through a lower temperature range. The advantages of this are that the steam cycle is in practically all respects the same as in standard steam turbine practice, and the mercury cycle is closely similar to the steam. Additional energy is made available from the same amount of initial heat due to the greater temperature range obtainable by the use of the mercury. The main disadvantage is the poisonous nature of mercury vapour and the difficulty of absolutely preventing its leakage at the high pressures and temperatures of the mercury boiler. These practical difficulties make it too early to predict whether or not this method will work out as a feasible solution of the thermo-dynamic engine problem. However, it can be said that, without some such method or device, the future is unlikely to bring any revolutionary improvements in thermo-dynamic engines over the best of modern practice.

In the matter of size and capacity of generating units it can safely be said that this will hereafter be fixed by the conditions to be met and not by any inherent limitation in our ability to produce units of any desired outputs. We now have units of 30,000-KW. capacity in service and still larger ones projected, and no limitations of design or material appear of such a nature as to place a stop to further progress along the same line.

In June, 1898, Mr. A. E. Kennelly, gave an inaugural address, in which he pointed out that "in 1884 a 50-KW. dynamo was considered a large machine, while a 100-KW. Edison steam dynamo was justly called a 'jumbo.' At present the largest size of generator built or building is of 4,600-KW. capacity." In the 14 years from 1884 to 1898 the maximum size of generator, therefore, increased 46-fold, while in the 17 years since that time, the increase has only been about seven-fold. While the increase in capacity, therefore, has been a marked one, the rate of increase has not been so rapid during the last 17 years as it was in the previous 14 years, a result which naturally might have been anticipated. The future will undoubtedly continue to produce larger and larger capacity machines, the limit as to size being dictated by plant capacity and economic considerations and not by any inability to produce the larger sizes.

In the matter of selling price, Kennelly mentioned that "the price of dynamos in 1882 was about 20 cents per watt of output, while dynamos of similar running speed for comparatively small sizes without switchboards now cost about 2 cents per watt." The speed and size of these units is not mentioned, but it may be said in comparison that, nowadays, prices are frequently quoted below ½ cent per watt. In this respect again the improvement in the last 17 years has not been so marked as it was in the 14 years previous; we are approaching a saturation point in this respect.

The two fundamental costs of electrical apparatus are those of labour and material. Economies in the use of labour will undoubtedly take place by the introduction of new methods of scientific management, &c., but these need not be expected to be revolutionary in character so far as cost of apparatus is concerned. The tendency of the labour item will unquestionably be toward appreciation rather than depreciation.

In regard to the item of material, modern design has approached very close to the physical limits of available materials. With higher permeability, making available greater flux densities, the cost of electrical apparatus might be considerably reduced; but it is highly improbable that improvement will be of such a revolutionary character as to cause any sweeping change in the cost of electrical apparatus.

The hysteresis and eddy current losses that take place in irons and steels that are subjected to varying magnetic fluxes is another of the limits encountered in the design of electrical machines. Our modern transformer steels in the matters of losses and iron ageing qualities show a vast improvement over those formerly available. Unfortunately these improvements have so far been accompanied by a decrease in permeability which is highly objectionable in rotating machinery. Unquestionably, further improvements will be made, but will probably make no revolutionary change in the costs of electrical apparatus.

The conductivity of the copper of commerce is within an extremely small percentage of that of pure copper, and we cannot expect to obtain a higher conductivity in copper than that of purity. There remains, of course, the possibility of using some metal other than copper, but there is apparently no metal that even approaches the space and cost characteristic of copper that makes it so essential to the construction of electrical apparatus. Aluminium is a competitor only when the volume of the conductor is not an essential element in design, as in transmission lines and the like.

(*To be concluded.*)

TRADE ENTENTE AFTER THE WAR.

[COMMUNICATED.]

For some considerable time past the question of mutually forming a Trade Entente among the Allies against Germany, after the war, has been very widely discussed from variously divergent standpoints. The proposition has undoubtedly much to commend it, but it is also beset with many serious objections, which probably even the patriotic sentiment of the moment is not capable of entirely removing. Past experience in regard to experiments of a similar nature have proved beyond all dispute that, although sentiment may be all very well in its right place, it cannot at any time be allowed to interfere with the recognised and time-proven laws governing the commercial system.

Too much importance can very easily be attached to the question of the boycotting of German goods by the Allies after the war is over. The experiment, for such it would inevitably have to be considered, would most probably find itself at the very outset in direct opposition to the laws of sound commercial trading. The laws which govern the commercial system are as immutable and dispassionate as those which govern the universe. The purchase of the best goods in the cheapest market is the foundation basis of all successful trading. Any other system which, by imposing artificial restrictions such as boycotting, seeks to evade this unalterable fact, is certain to defeat its own end.

There are may trades, and branches of trades, in which the Germans, from various advantages, geographical as well as traditional, are best fitted to render the highest service, not only to themselves and their neighbours, but to the whole world at large. We in this country likewise enjoy corresponding advantages not possible to the Germans, as, for example, the adaptability of the Lancashire climate to cotton-spinning, and the production of the best steam coal from Wales. Despite the sustained efforts of the Germans to make themselves independent of cotton goods from Lancashire, the exports from this country in this section, and the large exports sent direct from here on account of Germany, have maintained a steady level, and will doubtless continue to do so in the future, for the reasons just referred to.

On the other hand, there are commodities made in Germany in which other countries have never seriously attempted to compete. To do so in the future would necessitate, in many cases, the entire basic reconstruction of not only the commercial but the social system as well.

The case of the toy-maker furnishes an interesting example. No doubt most readers will have noticed the predominance of crude and half-finished toys in the shops at the present time, especially at the seaside towns. A very cursory examination of the articles is all that is required to act as a prelude to putting them back again on the stall and walking on. These are mostly samples of British manufacture. In Germany toy-making is a tradition, and has become bred in the bone of the peasant. For generation after generation the same families have made toys, from early childhood to old age. With them use has become second nature. The livelihood it brings to the rustic peasant, small as it may be, is certain and seldom fluctuates. This system is one that has gradually evolved, not over a period of a few decades, but over a period of a century or more. So perfect has it become in course of time that it is enabled to show how even a small body of rustic peasants in an out-of-the-way hamlet can produce a commodity cheaper than, and superior to, the products of the modern town factory, with all its scientific and up-to-date organisation and labour-saving devices.

In other directions also the boycotting of German goods after the war would prove a most unsound procedure to the commercial interests of this country. In the electrical engineering sections the Germans have built up a colossal system of specialisation, which has demonstrated its economical soundness in almost every possible way. Instead of producing a highly-complex machine complete, with almost every part made in the same works, as do many of the British firms, the German system of specialising confines the entire resources of one given firm to the production of one given part. The result is that many of the leading British machine-makers have been able to obtain certain machine parts from Germany cheaper and better made than from any other source.

If these sources of supply are stopped after the war, it will mean that British machine-makers will, while this system of specialisation is being built up and extended in this country, either have to put in inferior parts in their machines, or pay extortionate prices, and be put to endless inconvenience.

This building-up question, by a natural transition, leads to perhaps the most important aspect of the matter. Who is going to do the pioneer work, and undertake the enormous responsibilities in removing the dead wood and undergrowth to make clear the way for future enterprise? The individual trader was content to do this in the past, when other pioneers were doing the same elsewhere, with perhaps very little, if any, start of him. But to expect him in these times, on the uncertain offer of a temporary boycott of an outside competitor's goods, to attempt this prodigious task, confronted as he is with the knowledge of a highly scientific and almost perfect system attained elsewhere, is neither sound in theory nor reasonable in policy.

There are, doubtless, many trades in which the Germans have acquired a monopoly, apart altogether from geographical or traditional considerations, in which the Allies could make themselves independent in the course of time by mutually supporting each other wherever possible. Unless this mutual support, however, is based from the first upon the sound economic principles governing the laws of fair and legitimate trading, the experiment is almost bound to prove of no commercial value. Patriotic sentiment, and even Entente Cordiales, when brought into contact with the calm platonic laws of trade, quickly lose their identity.

The mutual interests of the Allies will, to our mind, be best served in the future, not by placing artificial restrictions against the German commercial system in so far as it affects them severally or collectively, but by their making themselves more independent of it by improving and strengthening their own. Moreover, in order to show their entire disgust of German barbarism, it would be necessary for the Allies to entirely dispense with everything associated with German origin. It is impossible to wholly effect this result, inasmuch as Germany has become by course of time a vital part of the international trade system, and cannot be cut away from it without mutilating the whole.

Even now, much as we do not care to realise the fact, there is hardly an important commercial house in London or Manchester, or in Berlin or Hamburg, that is not in some measure bound up with the interests, direct and indirect, of each other. To dispense with Germany from the international trade system, it would be necessary to efface her entirely as a commercial nation. This cannot be done, nor is it desirable that it should be attempted.

What is desirable, and even essential, is that something of the same excellent co-operation of the State with the individual, as is enjoyed by the German trader in his country, be likewise enjoyed by the British and French traders in theirs. If the State has held itself aloof from the interests and demands of its trading system, as it undoubtedly has done very largely in this country, it is not very likely to prove a success in negotiating a mutual system of trade reciprocity with other countries, whether they happen to be allies in war or not.

In this country the commercial democracy, which comprises the recognised authorities of each trade, has little or no sympathy with the official ornaments of State which are supposed to represent the commercial interests of the nation. While the accepted authorities of the variously important industries in this country resolutely refuse, and with good reason, to have anything to do with Government offices, or even to recognise their authority to speak on behalf of the national trade policy, so long will they remain incoherent to other friendly nations which are prepared to negotiate with us.

France has no more notion how best to approach us on the question of a Trade Entente after the war than the country most alien to our sympathies. The Government trade officials in this country are equally unfortunately placed, in that their utter inability to correctly gauge the opinion of the leading trades' authorities enforces them to sit tight rather than to make a move and come to grief. So much as has yet been done towards framing a suitable trade policy of mutual reciprocity of interests after the war, is due to the foresight and enterprise of the commercial leaders themselves in England and France, and not to the official system of either country.

When all has been said and written, however, on the subject of a Trade Entente among the Allies after the war, the probabilities are that nothing of any material difference will accrue in this direction at any future period whatever, apart from the time-proven policy in vogue prior to the war. The problem of German trade influence, like every problem that is associated with such a colossal question as the setting up of artificial barriers and restrictions against the cold dispassionate laws ruling throughout the entire commercial system, however patriotic the impulse prompting a remedy may have been, must, after all, be left to find its correct position in the universal trade system by the weight of other considerations in which it is inseparably bound up.

Swedish Electrical Exports.—There was a large increase in the exports of electrical machinery from Sweden during the six months ending with June last, the official returns showing that they attained a value of £143,635, as compared with only £97,368 in the corresponding half of 1914. On the other hand, the exports of telephone apparatus showed a marked decline—from £200,405 to £118,998.

GERMAN ENGINEERS IN CHINA: A GLANCE AT THEIR METHODS.

By Prof. C. A. MIDDLETON SMITH, M.Sc.

Eighteen months before the war commenced, the writer was taken to task for stating that the Germans were doing everything possible to undermine British engineering interests in China. The carefully-considered words were subjected to severe criticism at that time. If any Englishman now made a reverse statement, he would, justly enough, be written down as either extremely ignorant or hopelessly insane.

We are all of us, to-day, in possession of facts which two and a-half years ago, were known only to a few. Indeed, no one then quite understood the problem which time has shown up so clearly. There were so many different factors. The diplomatists knew a great deal then—engineers have discovered these facts by a laborious perusal of official papers and published speeches. Business people have been able to explain things which, without a war, would have been of little interest to people not in their own line of business, and the publication of which, indeed, might have injured their own careers.

Enemy Firms.—In the Far East certain information about German business methods has been gained in rather a curious fashion. In that little island Colony in South China, which has had such a romantic history of progress and development, until it has become one of the largest ports (if not, as is often claimed, actually *the* largest port) in the whole world, the Germans also have thriven and flourished under the protection of the Union Jack. The German club in Hong-Kong bears witness to the fact. It is now used as a barracks for the Volunteer defence forces of the Colony. Those Britishers, whose peculiar prejudice against things Teutonic in pre-war days prevented them from accepting the hospitality of members of the club, now have ample opportunity of seeing this centre of "Kultur"; for they rest therein between guards at the internment camp, where the late occupants of the Club Germania now reside. Also, Britishers are now "liquidating" the German businesses. Curious methods are being discovered.

The mention of the club reminds one of the outlook of the Germans in the Far East during the past 10 or 15 years. In Hong-Kong there are practically only three clubs. The largest is the Hong-Kong Club, which was, until recently, frequented by Europeans of all nationalities. There is the Institution of Engineers and Shipbuilders, which is much more of a club than the engineering Institutions in London. There were many German members of the Institution before the war. At a meeting held in this club the writer pointed out the truth, somewhat unpalatable to some of the members, that the unscrupulous commercial methods of the Germans in the Far East were not regarded with complacency by all Britishers, either in the Colony or at "home." Several British members frankly disliked any allusion to such topics, and said so. They have since generously congratulated the writer that there are no German members during his year in office as President of the Institution. It is, of course, almost certain that there never will be any such members in this generation.

Eligibility to these two clubs was not sufficient. These insane German fire-eaters must have their own Club Germania. The thing itself was a thinly-veiled insult to that spirit of generosity which offered all Europeans membership of the other clubs in a British Colony. No other nationality was guilty of such an action.

Li Hung Chang's Impressions.—Most of the readers of this journal will still remember Li Hung Chang's famous tour to Europe. Bismarck unburdened his soul to the astute Celestial. He spoke a great deal about England. "Bluster and bluff" were his expressions. He told the experienced Li that China was making a great mistake by supposing that England would remain in her then proud position. By word, deed and suggestion the German in the Far East has continued the unscrupulous policy of Bismarck. Unfortunately, some of the Orientals have been more gullible than the wily Li.

After the war broke out, the German engineering firms continued to use Hong-Kong as a base for their operations. A disreputable orgie at the Club Germania, in celebration of the fall of Antwerp, forced the hands of the authorities. Those Germans who did not, while yet there was time, leave for Shanghai, Tientsin, or other places in China, are now "interned."

The German Method.—In the West there are commissions. In the East there is "squeeze." There such commissions are moral or immoral, according as to whether they are open or secret. The Celestial mind differs very much indeed from that of the Britisher in many ways. It is probable that there have been certain commercial transactions between men of our own nationality and the Chinese which do not altogether redound to our credit. But, on the whole, the children of Far Cathay trust us more than any other nation. All of the native officials are not corrupt. It is a significant fact that the public men in China, with the best reputation for honesty, are not pro-German.

The methods of our late trade rivals were quite simple. Suppose the Chinese customer wished to purchase a dynamo. He would make inquiries and obtain prices. He would then inform the various competitors that the lowest price was, let us say, $1,500. The German firm would promptly revise their estimate to $1,300, and would supply him with a machine that would do the output required on the overload only. If the customer were a Government official he would have much "squeeze" from the job; the article sold would be, in some way or other, adulterated to pay for the "squeeze."

It is to be hoped that details of the methods of German firms in the Far East will be made public at some suitable time. Many British firms are now the official liquidators of these businesses in Hong-Kong. They have access to the books. It is rumoured that they can learn very little which will assist them to increase their own business by clean dealings.

Trading with the Enemy.—At long last, after 11 months of war, we have the Proclamation about trading with the enemy in China. If it be true, as it has been suggested in the Orient, that it is possible for German firms to reconstitute themselves, so that their headquarters are in, let us say, Shanghai and not Berlin, and so escape the penalties of the Proclamation, it seems a pity that this simple method of evasion was not anticipated.

The war cannot last for ever, and the Germans free to move about the Far East are working as industriously and as infamously against Great Britain as those in their Fatherland. They are spending large sums of money in subsidising the Chinese newspapers. They are organising and bribing and lying as actively as they did before the war. They have lost Tsingtau; but they have bases in Shanghai, Tientsin and other ports, where the Gospel of Hate against Britain flourishes.

They will fail in China, as they will fail in Europe. But for many years they will cause us anxiety out here. They will make efforts more desperate than ever to tap the enormous mineral wealth of this part of the world. They will attempt to use Hong-Kong as a base, but it is to be sincerely hoped that legislation will prevent them doing that.

From 1912 to 1914 the German Government spent large sums of money in China, mostly on behalf of work which would benefit their engineering interests. In the light of recent events we might hastily conclude that it has been all wasted. It is true that the millions spent at Tsingtau are a dead loss from Germany's point of view, although they will assist the other Powers to develop the Province of Shantung. It seems impossible that this nation which has alternately insulted and deceived the Chinese can ever obtain respect from the Celestial. The German people have "lost face." They have lost vast sums of money. But, despite these things, they continue, and after the war is over they will continue to plot and scheme against the influence of Great Britain in China.

It is true that at present many of the large engineering schemes out here are in abeyance. The Hankow concession was arranged soon after the war commenced. £10 000,000 sterling had been promised from a wealthy London firm. Fortunately, the chief engineer of the scheme is a Britisher. As the scheme progresses about 15 British assistants and a great deal of British machinery will be required. The London firm cannot, at present, export the gold, but it is certain that the Hankow development scheme will progress when the war is over. It seems also extremely probable that the prodigious wastage of metals in Europe will lead to the very desirable development of China's mineral wealth.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Wrinkles on the Operation of Alternators.

I have read Mr. Pausey's "Wrinkles on the Operation of Alternators" with much interest having encountered similar difficulties myself, viz, the absence of power-factor and frequency meters.

The traction station to which I refer is now somewhat out of date, and is equipped with B.T.H. multipolar alternators driven by compound vertical engines. To shut down an alternator running in parallel we give the signal to the driver, who begins to shut off steam whilst the switchman weakens the field to no-load excitation. How would Mr. Pausey suggest regulating the fields of two alternators in parallel when the only guide is an ammeter in the field circuit of each machine, and when weights are often placed on the governor of the smaller machine? The traditional method seems to be to synchronise the incoming machine at the normal bus-bar voltage, then to reduce the field of the machine already on the bars until the resultant voltage is the normal running voltage. Is this correct?

Again, a Westinghouse rotary of the fixed ratio type whose power-factor meter indicates ·95 lagging under all conditions of load except reverse current, runs with a constant excitation of 3·2 amps., but when a second alternator is switched in, the rule-of-thumb method is to reduce the field to about 2·8 amps. Are there any logical grounds for this?

Switchman.

Extraction of Oil from Feed Water.

In an article in this week's Review on "The Use and Abuse of Oils on Mining Plant," by T. C. Thomsen, B.Sc., on page 285, this statement appears :—"Electrical treatment of the feed water will extract every trace of oil." I should be pleased if, through your "Correspondence" columns, the exact method referred to could be given, and the quantity of current necessary per thousand gallons of water treated. The firm I am connected with use the hot water from the jet condenser, in connection with the main engine, for the washing of cloth. We have no oil separator, and treat the water by passing it through a coke filter. All the oil is not extracted, however, and I should welcome some method of eliminating the remaining traces of oil, such as suggested by the author of the above article. I may add that the present arrangement does not lend itself to the introduction of an oil separator.

Cloth.

August 30*th*, 1915.

Units from Refuse.

In reply to Mr. Morgan, I should again like to make it clear about the point "so strongly raised" by me, namely, the setting of the boiler directly above the combustion chamber. In the first place, for the last three years I have actually worked a similar arrangement (although not quite such a good one as that proposed) on our peak load in order to save refuse, as in this way I can get an evaporation of 4½ to 5 lb. of water per pound of refuse, as against 4 lb. with our new destructor, and 2·5 lb. with our old one (which was done away with).

Although the above requires no further argument, I see nothing whatever in Mr. Morgan's contentions. With the boiler directly above the combustion chamber :—

1. You can still get an equally large thermal storage system of red-hot brickwork, with the further advantage that this stored heat is always evaporating water to greater advantage, and the point that Mr. Morgan mentions about the boiler tubes tending to cool the brickwork more quickly is exactly what one wants for the purpose of raising steam. It is always an advantage in favour of any destructor to be able to get rid of your heat usefully.

2. The proper combustion of the fumes depends not only upon the temperature of this chamber but the size of it, and the combustion chamber can be made of ample size under a large water-tube boiler.

3. It is easier to raise steam, and, what is more important in a central station, to get it up when it has fallen on load.

4. The dust can be provided for just as easily as with the usual *wasteful* arrangement of having a combustion chamber which does not act directly upon the boiler tubes.

I am glad Mr. Morgan invites destructor engineers to take part in this controversy. Messrs. Meldrum installed our grates for burning refuse directly under the boilers, and Messrs. Heenan and Froude our last destructor. The Meldrum grate can beat the Heenan destructor (excellent as it is) for steam raising, and the Heenan destructor has the advantage of the Meldrum grates in other ways, such as dust catching and getting rid of a greater quantity of refuse. Therefore, as stated in my article, a combination of the two methods (namely, with the boiler fixed above the combustion-chamber), would have been the perfect method had the original arrangement of our plant allowed us to carry this out, and, whatever theory says against this method, I must be pardoned for still believing what I have seen every day for the last three years.

A. J. Abraham, *General Manager.*

Aberdare Electricity Works,
August 27th, 1915.

London Electrical Trades Arbitration.

The District Secretary of the London District Electrical Trades Union has circularised the Electrical Press, stating that Sir David Harrel, the Arbitrator, has awarded members of that Union an advance of ¾d. per hour, which, coupled with the 1d. advance obtained by the Union last year, constitutes an increase of 1¾d. per hour, in a little over 15 months, for electrical wiremen and fitters in the metropolitan district.

This statement is extremely misleading, and avoids the main facts, the intention being, no doubt, to claim a series of victories over the employers, who, however, stand in the happy position of knowing that the 1d. advance was offered by the masters, and accepted by the Union after the strike, which, from the men's point of view, was not a brilliant achievement. In addition to this, an advance of 1½d. per hour was demanded by the men, and refused. However, the masters agreed to arbitration, realising that an increase of wages was justified during the present national crisis, with the result that the Arbitrator awarded half the amount demanded, the award reading as follows:—

"August 11th, 1915.

"I hereby award that the existing rate shall be raised from 10½d. to 11¼d. per hour, with *pro rata* advances to electricians, labourers, and assistants, such advanced rate to come into operation as from the beginning of the first pay day following the date hereof, and the advance now awarded to be *regarded as war wages, and recognised as due to and dependent on the existence of the abnormal conditions now prevailing, in consequence of the war.*"

The italics are mine.

Although this award applies only to members of the London Union, and, strictly speaking, is limited to such, the members of the London Electrical Masters' Association have decided to apply the increase to all employés, *Union and non-Union*, although no agitation has been apparent among their non-Union employés.

Surely, it cannot be claimed that the award is a triumph for the Union! It would have been better to leave the matter as it was without comment, and it would have remained unchallenged, but for the braggadocio of a "Union" official.

The unfortunate outcome of any concessions by the employers to their workmen, is that the Trade Union officials flatter themselves that they have defeated Capital, whereas the result is but an empty triumph, resulting in constant stress instead of harmony.

In conclusion, it may be said that the award is anything but an advertisement for the Electrical Trades Union. The officials controlling same would be well advised to keep in the background, and avoid basking in the limelight during the present troublous times.

W. Ellerd Styles.

London, W., *August 30th*, 1915.

New Battery Signalling Bell.

From the "Notes" column of the ELECTRICAL REVIEW for August 13th I see that a paper on the above subject was read at a meeting of Mining and Mechanical Engineers at Newcastle-on-Tyne.

I should like to point out that I have fitted several bells with condensers and connected them across the contacts. This idea is working excellently, and reduces the spark on the contacts to a minimum.

I have had these bells (fitted as described above) in use for some time on surface work at Askern Colliery, and find not only that the spark is reduced but that there is much less trouble in keeping the contacts clean, thus ensuring a good signal.

Arthur H. Marsh.

Askern Colliery, near Doncaster,
August 28th, 1915.

Car Starting and Lighting Equipments in the States.—According to some figures compiled by Mr. G. Brewer Griffin, of the Westinghouse Co., U.S.A., the total number of motor-cars produced in the United States during the past 12 calendar months was 611,695, and of this number 261,860 were fitted with electric starting and lighting equipments.

LEGAL.

ELECTRIC POCKET LAMP PROSECUTION.

IN the City of London Court, on August 25th, before his Honour Judge Rentoul, K.C., Mr. E. B. Holmes, special constable, of Hackney, sought to recover £1 8s. 8d. against Mr. Percy Patterson, electrician, trading as the Electric Supply Store, 77, Fore Street, for damages for injury caused to his clothing owing to a defective flash lamp purchased from him.

PLAINTIFF'S solicitor said the plaintiff bought a pocket electric lamp of the defendant on his guarantee that the plaintiff could put it in his pocket without it leaking. Plaintiff wanted it for use during his duties as a special constable. When he put it in his pocket the lamp leaked owing to the accumulator being defective. He took it back, and a new accumulator was given to him, but that was worse than the first. Sulphuric acid from the lamp leaked. Plaintiff's clothes were burnt.

DEFENDANT told the Court that the lamp was absolutely safe if the plaintiff used it properly and carefully.

JUDGE RENTOUL thought that the bare fact that the defendant had sold the lamp was a guarantee that it was fit for use. An electric pocket lamp was not fit for use if it leaked.

DEFENDANT said that plaintiff handled it carelessly. He did not sell the accumulator as being unspillable. They were all made with a percentage of sulphuric acid in them, and it was impossible to make an accumulator otherwise. No maker would guarantee such a thing. If so, the whole electrical industry would be stopped.

PLAINTIFF added that when defendant told him that the lamp could not leak, he showed him that it was packed with gauze which would absorb the acid, and so prevent it coming out.

The DEFENDANT assured the Judge that an accumulator could not be made that would not leak. There was nothing on the lamp to say that the acid was unspillable.

JUDGE RENTOUL did not think the lamp ought to leak. He did not think anybody would buy an electric flash lamp if he knew it was going to leak and burn holes in his clothes. It seemed extraordinary to him that a man should be asked to take an electric lamp to use in his service as a special constable and for it to leak.

PLAINTIFF further said that when the lamp was attached to the terminals and started burning it caused the acid to bubble. The chemical action caused that, and that was what caused it to escape.

DEFENDANT said he could demonstrate in Court that that was not so, and that although he did his utmost to stop lamps from leaking and to make them as safe as possible, he could not undertake any responsibility. No manufacturer of electric pocket lamps would dream of doing anything of the sort. He produced a lamp which was put on the Judge's desk and lighted, and he declared that it would not bubble over as the plaintiff said had happened with his lamp. The lamp was put on the Bench and remained there until the end of the case without leaking.

PLAINTIFF suggested that if the lamp was put on its side it would probably leak.

JUDGE RENTOUL said the lamp had not leaked, but the defendant was responsible for leakage unless he could prove that electric pocket lamps could not be made without leaking.

DEFENDANT: Every accumulator has loose acid in it, and if you turn it upside down it will leak. I could make it leak if I pressed it. This lamp has been treated carelessly. This is a very important question, and the whole industry is looking to the decision in this case. This is a very vital case because all accumulator making, which is a vast industry, will be stopped if your decision is against me pending an appeal.

JUDGE RENTOUL: I hope not.

DEFENDANT: We dare not sell another. There must have been a pint of acid spilled over the plaintiff's clothes to have done this damage, and there was not more than a thimbleful of weak acid in the accumulator that he had.

PLAINTIFF pointed out that a few spots of sulphuric acid would be quite sufficient to burn the clothes in the manner shown. The acid had even eaten through the metal of the case. The defendant contended that it was a got up case.

JUDGE RENTOUL deprecated the use of such observations. At the same time he did not think he ought to give a decision without some independent evidence if the chemical or electric lamp industry was so concerned as the defendant suggested.

DEFENDANT: This acid is not dangerous.

JUDGE RENTOUL thought it might be wise to settle the case, and then suggested that expert evidence ought to be called.

DEFENDANT: This is not for carrying about in the pocket but for household use and to put on bicycles. It they are kept upright they will be all right. He paid 5s. 6d. for it. I do not guarantee it to be unleakable.

PLAINTIFF'S solicitor argued that the defendant would be liable for even a latent defect.

DEFENDANT: If you decide against me the case will have to be taken up by the whole industry.

PLAINTIFF: You said the manufacturers would defend the case, but they are not here. I was told that it would not leak if I turned it upside down.

DEFENDANT: We sell them as moist accumulators.

The JUDGE suggested that the plaintiff might accept half the amount of his claim, but the defendant said he was either in the right or in the wrong, and that if the decision was against him, pocket electric lamps made in the future would have to be stamped "sold without a guarantee."

The Judge did not think the plaintiff would have bought the lamp if he had thought it would leak. In his view unleakable lamps could be made, and electric pocket lamps ought not to be sold if they leaked. If the electrical trade was affected by the matter he would give leave to appeal against his decision, but he must find for the plaintiff, with costs.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New G.E.C. Flame-Proof and Water-Tight Bell for Mines.

In the new G.E.C. flame-proof and water-tight trembling bell illustrated in fig. 1, special attention has been given to the design and construction so as to make it comply thoroughly with the Home Office regulations.

The bell action is enclosed in a cast-iron flame-proof case. The lid is bolted to the case, and contact is made between machined flanges 1 in. wide. These are of sufficient heat capacity to cool effectively any hot gases expelled in the event of an internal explosion. The case is water-tight and thoroughly enamelled to prevent rusting. The internal unoccupied space is kept down to a minimum, so as to limit the amount of explosive gas which might accumulate.

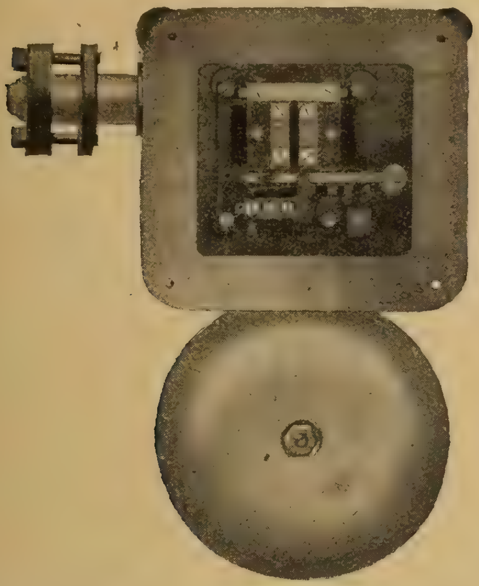


Fig. 1.—G.E.C. Flame-Proof and Water-Tight Mining Bell, with Cover removed.

The hammer is connected to the armature by a shaft which passes through a gland, 1 in. long, in the bottom of the case. It is situated under the gong and is thereby afforded additional protection. A flame-proof gland is also fitted to the case. It is designed to take an armoured lead-covered twin cable.

The bell is made with two sizes of gong, 6 in. and 8 in. respectively. The 6-in. bell weighs 14 lb., and requires a pressure of 6 volts across its terminals to work it satisfactorily, while the 8-in. bell weighs 16 lb. and requires 10 volts. The resistance in each case is 25 ohms, and the current taken just under 0·1 ampere.

These bells are made by the General Electric Co., Ltd., 67, Queen Victoria Street, E.C.

Ediswan Silk Shades.

Though it is probable that there will be fewer new lighting schemes undertaken in the coming season owing to the general feeling for "household economy," it is practically certain that in many cases new shades will have to replace those that have seen the previous season through.

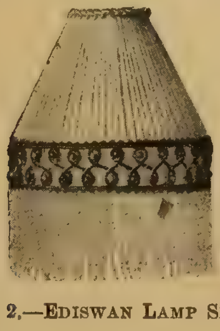


Fig. 2.—Ediswan Lamp Shade.

The Edison & Swan United Electric Light Co., Ltd., Ponder's End, who, we understand, have been doing exceedingly well in their silk shade department, have sent us a neat little stiff covered booklet of silks, which contains nearly 50 different tints of reds, greens, blues, browns, &c., with a sample attached to enable a prospective buyer to test the quality. All shades can be re-covered in a similar fashion to match others, and old pattern shades can be renovated. Illustrations are shown here of some recently executed designs, which are stock lines, but it is also a speciality of this department to make for all individual requirements.

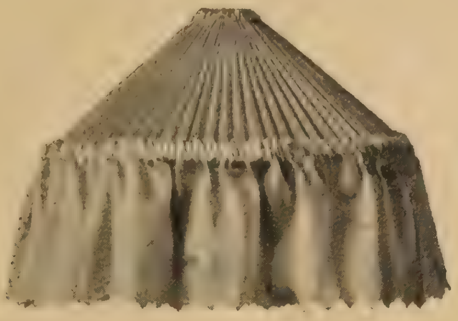


Fig. 3.—Ediswan Lamp Shade.

English Electrical Novelties.

Messrs. Ward & Goldstone, of Sampson Works (Salford) Manchester, have recently issued a four-page pamphlet dealing with electric pocket lamps, torches, medical coils, bell and pushes, miniature electric motors and parts for constructing same, lamp refills, dry batteries, and other small technical goods. These originally in great part came from the Continent, but Messrs. Ward & Goldstone are now manufacturing them for themselves.

We illustrate a Sturdee torch fitted with a hood (fig. 4); this is a non-rusting torch, fitted with a refill, which in ordinary use will give 15 hours' light, and hold up for 12 months without failing. Figs. 5 and 6 illustrate a special pocket lamp, and the Velox pocket lamp refill, which is made specially for export, and will remain in condition in stock for nine or 12 months.

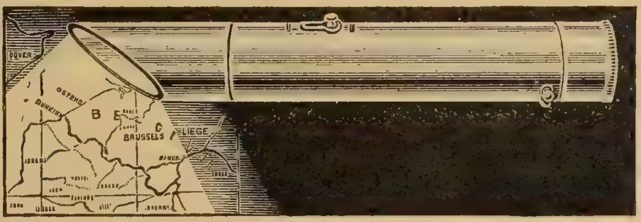


Fig. 4.—Sturdee Torch with Hood.

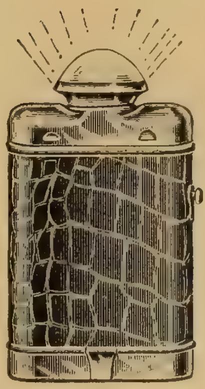


Fig. 5.—Special Pocket Lamp.

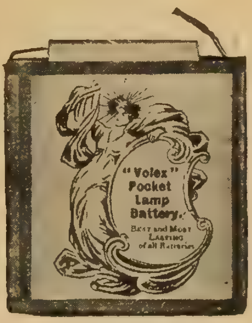


Fig. 6.—Velox Refill.

Photographic Meter Records.

The Eastman Kodak Co., of Rochester, N.Y., has introduced a novel meter reader's camera which enables photographic evidence of the state of the consumers' meter dials to be obtained.

The meter reader (or photographer in this case) simply holds the camera opening against the meter dial glass and presses a lever, which automatically opens the shutter for a definite period, and at the same time lights four small battery-operated lamps to illuminate the meter dial.

At each exposure the shutter is locked and cannot be again operated until the film has properly advanced for the next exposure.

By pressing a lever the camera can be used as a lantern in dark passages. A roll of film provides for 75 exposures, and costs roughly one shilling; two extra rolls can be carried in the camera, allowing a total of 225 exposures.

The film on which the pictures are taken consists of an emulsion on opaque paper, backed with a white coating, which makes details of the developed film show up clearly, reversed right and left, mirror fashion, and the reversed film is read by means of its reflection in a mirror and identified by the customer's name and meter number on the dial. The "Factograf" camera gives an indisputable record, and is especially useful in taking maximum demand readings, where the pointer is set back to zero, thus preventing future reference. These cameras are being employed on several meter routes by the Rochester Railway and Light Co., of N.Y.—*Electrical World.*

"Hemming" Grip Fittings.

The Hemming Conduit Grip, Ltd., of Hatherton Street, Walsall, is introducing a new patent grip fitting which we illustrate in fig. 7. It is claimed that its electrical conductivity is equal to the tube, and it can be used with any type of tube, close joint, or seamless. Undersized tubing can also be used with equally good results. It will be seen that the grip is obtained by screwing up a specially shaped cotter, the side of which bearing on the tube is serrated and bites into the tube. Unscrewing the nut and tapping the cotter pin, releases the tube. A full selection of conduit fittings is made by the firm in ½-in. to 1½-in. sizes.

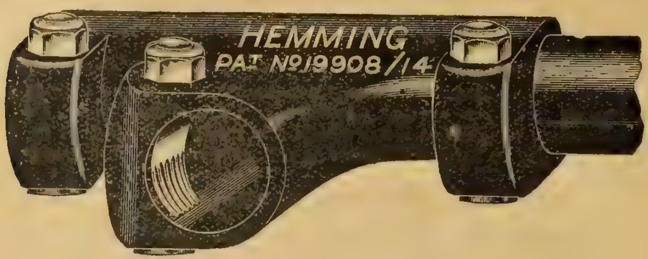


Fig. 7.—New Grip Fitting.

Single-Tumbler Double-Pole Switches.

The term single-tumbler double-pole switch is meant to convey that the article in question is a tumbler-action switch for double-pole connection. Thus, instead of the usual coupling together of two separate single-way tumbler switches, we have the combination on one base of ordinary size.

So far as we know, Messrs. A. P. Lundberg & Sons, of 477-489, Liverpool Road, London, N., are the only manufacturers of switches of this kind, and their 10-ampere surface and 5-ampere flush patterns are respectively shown in figs. 8 and 9.

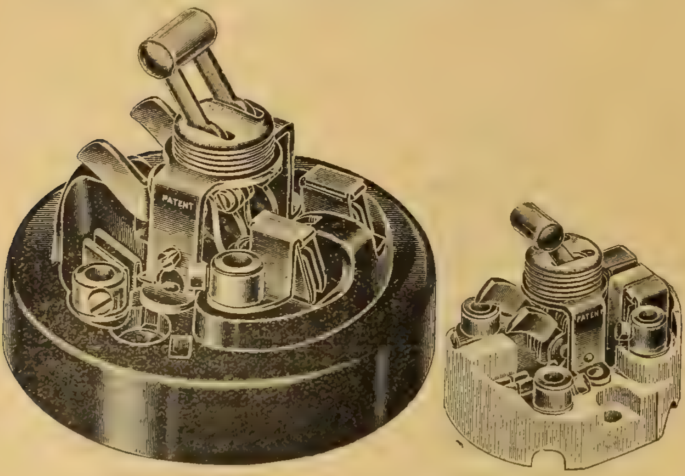


Fig. 8. Fig. 9.

Single-Tumbler D.P. Switches.

The 5-ampere size is also made for surface work, and various patterns of cover (metal or porcelain) are available, the metal covers for surface work being generally lined inside with fibre.

This type of switch is very largely used on electric heating and cooking apparatus in conjunction with some other type, for varying the number or arrangement of the heating sections in circuit. Some of these groupings are as follows:—Double-pole with series-parallel, double-pole with series-parallel and off, double-pole with "Twinob," double-pole with "all-or-part," double-pole with (special switch).

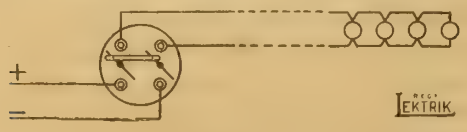


Fig. 10.

The uses to which these switches can be put in lighting installations is a matter of more general interest, and two such uses are shown in figs. 10 and 11.

When a lamp (or group of lamps) is on an out-of-doors circuit, or in a cellar or other more or less damp place, it is decidedly better, for various reasons, to break the circuit on both poles (as in fig. 10) than to use a single-way switch. The same arguments apply also to the control of plug-sockets (fig. 11), an additional one being that there is no chance of shock at all if the socket is entirely "dead" when off.

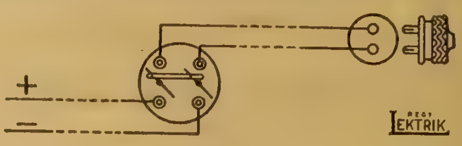


Fig. 11.

Lelios Lamps.

The A. & A. Electrical Co., Ltd., of 51, Whitcomb Street, W.C., has recently placed on the market the Lelios (patent) lamp shown in fig. 12, in which it will be noted that the filaments are stretched horizontally between flexible supports secured to a rectangular glass frame. The light is distributed downwards, giving, with the help of a suitable shade, an excellent illumination below the light source.

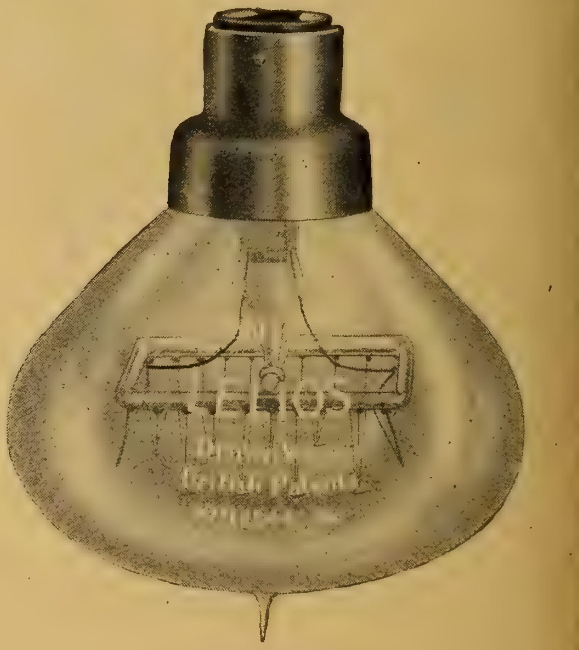


Fig. 12.—Lelios Lamp.

The lamp is of a type which has proved particularly serviceable for certain purposes, and is made in 10 to 50-c.p. sizes for 25-130 volts; in 16 to 50-c.p. for 140-260 volts; and in 100 to 600-c.p. sizes for all voltages.

The firm also supplies the A. & A. tungsten lamp of the standard pattern, in usual candle-powers and for usual pressures.

AMERICA AND ARGENTINE TRADE.

Argentina is dependent on foreign countries for almost all kinds of manufactures, and, as has been noted previously in the Electrical Review, the American Consular officials in that country have not lost sight of the fact that the conditions in Europe have presented an opportunity to the United States for consolidating her position in that market. The American Consul at Rosario in a recent report points out that, owing to business depression in Argentina, the new interest displayed in American goods failed to result in a corresponding increase of imports from the United States into his district. On the contrary, imports from the United States, as from other countries, fell off considerably during 1914. It may, however, be noted that in several instances Rosario houses have placed orders in the United States which would under ordinary circumstances have gone to Europe. Moreover, many new firms are now in correspondence with American exporters.

American business circles are fully alive to the opportunities for trade expansion in South America. However, in spite of intelligent efforts of numerous commercial organisations in the United States, many individuals are still in the dark as to how the desired end is to be attained. In view of the persistency with which numerous exporters remain true to the method that consists of advertisements, circulars to prospective customers, and inquiries addressed to Consuls, a repetition of former remarks and recommendations may be pardoned. Furthermore, this matter concerns the individual directly. The individual business man can only make known and urge his needs as respects trade facilities. When these facilities are given, however, whether or not he will reap any benefit from them depends chiefly on himself.

Granted adequate shipping and exchange facilities, the most important factor in the extension of export trade in Argentina is the willingness of the seller to get into some sort of personal relation with the Argentine customers and make indispensable concessions to the latter's methods of doing business. If the market appears likely to be important and permanent, the manufacturer can well afford to make the trip himself. Travelling salesmen should be sent out at regular intervals. If the probable demand does not seem to warrant such expense, articles may be placed in the hands of a commission house or a Rosario agent, although it is, of course, difficult to make satisfactory arrangements for an agency by correspondence. Another practice that may be recommended in such cases is the sending of a traveller by a group of non-competing manufacturers. Exporters should realise that their successful competitors have built up their export trade here through personal effort, and that goods will find a permanent market only in this way. Direct personal relations between buyer and seller will tend to obviate other difficulties often considered inherent in some trade methods, such as unfavourable credit terms and unwillingness to conform to local requirements.

The exporter who knows the standing of the purchaser of his goods will realise the propriety of giving him credit, and not a few travellers who have left their principals with orders to demand cash have prevailed on their firms to grant reasonable credit facilities after they have reported satisfactorily on standing and banking arrangements. In the same way, the writer knows of cases where the personal visit of a factory representative has sufficed to insure the local importer a regular supply of articles specially designed to meet his needs. It is, furthermore, obvious that the establishment of direct personal relations will do away with hundreds of misunderstandings, inevitable under other circumstances and harmful in the highest degree to American trade in general, which can frequently be ascribed to business on a correspondence basis. Orders are undoubtedly secured by correspondence, but such business generally lacks a firm basis and is apt to be taken by the first enterprising competitor who gets into personal touch with the customer.

The outbreak of hostilities in Europe and the current belief that there was a shortage of merchandise in South America gave an unprecedented increment to the steady flow of catalogues, circulars, and letters—often bearing the well-known penalty postage stamp—from American firms to Rosario. Such literature receives little attention. Especially when business is good, importers have no time to wade through catalogues and cannot afford to lose the six or eight months often required to make satisfactory arrangements by letter. Such trade methods are viewed with little favour. The average Rosario importer is a frank critic. If possessed of a kindly feeling toward the United States, he regrets what he considers the ignorance of American exporters. In many instances, however, he attributes the correspondence method of trade extension to the desire of the American manufacturer to get something for nothing. Certain features of American foreign commerce—strict adherence to cash policy, unwillingness to meet local requirements, failure to cultivate personal relations with customers—have created an impression in certain quarters that the American merchant is selfish, inconsiderate, exacting; that he demands the largest profit with the smallest risk, and that, giving no aid, he expects the local importer to do all the work. The attitude of many Rosario merchants towards American trade methods is apparent from the frequency with which they terminate any discussion of the subject by the Spanish proverb: "He who wants to eat fish must be prepared to get wet."

Many exporters seem to be of the opinion that a great volume of new business can be obtained by mailing catalogues and circulars to all consular officers. As respects Rosario this is an error. This does not, however, mean that it is not advisable to have catalogues on file in Consulates, and this practice undoubtedly does result in orders. Furthermore, letters addressed to Consular officers on particular subjects enable them to furnish useful and timely information. The Consular officer cannot, however, replace the traveller. He has not the samples, the necessary technical knowledge, nor the time to press goods on merchants, and he cannot, of course, take orders. His rôle in trade extension is essentially that of a go-between who endeavours to place those who want to sell in communication with those who are prepared to buy. As respects the supply of information, the Consul obtains the most reliable data available, but he cannot in all cases, in spite of a careful study of the situation, report definitely on the saleability of a particular article. A salesman might often succeed in marketing goods when importers have unanimously informed the Consul that there is no demand. The Consular service is a factor in trade expansion, but it must not be assumed that it can relieve thousands of exporters of the necessity of doing just such things as their foreign competitors have had to do.

It not infrequently happens that a firm will prepare a circular to be sent to all Consular officers requesting information, names of dealers, possible agents, etc. Occasionally such a general circular will be received by a Consular officer in a large city where the firm in question has already appointed an exclusive agent. It is obvious that the possible ignorance of the existing agency arrangement on the part of the Consular officer may lead to unpleasantness, and, in extreme cases, to the loss of a good agent. The method of requesting information, and the details that should be given to ensure getting useful information, must vary according to the market to which the request is sent. It not infrequently happens that when the results of such an inquiry are not as satisfactory as the firm might desire, the firm itself is considerably more to blame than the Consul to whom the application was sent.

TRADE STATISTICS OF EGYPT, 1914.

The following statement, showing the imports of electrical and similar goods into Egypt during the year 1914, is taken from the recently issued trade statistics. The figures for 1913 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1913. £E.	1914. £E.	Inc. or dec. £E.
Rails.—			
From Great Britain ...	106,000	8,000	− 98,000
,, Germany	20,000	140,000	+ 120,000
,, Belgium	59,000	18,000	− 41,000
Total	185,000	166,000	− 19,000
Steam engines, including boilers, etc.—			
From Great Britain ...	128,000	85,000	− 43,000
,, Germany	7,000	13,000	+ 6,000
,, Belgium	500	4,000	− 3,500
,, France	8,000	5,000	− 3,000
,, Holland	6,000	1,000	− 5,000
,, Italy	11,000	13,000	+ 2,000
,, Switzerland ...	2,000	—	− 2,000
,, Austria-Hungary ...	20,000	—	− 20,000
Total	183,000	121,000	− 62,000
Electrical machinery.—			
From Great Britain ...	15,000	13,000	− 2,000
,, Germany	8,000	2,000	− 6,000
,, Austria-Hungary ...	3,000	9,000	+ 6,000
,, Belgium	6,000	1,000	− 5,000
,, United States ...	3,000	—	− 3,000
,, France	27,000	2,000	− 25,000
,, Italy	3,000	1,000	− 2,000
,, Other countries ...	1,000	8,000*	+ 7,000
Total	66,000	36,000	− 30,000
* Switzerland 7,000.			
Petrol and benzine motors.—			
From Great Britain ...	62,000	74,000	+ 12,000
,, Germany	31,000	21,000	− 10,000
,, Italy	22,000	15,000	− 7,000
,, Switzerland ...	29,000	35,000	+ 6,000
,, Other countries ...	2,000	7,000	+ 5,000
Total	146,000	152,000	+ 6,000
Railway and tramway carriages.—			
From Great Britain ...	2,000	36,000	+ 34,000
,, Germany	5,000	10,000	+ 5,000
,, Austria	21,000	30,000	+ 9,000
,, Belgium	20,000	16,000	− 4,000
Total	48,000	92,000	+ 44,000
Lamps of all kinds.—			
From Great Britain ...	6,000	6,000	—
,, Germany	21,000	14,000	− 7,000
,, Austria	29,000	14,000	− 15,000
,, France	6,000	7,000	+ 1,000
,, Italy	1,000	1,000	—
,, Sweden	7,000	5,000	− 2,000
,, Holland	2,000	1,000	− 1,000
,, Other countries ...	1,000	1,000	—
Total	73,000	49,000	− 24,000
Copper, manufactured.—			
From Great Britain ...	11,000	8,000	− 3,000
,, Germany	20,000	26,000	+ 6,000
,, Belgium	2,600	3,000	+ 400
,, France	17,000	17,000	—
,, Italy	6,000	6,000	—
,, Other countries ...	3,000	2,000	− 1,000
Total	59,600	62,000	+ 2,400

	1913. £E.	1914. £E.	Inc. or dec. £E.
Scientific instruments.—			
From Great Britain ...	20,000	35,000	+ 15,000
,, Germany	21,000	13,000	– 8,000
,, Austria	1,000	8,000	+ 7,000
,, United States ...	2,000	500	– 1,500
,, France	14,000	9,000	– 5,000
,, Italy	1,000	3,000	+ 2,000
,, Switzerland ...	1,000	2,000	+ 1,000
,, Other countries ...	2,000	14,500	+ 12,500
Total	62,000	85,000	+ 23,000
Other machinery (except agricultural).—			
From Great Britain ...	103,000	79,000	– 24,000
,, Germany	36,000	21,000	– 15,000
,, Austria	7,000	2,000	– 5,000
,, Belgium	4,000	6,000	+ 2,000
,, United States ...	30,000	35,000	+ 5,000
,, France	36,000	15,000	– 21,000
,, Italy	5,000	3,000	– 2,000
,, Switzerland ...	9,000	11,000	+ 2,000
,, Turkey	1,000	—	– 1,000
,, Holland	2,000	2,000	—
,, Other countries ...	—	1,000	+ 1,000
Total	233,000	175,000	– 58,000
Copper, hammered, drawn or sheet.—			
From Great Britain ...	96,000	88,000	– 8,000
,, Germany	15,000	15,000	—
,, Belgium	600	2,000	+ 1,400
,, France	1,000	7,000	+ 6,000
,, Other countries ...	400	2,500	+ 2,100
Total	113,000	114,500	+ 1,500
India-rubber and gutta-percha, raw or manufactured.—			
From Great Britain ...	12,000	8,000	– 4,000
,, Germany	15,000	10,000	– 5,000
,, Austria	4,000	2,000	– 2,000
,, France	8,000	5,000	– 3,000
,, Italy	10,000	5,000	– 5,000
,, Switzerland ...	—	500	+ 500
,, Belgium	1,000	1,000	—
,, Other countries ...	2,000	1,500	– 500
Total	52,000	33,000	– 19,000
Electric, telegraphic and telephonic apparatus.—			
From Great Britain ...	46,000	35,000	– 11,000
,, Germany	25,000	13,000	– 12,000
,, Austria	15,000	8,000	– 7,000
,, Belgium	7,500	10,000	+ 2,500
,, United States ...	1,000	500	– 500
,, France	19,000	9,000	– 10,000
,, Italy	3,000	3,000	—
,, Sweden	18,000	5,000	– 13,000
,, Switzerland ...	4,500	2,000	– 2,500
Total	139,000	85,500	– 53,500

£E = £1 0s. 6¼d.

WAR ITEMS.

Effects of a Year of War upon American Electrical Industry.—In order to ascertain just how the present trouble in Europe has affected the American electrical industry in various sections of the country, the New York "Electrical World" recently approached a number of prominent central-station officials, manufacturers, jobbers and contractors, requesting their opinions and observations based on their experiences after a year of the war. The central-station industry, while it has gone forward, did not enjoy during the past year the same ratio of increase owing to a combination of depressed business conditions and to the war. Capital for development purposes is not now easy to obtain despite the permanency of the investment and the vast amount of gold hoarded in bank vaults. Throughout the trade many of the manufacturers feel the results of decreased building operation, but yet they are sanguine of good times to come. The contractors and jobbers naturally experienced some setback in business because of stagnant building trade conditions, while, on the other hand, the widening application of electricity and the campaign for the intensive cultivation of customers now being waged by many central-station companies has resulted in increased sales of electrical appliances, so that dealers generally look on present conditions with complacency.

Our contemporary publishes communications received from the heads of some of the largest holding companies in the country bearing on the situation.

Mr. S. Z. Mitchell, of the Electric Bond & Share Co., of New York, says:—"The earning power of the electrical industry, taken as a whole, has been hurt but little by war conditions. However, the uncertainties created by war conditions have somewhat depressed the market value of electrical securities along with all securities generally, other than the so-called 'war stocks.' Naturally these difficulties have adversely affected the ease of permanently financing every line of business. The money markets and the investment or capital markets, now, as always in times of disturbance, have drifted far apart. Money, as exemplified by short-time, well-secured loans, is dirt cheap and is going begging, whereas capital for permanent investment, particularly for new enterprises, is almost unobtainable at any reasonable price. This has naturally had the effect of checking new developments and expansion of old developments, and I do not look for any material improvement in these conditions until the fear of our becoming involved in foreign quarrels is gone, and also until our people can get a better idea as to what our industrial condition will be when the war is over. Many people feel that a great industrial boom in this country will follow the termination of the war. Others think that directly opposite conditions will prevail, particularly if no changes are made in the meanwhile in the tariff. They believe that when the war is concluded European factories will be found practically intact, and the necessity for employment, and particularly the necessity for immediately producing the largest possible factory output in order to meet war taxes, will be so great that European labour and European manufacturers, under the guidance of their respective Governments, will immediately rush production to the utmost and will make wages and commodity prices low enough to overcome all competition in selling goods, and that under these conditions the Europeans are bound to cut under our prices so that we shall be swamped with foreign goods. . . . I am sure that capital will be timid and new developments will be delayed until investors are better assured as to the outcome than is now the case. The advent of so many war orders in a large number of Eastern cities is proving very helpful to the electrical business. The same may be said as to some of the metal-mining industries. On the other hand, business conditions in the lumber and fruit countries of the Pacific Coast are greatly depressed, and nearly all public utilities in that section are suffering accordingly. The same thing applies, but in less degree, to conditions in some of the Southern States."

Mr. H. M. Byllesby, of H. M. Byllesby & Co., of Chicago, writing from the point of view of the local public utility company, says that there has been a very pronounced adverse effect upon the business conditions of the United States due to the war. "In the first place, it has practically stopped all financing on a large scale, and particularly for new enterprises. In sections which have profited directly from war orders or from the crop situation due to the war there is a certain degree of artificial stimulation. In general we find business in the cities and towns in which we operate to be at least dull, in most cases 'marking time,' and in the Puget Sound and Pacific Northwest section to be increasingly stagnant, this latter situation being more or less influenced by the depression in the lumber trade, which is not altogether due to the war, and to a general collapse following over-expansion in that section. . . . In general the war has had a most distressing effect upon business. It has stopped large financing of a permanent nature, and there is, I think, on the part of all responsible people a feeling of very great anxiety and apprehension as to the future of our own country as judged by the portentous events involved in the present European war."

Mr. Samuel T. Bodine, of the United Gas Improvement Co., of Philadelphia, says that should the war continue for another year, and American concerns continue to rush into the manufacture of supplies for the belligerents at phenomenal profits, of which labour is justly claiming a share, he foresees unrest and misunderstanding in other industries. He concludes:—"I cannot but feel that it would be for the common good of Labour and Capital if the concerns which are growing rich on war orders, instead of establishing high wage schedules, which cannot be maintained when business conditions become normal, would arrange with their employés to set aside for labour a percentage of their phenomenal profits, to be divided, say, every three months."

Munitions Manufacture in Australia.—In the "Sydney Morning Herald" of July 5th it was stated that the manufacture of shrapnel shells would probably be in full swing there within a few weeks. An armaments committee, at the head of which is Mr. A. E. Cutler, and which comprises Mr. J. Davis (Director-General of Public Works), Professor Warren, Mr. Lucy (Chief Mechanical Engineer for Railways), Mr. Brain (Chief Electrical Engineer for Railways), and the representatives of the principal engineering firms, have been handling the work pertaining to engineering matters, while the Chamber of Manufactures has been attending to the remaining supplies. The various engineering firms have been circularised as to their possibilities, and the replies have been highly satisfactory. Several well-known gentlemen of high standing have offered their services free. It is expected that, with the plant which the State Government is obtaining, and with the co-operation of existing Government workshops and those owned by private employers, there will soon be a large output of shrapnel shells there.

After the War: German Preparations.—In an editorial note regarding the efforts which Germany may naturally be expected to put forth to recover her trading position, "Eastern Engineering" quotes some significant information sent by the New York correspondent of a London newspaper showing the lengths to which Teutonic traders are prepared to go to secure the ends they have in view. It may be that they will find so much of the world against them that their desires will not be realised so speedily as they anticipate, but we are told on the authority of an eminent financial expert that, as one part of the scheme, Germany will require to obtain, and quickly, £200,000,000 worth of raw materials. "She cannot purchase those with bank notes. Accordingly, far-sighted Germans are now, during the war, keeping up the manufacture of iron and steel and storing up the products; they are continuing in the same way the mining of potash, and their dye factories are running at full speed. Germany's scheme is, the moment the war is over, to dump into one big market all the iron, steel, and other materials she has been able to manufacture and store during the war. The only big market available to her is the United States, since South Americans like their bills hung up, and it is an imperative need for Germany to have cash payments so that she can instantly buy with them new stocks of cotton, copper, wool, jute, and so on. For some time past America has been swarming with agents of German steel manufacturers, who are canvassing all American users of steel and telling them, 'Please give us complete lists and specifications of the sheets and tubes you use in your business, for the moment the war is over we shall be in a position to offer you those materials at prices you have never even dreamed of.' Dye manufacturers in Germany are making similar offers, and are besides conducting a most skilful campaign with a view to preventing developments of the American dye industries. This is some indication of the efforts which German traders will make to retain and foster trade." The discussion of "terms of settlement" appears to be a long way off, but it may well happen that the very confident Teutonic commercial calculations with reference to the future will prove to be like some others that have gone wrong. It will be for the Allied Governments, and especially our own, to watch such matters most closely to prevent as far as practicable a revival of the old economic war. We believe that our Coalition Government is fully alive to the possibilities, and that it will have behind it in whatever action it may take to deal adequately with this important aspect of the present struggle, the great majority of British opinion. We are so deeply absorbed with the struggle for life just now that such matters have to wait, but the time will come when victory will force such questions most prominently under everybody's attention.

Early Zeal.—While we are far from wishing to damp the ardour of the youth of England, and while we have no desire here to enter into the National Service controversy, we cannot help feeling that the action of Palmer's Shipbuilding and Iron Co. in taking proceedings against apprentices who have left their work without permission, and enlisted, will meet with approval in many quarters. We can quite imagine that the enticements of the recruiting officer are irresistible to the under-age youngster who is swept up in the waves of patriotism, but Palmer's is essentially a war factory, and its employés are war-workers, and under some circumstances it may be heroic to remain at the tasks of apprentice monotony and resist the "death or glory" appeal. When we are getting back all the engineering labour that we can from the Front it is regrettable that we should lose even the partly-trained men and boys from the places that they rightly occupy in our works to-day. Palmer's is a large company as well as a war concern, and it is able to take action where others by doing so would suffer. Legally, the apprentice cannot break his agreement and enlist unless the employer agrees, but deeds have been broken in innumerable cases. We have in mind a business in a small country town, the principal of which was without three apprentices who had flouted their legal obligations and answered the country's call to older men. He reviewed his position thus: "I can't stop them. How can I object? I shall be the most unpopular tradesman in the town if I do so." We may admire the zeal of our undeveloped lads, grumble at the condition of things that weans them away when eligible slackers hang back, and cheerfully go on bearing our share of the hardships involved, but it is as well that the sanctity of legal obligations should be brought home to the junior mind even in time of war. Certainly we must let war munitions apprentices know beyond all misunderstanding that the bench is as important as the trench in this war.

Belgians as A.S.E. Men.—The Amalgamated Society of Engineers has had under consideration the admission of Belgian workmen into the union, and it has made the following recommendations to the branches:—"Belgian mechanics who can produce proof of membership in a Belgian trade union must join the class for which they are eligible according to our rules, but such candidates will be charged no entrance fee. Where they can prove to have belonged to a trade union in Belgium they are eligible for full membership up to the age of forty-five." Privileges will be granted to Belgians for the war period only, and on the understanding that they return to their own country after the war. If any of them should remain here for a longer period than one month after the declaration of peace they must be charged entrance fee according to the rule of their age on admittance to the society. The recommendations are not applicable to candidates who were not financial members of a Belgian trade union prior to their starting work in Great Britain.—"Ironmonger."

Australia and Enemy Companies.—An Australian newspaper ("Melbourne Age") just to hand states that on July 12th, in the Central Summons Court, Sydney, the Amalgamated Wireless (Australasia) Ltd., Ernest Thomas Fish and Charles Bartholomew were charged with having traded with the enemy. It was alleged that on or about December 8th, 1914, defendants had, by entering into a contract with Gesellschaft fur Drahthlose Telegraphie mit Beschrankter Haftung, of Berlin, traded with the enemy. "Entering into an obligation" was also alleged. Mr. Bavin, for the defence, applied for an adjournment, on the ground that Mr. Denison, one of the directors of the company, was absent in Northern Queensland, and had not yet been served with the summons. The case was adjourned until July 28th.

A proclamation, issued at Melbourne on July 9th, declared the Australian Metal Co. to be an enemy subject. On July 10th, according to an Australian paper, two directors of the company (W. Friedrich Christian Schmidt, and Franz Wallach) were arrested and interned by officers of the Intelligence Corps. Both were naturalised and had lived in the Commonwealth for many years.

Metropolitan Munitions Committee.—It will be of interest to the engineering world, and to manufacturers generally, to learn that the organisation of the Metropolitan Munitions Committee is now practically complete, and that most excellent work is being done. A central office has been established at Alexandra House, Kingsway, with Mr. Cecil Partridge as general manager, and Mr. Ireland as chief engineer, with a competent staff and commodious premises. The jurisdiction of the committee extends over the whole of the Metropolitan Police area, which has been divided into ten districts, each under a district manager, associated with an assistant and a munitions engineer; and the following gentlemen have been appointed as district managers:—

Northern.—Mr. A. Hugh Seabrook (acting), 62, Finsbury Pavement, E.C. (temporary address).
North-Western.—Mr. E. T. Ruthven Murray, 346, High Road, Kilburn, N.W.
Southern.—Mr. A. C. Cramb, Town Hall, Croydon.
South-Eastern.—Mr. W. G. Head, Borough Hall, Royal Hill, Greenwich, S.E.
South-Western.—Mr. C. O. Grimshaw, 6, Eccleston Place, S.W.
Eastern.—Mr. C. Newton Russell, 215-217, Bishopsgate, E.C.
East Central and part South-Eastern.—Mr. E. Harlow, 64, Bankside, S.E.
Western.—Mr. R. S. Downe, Carnegie Library, Hammersmith, W.
Poplar and Stepney.—Mr. G. M. Gill, East London College, Mile End, E. (temporary address).
Outer Eastern.—Mr. S. H. Wood, Gas Works, Beckton.

Any information likely to be of use in connection with the production of munitions, and all inquiries, offers of premises, of tools, plant or services, etc., should be directed to the General Manager, Metropolitan Munitions Committee, Alexandra House, Kingsway, or to one or other of the District Managers, according to the district.

Copper Shortage in Germany.—Reuter's agent at Zurich states that agents are conducting a diligent and systematic hunt for copper throughout Switzerland. They are penetrating the mountains to the remotest valleys, and persuading the peasants to part with this precious metal. Taking advantage of the ignorance of these country-people they tell housewives that their copper utensils are burned out, and offer to give them new pots and kettles in exchange, which, of course, prove to be of greatly inferior metal. The business is enormously profitable, since the agents pay only 2d. to 4d. a lb. for copper which they sell to Germany for ten times as much. The Germans are constantly finding new ways of getting copper from the Swiss. There are no brass smelters in Switzerland, and taking the advantage of this the Germans insist upon receiving an equal amount of copper for every delivery of brass. And as brass weighs only about one-half or three-fifths as much as copper the Germans obtain a large surplus.—"Financial Times."

War Substitutes in Germany.—A long discussion on substitutes for raw materials which the war had made scarce or unavailable, was recently held by the Mannheim branch of the Verein Deutscher Ingenieure. Various materials were considered, and details were given of experiments now being carried on at several electric power-stations on the best ways of burning coke mixed with coal or lignite in boiler furnaces. Rubber was also discussed. It was stated that the production of synthetic rubber seemed nine-tenths successful, but the final part of the problem had never been solved. Not only the Elberfeld Dye Works, whose investigations looked very promising a few years ago, but also the Badische Anilin und Soda Fabrik had experimented on a large scale; but the researches had not been pushed of late, because the prices of rubber had gone down (before the war), and because the artificial rubber proved disappointing in use.—"Engineering."

Australia Taking Stock of Metals.—According to an Australian newspaper, the Federal Government made an order recently that persons holding more than certain quantities of steel, including steel ingots, blooms, slabs, billets, bar, rod, angle, tee, scrap, and bar and tool steel; pig iron, scrap iron, wrought iron, bar and sheet; copper ore, blocks and ingots, plate and sheet zinc or spelter, including ore, sheet, bar, blocks, lead ore, sheet and pig lead, nickel, block tin, aluminium, ferro-manganese, ferro-silicon, or antimony, must supply the Commonwealth Statistician with particulars.

Munition-Workers to Visit the Front.—The "Sheffield Independent" states that a party of munitions workers are to be sent to the front for the purpose of enabling them to judge first-hand of the necessity for increasing the amount and accelerating the production of munitions of war. The following trade unions have been asked to send representative workmen:—Engineers, brass founders and copper smiths, plumbers, boilermakers, shipwrights, union of labour, blacksmiths and ironworkers, sheet metal workers and braziers, electrical trade, patternmakers, ironfounders, tool makers, machine workers and engine makers.

Lighting Precautions: Bridlington Engineer Fined.—At the Bridlington Police Court, on Saturday, Mr. Frederick Ffrench (acting borough electrical engineer), was summoned for failing to obscure the light from the roof of the engine-house at the Bridlington Electricity Works. Evidence was given by two special constables, members of the Bridlington Town Council, the East Riding County Council, and the local Magisterial Bench that the light coming from the works constituted a danger to the building itself and to the community. A fine of £3 was imposed.

New Zealand and Enemy Goods.—Reuter's correspondent at Wellington states that Sir Joseph Ward, Minister of Finance, in laying the new Budget before the House of Representatives, said that in the Customs increases motor-cars, chassis and bodies would pay 10 per cent. ad valorem, with 50 per cent. additional on cars made in enemy countries. In addition to the individual increases in the Customs, he proposed to put an additional increase of 50 per cent. on all importations from countries that are or may be enemies of the British Empire.

Electric Fans for Military Hospitals.—An appeal for help in sending 150 electric fans to the military hospitals in Malta has been published in the daily papers by Miss Olga Nethersole, of Heathland Lodge, East Heath, Hampstead, N.W.

The Air Raid at Mülheim.—A squadron of Allied aircraft on the morning of August 27th bombarded the station and the electrical installation at Mülheim, in the Grand Duchy of Baden.

Machine Guns from Canadian Electrical Men.—The "Canadian Electrical News" states that the chief officers of the Montreal, Light, Heat and Power Co. have made contributions of machine guns for the Canadian troops; Mr. J. S. Norris, the general manager, Mr. R. M. Wilson, chief electrical engineer, and the heads of the departments, have each contributed a gun. The employés of the Northern Electric Co., Ltd., have purchased two guns.

The Government and War Badges.—The "Times" states that firms manufacturing war badges in Birmingham have received an intimation from the Minister of Munitions that all permissions given for the manufacture of private war work badges have been cancelled. The Government view with disfavour any private badges which suggest that the wearer is engaged in Government work.

Fighting the Submarine.—Writing from Geneva, Signor Emile Guarini, an Italian electrical engineer, well-known for many developments with which his name is connected, especially in the field of wireless telegraphy, informs us that he has invented an electrical arrangement for dealing with submarines, which he has submitted to the naval authorities of each of the Allied nations.

REVIEWS.

Modern Boiler Practice and Smoke Abatement. By Jas. T. Hodgson. London: The *Railway Engineer.* Price 3s. 6d.

The author of this book has set himself a task which is capable of an endless variety of fulfilment. The method he has chosen is that of illustrating and describing a very large number of boilers, furnaces, and accessories, so that there might be cast up against him the crime of making a catalogue book. But this would be an unfair description, for this is no mere bald catalogue, but a good work, for the illustrations are really illustrative of appliances which do enter into boiler practice very largely or are characteristic of the trend of practice, and such a book as this will appeal very much to the engineer-in-charge or the young power-station man who wishes to get ideas of what is being done.

The author connects everything very well by his own criticisms and reasonings, and is a safe guide to follow, evidently having a good grasp of his subject and understanding the subject of combustion. With 20 chapters to compress into 300 pages, the treatment of each item in each chapter must necessarily be very brief, and any fault that may be found is that the number of headings in each chapter is somewhat large. The wide range of subjects treated includes coal, draught, firing or stoking, conveyors, gas analysis, mountings, feed heating, steam, calorimeters, and so on through almost every detail of practice and apparatus. The author makes good comments, notably on feed heating with live steam, and superheat, but he omits to name the precaution of drilling a small hole near the top of the closed plate sliding damper so that gas cannot accumulate behind the closed damper with the danger of being exploded by sudden break up of the fire before the dampers are raised. The drilled hole allows gas to escape which might otherwise accumulate at the flue crown.

Incidentally, also, the too common error is made of using the plural form "strata" when referring to a single stratum. And, though probably of little importance, the diagram of the old wagon boiler is not correct. In the wagon boiler the top included a complete half-circle at least, which joined up directly with the hollow sides. Many of these boilers have been seen by us, and never one of the form shown by this book, with a flatly curved top joined by small radius curves to the hollow sides and with no steam room above the side flue level. This is of no moment, however, except that it is so long since the days of the wagon boiler and its pressure of ∓ on the gauge—if there had been gauges in those days—that it might be well left out of a modern book and studied only as a matter of archæological interest in older books.

Nor does the description of the calorimeter add value to the book. When a modern instrument is described whose object is to measure steam wetness, the student is, rightly, apt to think that such an instrument is reliable. Without doubting the capacity of the calorimeter to measure the dryness of the steam passing through it, that steam cannot be known to represent the steam in the pipe whence the sample is taken. No means of taking a sample have yet been devised which are worth a moment's consideration. The only possible reliable method, viz., to condense the whole output of the boiler, is too wasteful, too costly to undertake, and too cumbersome. There is one cure for wetness, and that is to superheat the steam beyond, say, 215 deg. F. at least, and use the only safe calorimeter—a thermometer—to record the dryness of the steam. Steam which is wet is not steam, but an unfinished product unfit for use in a heat engine.

Very properly, a chapter on superheat follows that on the calorimeter, and here the author draws attention to the water-screen placed in advance of the directly-fired superheater so as to conserve the superheater tubes by letting down the gas temperature. The water screen is the only sound method of doing this, and it is to be wished that the use of great volumes of cold air which are sent hot up the chimney will be abandoned. This book should be in the hands of all engineers in charge of boiler plant.

Principles and Practice of Electrical Engineering. By Alexander Gray, B.Sc. London: Hill Publishing Co. Price 12s. 6d. net.

This book is based on the lecture and laboratory course given to the senior civil, mechanical, and mining students at McGill University, Montreal, Canada. It is suited to the requirements of men who desire to obtain a broad idea of the principles and practice of electrical engineering, but who have only a limited amount of time to spend on the subject. This statement must not, however, be taken to suggest that the book is in any way a superficial study of electrical engineering. On the contrary, the fundamental principles are thoroughly emphasised and the subject is developed by elaborating these principles along essentially practical lines.

The first two chapters are given to the fundamental principles of electricity and magnetism, chapters X to XXI to the construction, operation and control of D.C. machinery, and chapters XXVII to XXXIX to alternating currents. There are also chapters on electrolysis, storage batteries, traction, lighting and transmission. The first two chapters on magnetism and electromagnetism are models of brevity and clearness, and, in fact, the whole of the introductory portion of the book is consistently good. The insertion of completely worked examples in the text is an excellent feature.

Considerable attention is given to practical details of construction even in the simpler instruments, such as rheostats and resisters, and in Chapter VI descriptions and illustrations are given of all the practical types of adjustable and standard resistances. An equally thorough treatment is given to solenoids and electromagnets of all kinds.

Two chapters are devoted to the construction of the D.C. generator. The treatment is brief, and, although it cannot be called scanty, yet, perhaps, the importance of the subject would have warranted some amplifications in certain places. The three equally brief chapters on commutation, armature reaction, and D.C. characteristics are, however, all that could be desired. The sections dealing with D.C. motors are also very satisfactory, especially the portion on adjustable speed operation. The practical uses to which the various types of motors may be put are carefully considered, and the discussion is illustrated by worked examples from practical data.

The principles of alternating currents and their application to inductive and capacity circuits are dealt with very thoroughly in four well illustrated chapters. These are followed by chapters on alternators, synchronous and induction motors and transformers. The illustrations throughout the A.C. portion of the book are excellent, and colours are used to distinguish between the various phases, both in the diagrams of machines and in the vector diagrams. Completely worked out examples also add considerably to the value of these chapters.

In the short treatment of electric traction and transmission and distribution given in chapters XL and XLI, the method adopted is almost entirely that of taking typical cases and working out the details from actual practical data. And from all points of view this method is astonishingly successful, for all kinds of practical problems can be worked on the models given. It is certainly far more satisfactory than the method of juggling with mathematical symbols and obtaining the hideous and often meaningless formulæ which characterise some of the older text-books of this type, especially in view of the practical type of student for which the book is primarily intended.

The chapters on batteries and electric lighting are extraordinarily complete considering their brevity, and, in fact, the whole work bears the hall-mark of sound experience and accurate, complete knowledge of the science. The last chapter of the book consists of an appendix of twenty laboratory experiments illustrative of the principles treated in the previous chapters. Pertinent questions follow each experiment.

It would be difficult to suggest any improvement in Professor Gray's book except, perhaps, the amplification of the chapters on D.C. machines and the addition of a collection of exercises based on the examples worked out in the text. It is certainly one of the best books on electrical engineering that any kind of engineering student could wish to study from.—P.H.S.K.

Hand Lettering for Engineers, Architects, Surveyors and Students. By W. J. Lineham. London: Chapman and Hall. Price 7s. 6d. net.

This treatise is unique, and the more one studies its pages the less is one able to understand how so splendidly produced a work, involving such labour in its preparation, can possibly be sold at the very reasonable price placed upon it. However, the feat has been accomplished, and there is now within the reach of all a work which covers completely all but freak lettering methods, and should do a great deal to encourage neatness and proficiency in what is still a very important branch of the draughtman's art. As a matter of fact, hand lettering is required in drawing and designing offices of all kinds to a far greater extent than is generally appreciated, and that it should be done as well and as quickly as possible goes without saying. To cite only two respects in which hand lettering does what mechanical lettering cannot do, the former can be adapted in infinite variety to the exigencies of space and style and in those schedules which are more and more commonly employed on machine drawings, hand lettering is alone applicable

The plates here presented include alphabets suitable for mechanical, electrical, constructional and civil engineers, architects, and architect decorators. They should be useful, as well, to map draughtsmen, Patent Office draughtsmen, and authors making their own drawings. Students and men in practice will alike find the work valuable, and any doubts they may experience as to the justification for so extensive a treatment of the subject will quickly and progressively vanish as they appreciate the gain in efficiency as well as appearance resulting from systematic practice along the lines advocated by the author. After the necessary proficiency has been attained, the book still remains valuable as a work of reference. Capital and small letters for each alphabet, figures and fractions, all in various sizes, form the subject of each group of plates. The characters are arranged first in order of difficulty, then in alphabetical order, and, finally, in words and actual phrases and titles, the better to illustrate the principles of spacing and balance. Working instructions and warnings are given for each plate, together with practical notes concerning the applicability of each fount.

Short sections are devoted to line shading of drawings and dimensioning methods. The preparation of scales is dealt with usefully, and instructions are included for the preparation of Patent Office drawings. The notes on zincography deserve special mention, and should save those who prepare line drawings for reproduction clear from many pitfalls. Another valuable feature is the section on photo-printing processes as used in drawing offices. In conclusion, folding plates are included to illustrate the application of various methods and alphabets in first-class modern drawings of a variety of types. The whole treatise is entirely above criticism, and should render sterling service in rescuing an important and thoroughly justified handicraft from the semi-mechanical mistreatment to which it is so often subjected and in securing authoritative form to lettering which, as the evolution of generations, is not likely to be improved by the sporadic inventions of a rampant imagination.

THE RUSSIAN ELECTROCHEMICAL INDUSTRY.

The serious shortage experienced in the supply of various electrochemical products in Russia since the outbreak of war has attracted much attention to the position and prospects of electrochemical industries in that country. Hitherto no aluminium has been made in Russia, though the demand (particularly during the last year) has been considerable for aviation purposes, utensils of all kinds, and as a substitute for copper in electrical applications. Magnesium and sodium have not been produced commercially in Russia, and large sums have been paid annually to Germany and America for carborundum. Other materials exclusively imported include calcium cyanamide, hydrogen-per-oxide, and "Berthollet salts," or fulminating silver. Practically nothing has yet been done there in respect of the electrical manufacture of steel, nor have the electro-thermal processes associated with zinc, phosphorus and carbon bisulphide been investigated, and, as a natural consequence, there is no native industry for the manufacture of accessory material such as carbon electrodes. There are believed to have been only two calcium carbide furnaces in Russia on the outbreak of war, whilst for the manufacture of ferro-silicium, ferro-chrome, and other special alloys, there was one small works in the Urals, and for the manufacture of fulminate there were reopened one works in the Government of Petrikau and one in Imatrafall (Finland). On the other hand, the electric refining of copper, the manufacture of accumulators, and the production of lye and chlorine were flourishing branches of electrochemical and electrometallurgical manufacture.

According to the latest available official statistics, consumption and imports of various materials during 1912 were as follows:—

	Consumption.		Imports.	
	Tons.	£	Tons.	£
Electrolytic copper	21,000	1,930 000	9,400	595.000
Lye and etching salts... ...	88 500	1,010,000	355	5,700
Accumulators	3,390	180 000	27	5,400
Aluminium	1,290	170,000	1,290	170,000
Berthollet salts and sodium chlorate	2 800	114 000	2 800	114,000
Abrasives	1,110	67 000	1.110	67.000
Electro-steel	4 030	66,100	1,940	32,900
Calcium-carbide	1,450	42,500	129	6,250
Norw. saltpeter and calc. cyanamide	2,200	10,700	2,200	10,700

The conditions necessary for the healthy development of electrochemical industry in Russia are:—Cheap power, sufficient raw materials, free capital and trained employés. As to the sufficiency of raw materials available there is not the least question, the materials chiefly required being coal, clay, sand, lime, common salt, and hydrogen, besides the various metals concerned, which are available in plenty. The capital expenditure involved is not heavy, except in the case of aluminium and nitric acid plant, and, in any event, the necessary funds should be forthcoming quite readily from native sources after the war, when the ramifications of German intrigue in Russian finance and industry have been thoroughly eradicated. Nor is there any doubt that skilled employés can be obtained in sufficient numbers and with suitable qualifications or aptitude for learning. The crux of the whole problem lies in the availability or otherwise of electrical energy at a sufficiently low price.

The average market prices of various materials in Russia in 1913, and the maximum price of electrical energy at which it is estimated profitable electrochemical manufacture could be conducted, are as below:—

	Market price per ton.		Max. competitive price for electricity.
	£	s.	
Refined copper	92	0	1·28d. per KW.-hr.
Calcium carbide	26	6	1·17d. ,,
Berthollet salts...	59	4	0 72d. ,,
Sodium chlorate	71	0	0·64d. ,,
Caustic soda	16	8	0·41d. ,,
Ferrosilicon (50 per cent.)...	41	2	0·17d. ,,
Aluminium	85	10	0·15d. ,,
Calcium nitrate	11	16	0·06d. ,,

Current for lighting purposes is commonly sold at from 5d. to 10d. a unit in Russia, that for power purposes selling at from ½d. to 2½d. per unit, but for extensive electrochemical developments, current at 0·03d. to 0·125d. per unit is desirable. Russia is at present so deficient in large hydro-electric works that it can hardly be practicable in the near future to establish such electrochemical industries as the fixation of atmospheric nitrogen or the manufacture of aluminium in that country. The limitation is, however, only temporary. It is considered that the institution of a high import tariff would encourage the development of the industries concerned, but such could, or, at any rate, should, only be a temporary expedient, as it would necessarily involve an inflated market price for the protected products.

Healthy development in this, as in so many other Russian fields, depends on the erection of really large power development schemes, and from the market opened out, directly and indirectly, by the latter, British manufacturers may reasonably hope to derive considerable benefit. Large stations must sooner or later be erected in the hard coal districts (*e.g.*, the Donetz area), and in or near the peat fields, from which ammonia and other valuable by-products could be derived, thus simplifying considerably the economic problem. At least 100,000,000 KW. could be derived from water-power in Finland and in the Urals and Caucasian districts, and it is estimated that 300,000 KW. of hydro-electric power could be developed in the Petrograd district alone and sold for electrochemical purposes at 0·03d. per KW.-hour. The fatal policy of taxing electrical energy must naturally be completely abandoned before any industry can hope to succeed which uses electrical energy in bulk.

The availability of hydro-electric power in Russia, and the possibility of utilising it profitably, are beyond question, and whilst the chief ultimate benefit will be to Russia herself, it should not be overlooked that there will be an enormous demand for imported material and plant in the years following the war, and conditions will be more favourable than ever before for attaching a large share of this business to British interests.

BUSINESS NOTES.

Catalogues and Lists.—Messrs. Perkin & Co., Ltd., Junction Works, Leeds.—Illustrated and priced descriptive lists relating to high-speed hack saws, bench millers, cutter grinders and shapers.

Messrs. Electro Galvanizers, Ltd., 16, Green Street, Trafalgar Square, London.—24-page pamphlet containing notes on electro-deposition and illustrations of nails, screws, bolts, chains, metal lift cages, steel casements, railway ironwork, electric fittings, and other articles dealt with by their patent processes.

Messrs. L. E. Wilson & Co., 10, Corporation Street, Manchester.—8-page pamphlet giving a list of electric light and power installations carried out by them for cotton mills, engineering works, warehouses, public buildings, &c.; also a few half-tone pictures showing some of the electric power applications in such places.

Messrs. Carron Co, Carron, Falkirk.—20-page pamphlet containing excellent illustrations, brief particulars, and prices of Carron electric heating appliances, including luminous and other radiators, bathroom stove, electric fires, and dog grate fires.

Messrs. Hemming Conduit Grip, Ltd., Hatherton Works, Walsall.—Four-page illustrated circular giving particulars and prices of the "Hemming" grip electrical conduit fittings.

Messrs. Matthews & Yates, Ltd., Cyclone Works, Swinton, Manchester.—Eight-page illustrated pamphlet containing particulars of their "Cyclone" electric fans and exhausters, and oxy-acetylene welding and metal-cutting plant.

British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.—Four-page illustrated price list of "Mazda" drawn-wire electric lamps relating to the following voltages and sizes:—20-89 volts, 6-60 watts; 100-155 volts, 10-150 watts; 200-260 volts, 15-150 watts; H.C.P.—100-260 volts, 100-400 watts. Prices are also given of candle, Mazdalite, sign, tubular, steamship, and traction lamps. All of these lamps are manufactured at Rugby.

For Sale.—Farnworth U.D.C. invites tenders for the purchase of one 150-KW. high-speed, direct-coupled, steam-driven dynamo. Particulars are given in our advertisement pages.

Australia.—The Commonwealth Defence Department having taken over the engineering works on Cockatoo Island, belonging to the N.S.W. Government, arrangements are in hand for converting it into a dockyard. The work to be carried out includes the installation of a large electric generating plant, tenders for the supply of which are at present being invited. The plant to be installed comprises three 1,000-KW. geared turbo-generators and one of 225-KW. capacity, four 750-KW. turbo-generators, three 500-KW. generators, two 1,200-ampere rotary balancers (250-125 volts), and two of 600-ampere capacity, five 600-KW. Diesel engines, and one of 225-KW. capacity,

Dissolutions and Liquidations. — Consolidated Diesel Engine Manufacturers, Ltd.—Mr. W. B. Peat, the liquidator, in the summary of his accounts in this matter, gives the following particulars:—*Receipts:* Balance, £8,155; book debts, £1,140; surplus from securities, £110,331; receipts per trading account, £1,629; other receipts, £44, making £121,299; less payments to execution and other secured creditors, £29,720; payments to creditors sanctioned by Court, £816; payments per trading account, £926 = £31,461, making £89,838. The *payments* were:—Salaries, wages, cost of completing contracts, Board of Trade and Court fees, law and other costs, £1,559, leaving a balance of £88,279.

G. Straus & Co., Ltd.—This company is winding up voluntarily, with Mr. W. J. Colquhoun, of 211, Upper Thames Street, E.C, as liquidator. A meeting of creditors is called for September 6th.

Willis & Hallowell, engineers' agents, electrical engineers and merchants, 211, Corn Exchange Buildings, Manchester.—Messrs. R. H. Willis and W. Hallowell have dissolved partnership.

Venner's Electrical Cooking and Heating Appliances, Ltd.—The adjourned meeting of creditors will be held at 65, London Wall, E.C., on Thursday, September 9th, at 12.30 o'clock.

Bankruptcy Proceedings.—Arthur Faraday Hawdon, electrical engineer, Yetholm, Elmfield Gardens, Gosforth, Northumberland. The following are creditors herein:—

Batty, G. L.,	Newcastle-on-Tyne	£243
"Bankers,"	" "	199
Parker, Miss M. M. W.	"	102

The Chinese Market: Long Credit.—In the course of an article on "British Manufacturers and the Machinery Trade of China," *Eastern Engineering* writes as follows:—"There is an unlimited outlet for machinery in China, but the drawback is that the Chinese usually have no money to pay the purchase price, and ask for payment facilities. The reason why German firms occupy such a dominating position in the machinery market of this country is due to the fact that they have always met the buyers, taking part-payment upon delivery and the balance extended over a few years. For instance, there are two electrical installations for, together, about 30,000 lamps in a certain district in China, supplied by the Allgemeine Elektrizitäts Gesellschaft, of Berlin. The Chinese company only paid about 15 per cent. of the value of the plant at the time when it was delivered, the balance being made up in instalments divided over six years. In other words, the Chinese usually wish to pay for the plant *out of the profits* which they can make with the installation, and it is very seldom that they can accept the terms given by nearly all the British machinery manufacturers, viz, one-third upon signing the contract, one-third upon shipment, and one-third upon delivery. If British manufacturers wish to get the bulk of this trade in China, or at least a fair share of it, they will have to give facilities for payment. The fact that German competition is tied up now does not alter the situation much as regards terms, because the Chinese *cannot* buy the machinery if they have to pay in full for it; they have no money, and unless they are assisted by sellers the business is simply impossible. To mention a few of the leading engineering schemes worked in China by German firms on the basis of extended payments, the following Chinese companies in the Yangtsze Valley alone will show how German manufacturers got a strong hold of the trade:—

Hunan Electric Light Co. at Changsha.—Contract about £15 000, payment in six years.

Chungking Electric Light Co.—Contract about £8,000, payment in four years.

Shasi Electric Light Co.—Contract about £4,000, payment in five years.

Siangtan Electric Light Co.—Contract about £12,000, payment in six years.

Changsha Cotton Mill.—Contract about £110,000, payment in five years.

Hunan Telephone Co.—Contract about £90,000, payment in three years.

"To the foregoing might be added hundreds of smaller concerns for pumping, mining, printing, flour mill, rice mill machinery, &c. The purchase price is even of less importance than the question of terms, and British machinery can be better and cheaper than anything else in the world, but it is the *terms* which the Chinese require."

Annual Outing.—The electrical and works staff of the Alpha Manufacturing Co, Balham, held their annual outing at Southend on Saturday, the 21st ult. The staff, numbering about 40, were accompanied by Mr. G. F. Beare and Mr. Harris. Mr. Hill, on behalf of the works staff, proposed the health of Mr. and Mrs. Beare, who were married a few weeks ago, and Mr. Beare, in returning thanks, referred to the fact that the number of employés had doubled itself since last year's outing. Later Mr. Harris, in reply to a toast, stated that the firm were engaged on several important electrical contracts.

Trade Announcements.—Messrs. Callas, Sons and May, Ltd., electrical engineers, have opened new premises at 65, 67 and 69, Oxford Street, Reading.

Mr. H. A. Lee, late of the Westcliff Electrical Co., of West Road, Westcliff, Southend-on-Sea, has gone into business at Northview Drive, Westcliff.

The Gardy Co. (France and Switzerland), makers of all kinds of electrical fittings and insulators, have appointed as their sole representative for this country and the Colonies, Mr. C. Campart, 49, Newgate Street, London, E.C. Telephone: No. 3,497 Central; Telegrams: "Cecampart, London."

Book Notices.—"*Journal* of the Tramways and Light Railways Association." Special Congress Number. August. 1s. The discussions and other proceedings at the Congress are reported.

"*Proceedings* of the Physical Society of London." Vol. XXVII. Part 5. August 15th, 1915. London: *The Electrician* Printing and Publishing Co., Ltd. Price 4s. net.

"Science Abstracts," A and B. Vol. XVIII, part 8. August 30th, 1915. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"Constructional Data of Small Telescope Objectives calculated at the National Physical Laboratory, Teddington." London: Harrison & Sons. Price 2s. 6d. This has been prepared by desire of the Director-General of Munitions Supply, and is intended for the assistance of opticians who may be engaged in the manufacture of optical instruments. The crown and flint glasses for which the calculations have been carried out are those contained in a recent list of optical glasses issued by Messrs. Chance Bros. The Laboratory authorities retain the copyright of these tables.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXXI. Part 5. Newcastle-on-Tyne: The Institution. Price 5s.

Messrs. Alfred Herbert's *Monthly Review* of Machine Shop Practice for August contains among other things an account of the King's visit to the firm's works in July.

LIGHTING and POWER NOTES.

Armagh.—Proposed E.L.—The Council is to consider a report on an electric lighting scheme for the town, and the town clerk has been instructed to obtain information from Dundalk and Lurgan, where electric lighting had been introduced, for the purpose of the promotion of the scheme.

Batley.—Year's Working.—According to the abstract of accounts for the year ended March 31st last, the Corporation electricity works commenced the year with a credit balance of £138, and a net profit of £634 on the year's working has been made, making a total of £772, of which £714 has been allocated to the liquidation of a debt in respect of a new switchboard. For the past 10 years the figures of profit and loss have been as follow:—1905-6, loss, £61; 1906-7, profit, £494; 1907-8, profit, £121; 1908-9, loss, £307; 1909-10, profit, £170; 1910-11, loss, £127; 1911-12, loss, £37; 1912-13, profit, £1; 1913-14, loss, £116; 1914-15, profit, £634. The capital expenditure on the undertaking to date amounts to £55,721.

Belfast.—Power Station Fire.—In our last issue we referred to the fire which occurred at the Corporation electricity works; we now learn from Mr. Bloxam, the city electrical engineer, that this fire occurred early on the Sunday morning, involving the part of the building immediately over the bunkers. This portion of the building was designed to avoid coal dust causing a nuisance in the adjoining street, and was in consequence poorly ventilated, but was constructed largely of wood. Heating in one of the bunkers liberated sufficient gas to fill this structure; the gas became ignited, and fired all the woodwork simultaneously. The damage is chiefly confined to this structure and the coal conveyor, which is partly destroyed; there was no interruption to the electricity supply whatever, the fire brigade effecting a splendid save of the adjoining buildings. The whole damage is covered by insurance, and the work of restoration will easily be completed before the winter's load.

Bispham.—An agreement has been entered into for a supply of electricity to be given to the premises of the Cleveleys Hydro., Ltd.

Blackburn.—Price Increase—The Electricity Committee is to consider, in view of the increased cost of fuel, whether the charges for current should be increased.

Blackpool.—The effect of the lighting restrictions at Blackpool "in the season" may be judged to some extent by comparative figures for July this year and July of 1914. The falling-off in July this year is no less than 146,471 units, the largest decreases being 64,786 units for private lighting, and 77,090 units for tramway purposes. Over a period of four months, the decrease in the units consumed amounts to 231,100 units—127,720 units being due to the decreased demand of the tramways department. During the four months 100 new consumers have been secured, as against 187 in the corresponding period of last year.

Bolton.—The Electricity Committee has made a grant of £10 to the Engineering Standards Committee towards the fund necessary to carry on the work of electrical standardisation.

Brymbo.—E.L. Proposals.—The Brymbo Steel Works, in reply to a communication from the P.C., has intimated that it has no objection to the Wrexham T.C. extending its area for the supply of current to the parish, as it does not intend supplying electricity for private purposes. The Council has decided to offer no objection to the application of the Wrexham T.C. for a prov. order.

Canada.—Life of Half-Watt Lamps.—The Hamilton Hydro-electric Department makes careful records of the life of different lamps, and so is accumulating valuable information regarding the relative merits of the various types. During 1914 the city installed approximately 1,000 500-watt nitrogen lamps, and a report of May 22nd, this year, states that 977 lamps had given a total of 1,456,848 hours of light. This is an average of 1,491 hours per lamp, including all troubles. Even at that, a very large percentage of the original lamps were still in operation.

The contract for the construction of La Loutre Dam, on the St. Maurice River, 52 miles from the mouth of the Manouan River, P.Q., has been let to the St. Maurice Construction Co. The price is $1,425,000. The dam will be of great benefit to the hydro power companies and plants on the St. Maurice River, and the Quebec Government, which has undertaken the enterprise, is assured of sufficient annual income, from the companies having plants, to more than pay for the maintenance charges and interest on the capital cost. The storage proposed will increase the power at Shawinigan over the low water year of 1906 by 32,000 H.P., and will double the low water possibilities of the St. Maurice River at that point.—*Canadian Electrical News.*

A hydro-electric scheme which is talked of involves an expenditure of about $100,000,000 in damming the lower Niagara River, and developing 2,000,000 H.P. of electrical energy for use on both sides of the boundary. This would be accomplished by constructing a 90-ft. dam, just above Queenston and backing the water up practically to the foot of the Falls.

The proposal was presented last week to the Joint Legislative Commission of New York State by Mr. P. A. Porter, who nearly 30 years ago introduced the original Power Development Bill.

There is no relation, it is stated, between this scheme and that of the Hydro-Electric Power Commission of Ontario.—*Canadian Engineer.*

Cardiff.—Price Increase.—Owing to the advance in the price of fuel, &c., the T.C. has decided to notify all consumers other than those under special contract, that the charges for electricity will be increased as from October next.

Continental Notes.—Spain.—The *Gaceta de Madrid* states that Don José Echevarria Lavin and others have been authorised to utilise the waters of the Rio Cares, in the district of Posada de Valdéon, Province of Leon, at the rate of 3,400 litres per second, for the production of electric power for lighting and other industrial uses.

The *Gaceta* may be consulted at the Commercial Intelligence Branch, B. of T.

An electric lighting station has been installed at Tetuan, Morocco. The plant consists of an 80-H.P. generating set, driven by steam power, creosote being used for fuel.

Coventry.—Loan Application.—The E.L. Committee of the T.C. has applied for a loan of £80 088 for the provision of new plant and for building extensions at the E.L. works. The extension is required for Government purposes.

Fermoy.—E.L. Scheme.—The U.D.C. had under consideration an application from the firm of electrical engineers, which is carrying out the scheme of electric lighting for the town, for permission to provide overhead instead of underground cables, as originally intended. The Council decided that the original scheme should be carried out.

Glasgow.—Restricted Lighting.—According to the *Scotsman*, the lighting of the streets is to be reduced by one half after midnight in order to reduce the expenses, and to make the city less conspicuous from above. When the new system is adopted the electric lights on one side of each street are to be extinguished at midnight.

Haslingden.—The T.C. has referred to the Electricity Committee a communication from the Helmshore Co-operative Society, asking whether there was any probability of the Corporation's extending the electric cable, to give a supply to Helmshore in the future.

Market Drayton.—The E.L. and Power Co., Ltd., has applied to the B. of T. for permission to erect 240-volt overhead lines in several streets in the town. The company was recently given the public lighting contract for the town.

Manchester.—Loan Sanction.—The Sanitary Committee has received sanction to borrow £684 for works in connection with the electric lighting installation at Baguley Sanatorium.

The City Council has rejected the resolution by Councillor Clyne, that an independent expert be appointed to inquire into the whole policy of the Electricity Department; only two votes were recorded for the resolution.

Portrush.—The B. of T. has extended the time for the laying of the mains in certain streets under the Portrush Electric Lighting Order, 1913, for one year from August 15th, 1915.—*Belfast News Letter.*

St. Helens.—L.G.B. Inquiry.—An inquiry was held on the 26th ult. into the application of the Corporation for permission to borrow £15,000 for electricity works extensions and additions to plant. The proposed work comprises the enlargement of the engine house, £850; the installation of a 3,000-KW. turbo-alternator and condenser, £9,985; switchgear, £515; water cooling tower, pipe works, &c., £1,250; water-tube boiler and mechanical stokers, £1,750; and £650 is set apart for contingencies. It was stated that the application for borrowing powers had been hastened by the increasing demand for electrical energy by firms employed on Government work.

Salford.—The Electricity Committee has decided that all power supplied to motors employed in driving electric generators producing energy for lighting purposes shall be charged at lighting rates, except in the case of motor generators used for cinematographs, when the charge will be a flat rate of 2½d. per unit.

South Shields.—Year's Working.—The annual report on the working of the Corporation electricity undertaking for the past year shows that the revenue was £34,482, as compared with £33,775 in the previous year, an increase of 2 per cent. ; the expenditure amounted to £17,534, an increase of £712 due chiefly to heavier rents, rates, and taxes. The gross profit was £16,948, as compared with £16,953, and after providing for interest and sinking fund charges, &c., there was a net surplus of £3,215, as compared with £3,484 in the previous year. Of this, £1,600 has been contributed to the rates, and the balance placed to the reserve fund, which stands at £16,335. The net amount provided for the extinction of debt since the inception of the undertaking has been £88,568, equal to 41 per cent. of the total capital expenditure. The engineer, Mr. H. S. Ellis, reports that satisfactory progress has been made in connection with the electrical clauses of the Corporation Bill, and it is hoped to be in a position shortly to hire out electrical apparatus, such as motors, heaters and cookers, at a nominal annual charge.

U.S.A.—Flooded Power Plant.—On August 3rd last, the French Street station of the Erie Electric Co., in Erie, Pa., was wrecked by a flood, which at its height left 20 ft. of water in the buildings, covering the engine foundations with over 2 ft. of mud and choking the machines with sand, &c. The generators were completely submerged, and it was several days before the machines were finally dried out and ready for service again. The company received immediate assistance from the staffs of neighbouring E.L. Cos., while the Westinghouse and General Electric Co.'s dispatched experts and repair equipments, and apparently the plant resumed operation in about 10 days' time. The station had previously given uninterrupted service for 27 years.—*Elec. World.*

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Year's Working.—With further reference to the year's working of the Corporation tramway department, of which some particulars were given on page 142, the total revenue, £88,002, was the highest so far obtained, being an increase of £2,735 on the previous year, despite adverse conditions. Of the net profit, £7,590 has been carried to the reserve account, which now amounts to £36,805 ; the depreciation fund stands at £152,997. The average total revenue per car-mile was 11·06d., and average working expenses per car-mile 6·48d. The units used for traction purposes were 2,317,204, at an average cost of ·845d. per unit. During the year £10,250 was expended out of capital, making a total capital expenditure to date of £366,332.

Belfast.—At a special meeting of the Tramways and Electrical Committee, the Sub-Committee appointed to consider the reduction of the working expenses of the tramway system, submitted certain recommendations to achieve the desired effect, the estimated saving being £4,300, or within £700 of the estimated deficit, in conjunction with the raising of the fares on the Glengormely line.

Blackburn.—A Sub-Committee has been appointed to revise the tramway fares, with a view to obtaining a larger revenue by a re-arrangement of stages, and, it is stated, increases on certain sections. An alternative policy is favoured by a section of the Council of a system of penny fares for any distance within the boundaries.

Blackpool.—Figures presented by the manager to the Tramways Committee show that at the end of July the total decrease of tramway revenue was £8,700. By August 19th this figure had been reduced to £5,660. The season figures are much better than anticipated, though it is not likely the whole of the present £5,660 decrease will be made up.

Continental.—Portugal.—The *Diario do Governo* (Lisbon) publishes a notice that a concession has been granted to the "Companhia Carris de Ferro do Porto," for the construction and working, for a period of 75 years, of an electric railway from Botica da Maia to the station of Ermezinde. Particulars can be seen at the Board of Trade Commercial Intelligence Department.

Germany.—The Berlin Tramway Co. has greatly increased the number of its female employés owing to the constant drain on the male servants by the military authorities. The number of female conductors at the end of June, 2,000, has now been increased to 2,700, and it is now stated that should the drafts for military purposes continue the entire staff of conductors, numbering 4,900, will be composed of women in the early autumn. Hitherto no attempt has been made to use women as drivers, but it is understood that the military authorities have informed the company that the male drivers will all be wanted in a short time, and that it will be necessary to begin with the training of women. Some 250 ntelligent women have been already selected by the company for nstruction.—*Daily Chronicle.*

Dundee.—Tramway Fares.—The Special Committee of the T.C. has had under consideration the question of taking over a small section of tramway hitherto owned by the Dundee and Broughty Ferry Tramway Co. and also the question of fares. The Corporation tramway manager reported that the fares had been so increased by the company on the part of the line it still possessed that the public would not benefit, although it was for that object that the Corporation took over the section of the line. He suggested that the Corporation could not afford to pay £20,000 for this part of the line, its improvement and working, unless the fares were modified. The Committee decided to recommend the T.C. to terminate the agreement with the company, unless the fares were modified.

Huddersfield.—The Brighouse Corporation has signified its acceptance of the proposal put forward by the Huddersfield T.C. for the postponement of the scheme for the construction of a new line through Rastrick, so linking up Brighouse with Bradford. The scheme is to be delayed until the Parliamentary Session of 1917.

Liverpool.—Traffic Statistics.—The traffic return of the Corporation tramways for the period from January 1st to August 21st, shows receipts amounting to £442,221, as against £443,061 last year, being a decrease of £840. The passengers totalled 95,766,114, as against 94,053,741 in 1914, an increase of 1,712,373. The decrease of £840 in receipts, coupled with an increase of nearly a million and three-quarters of passengers, is explained by the fact that 4,483,775 free journeys were given to soldiers on duty or on furlough, to wounded soldiers and to nurses. These journeys at the average fare would have yielded £22,745.

Manchester.—The Tramways Committee has decided to apply to the B. of T. for a further extension of the period allowed for the construction of certain tramways and the compulsory purchase of lands for and in respect of street widenings and works, and the town clerk has been instructed to take the necessary steps in conjunction with the local authorities concerned.

Female Labour.—The Tramways Committee has decided that a few women conductors should be employed by way of experiment. The latest return of enlistments shows that 2,013 men from the tramways department have joined the Forces, 1,121 being married men, 644 single men, and 245 trolley boys. The allowances made by the department to the men or to their dependents is now at the rate of £70,000 per annum.

Wharfedale.—Railless Service.—Delay is taking place in the inauguration of the railless traction service in Wharfedale, in conjunction with the Leeds City tramways, on account of the impossibility of getting the necessary cars delivered. The builders are engaged on Government work and, therefore, local municipal requirements have to stand aside, and it is impossible to state definitely when the service will be commenced.

TELEGRAPH and TELEPHONE NOTES.

Norway.—The construction of the trans-Atlantic radio-telegraphic station at Stavanger, which has been delayed by the war, is now being proceeded with by the Marconi Co. In order to equip it as a first-class station, and to utilise all the most recent improvements resulting from experience gained in the war, extensive reconstruction is taking place, the cost of which, amounting to £40,000, is being borne by the Marconi Co.

Reduced Wireless Rates.—The Marconi Wireless Telegraph Co. announces that telegrams can now be accepted at its offices to be exchanged between the United Kingdom of Great Britain and Ireland and Bermuda, Turks Island, Jamaica, Antigua, St. Kitts, Dominica, St. Lucia, St. Vincent, Barbadoes, Grenada, Tobago, Trinidad and British Guiana at 2s. 2d. per word for ordinary full rate messages, and at 1s. 1d. per word for deferred messages in plain language. The rates for Bahamas-Nassau for the same classes of telegrams are respectively 2s. 2d. and 1s. 0½d. per word. A service at deferred rates is not at present recognised by the Islands of Porto Rico, St. Croix and St. Thomas, but the rates to these islands for ordinary telegrams have also been reduced to 2s. 9d. per word. The above rates are, in all cases, cheaper than those charged by other companies by 4d. and 2d. per word, and they will be notified by the General Post Office to all provincial offices, in the next Post Office circular.

Spanish Guinea Telephones.—The work of installing telephone lines in Spanish Guinea is proceeding actively. A beginning has been made with the line from Santa Isabel to San Carlos, with the object of uniting the capital with the principal centres of Fernando Po, and it is proposed to continue the circuit from Santa Isabel to Musola and La Conception, for which object the material is being forwarded to the colony, but the necessity of awaiting the construction of the Continental telephone line (Campo to Bata Kogo), which compels the forwarding of the material required to Fernando Po and the convenience of shipping the telephone material to the island in the neighbourhood of the railway, has caused the temporary setting back of the proposal. The telephone is now in operation between Campo and Bata, and it is in course of extension from Santa Isabel to Bausupu, following the course of the railway.—*Industria e Invenciones.*

Stockport.—The local branch of the Amalgamated oiety of Telephone Employés has decided to send a resolution the Postmaster-General urging the payment of the war bonus anted from March 1st last.

Telegraph Plot.—The *Times* mentions the reported scovery of a German plot to seize Vancouver and other Pacific ast cities at the beginning of the war; it is stated that it was anned to control the Pacific Cable and route to Vladivostok from ncouver.

Wireless Experiences at Gallipoli.—The following stract is from a letter received by the Marconi Co., and culated by the *Wireless Press*, from a naval wireless teleaph station on the Gallipoli Peninsula:—"Times have been ry exciting, and working wireless here is not quite the same sitting in a comfortable Marconi room on board ship. Our struments are in a dug-out on a hill side facing the sea, our ing 'room' is next door. We are using a ·5-KW. pack set, cepting that the engine and generator are mounted on a bedate instead of on the usual pack-saddle frame. It has been out the best working set it has been my fortune to use; we have d no trouble at all, except very minor forms, since we landed. ır main trouble is broken shafts; we broke the original steel aft, and have since had to manufacture our own from wood, ıich, needless to relate, do not last very long. We have been der a continual shell fire all the time—shells varying in size om 18-pounder to 11-in. (probably from the *Goeben*). It is a ore or less common occurrence to have our aerial shot away; in at case we do not stop outside to make neat splices, but tie knots the wire and rush for cover again. The last time it happened piece of shell made a hole right through the base of the mast d out two stays. The mast is still standing however. We also d a new reel of aerial wire cut up into small pieces! There e four operators besides myself. I do not keep a watch, as I ve to generally superintend the working of the station. When get any spare time, which is not often, I take a trip to the enches and fire a few shots at sandbags—all I could see of the ırkish position excepting dead Turks. My last voyage with the arconi Co. was coming home with the Australian troops. I have et them all here since and renewed many friendships."

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—September 8th. Supply of electrical stores, r the directors of the Powell-Duffryn Steam Coal Co., Ltd. orms of tender from the Stores Manager, Aberaman offices, near berdare.

Australia.—ADELAIDE.—October 6th. Portable directupled internal combustion engine and dynamo; extension to orage batteries at Central Exchange, for Deputy P.M.G.*

BRISBANE.—October 6th. Tinned-copper wire, porcelain pothead sulators, for the P.M.G. See "Official Notices" August 20th.

SYDNEY.—September 23rd. Condensers, galvanometers, relays, ıd sounders, also incandescent electric lamps, for the P.M.G.'s epartment. See "Official Notices" August 13th.

October 25th. Six electrically-operated wharf capstans, for the ydney Harbour Trust. Forms of tender from the Engineer-inhief, Harbour Trust Offices, Circular Quay.*

October 25th. For the Commonwealth Department of Defence Navy Office). Supply, delivery and erection of power-station lant and equipment for the Commonwealth Naval Dockyard, ydney.*

City Council. Turbine oils; motor or rotary converter for Town all sub-station; feed-water heater for power house.

HAWTHORN.—November 30th. Refuse destructor plant, for the awthorn-Malvern-Camberwell and Kew Destructor Trust. Specication from the Trust Engineer's Office, Town Hall.

Birmingham.—September 4th. Corporation. 250,000 ons of coal, for the Electricity Supply Department. Particulars rom Mr. R. A. Chattock, City Electrical Engineer.

Edinburgh.—October 4th. Corporation. Cast-iron ıtake shaft, pump shaft, and connecting tunnel for obtaining ea-water for condensing in connection with the new electricity tation at West Bank, Portobello. Specifications can be seen at the ffice of Sir A. B. W. Kennedy, 17, Victoria Street, S.W., and btained from the Engineer, Dewar Place station, Edinburgh.

Kirkcaldy.—September 6th. Installation of electric ight at the new Sanatorium and Fever Hospital buildings. pecifications, &c., from the Burgh Electrical Engineer.

London.—Bow.—September 21st. Supply of electrical oods, for the managers of the Poplar and Stepney Sick Asylum District. Forms of tender from Mr. S. G. Wright, Clerk, the Asylum, Devon's Road, Bow, E.

ISLINGTON.—September 7th. Six months' supply of electrical ittings and sundries, for the Guardians of St. Mary's, Islington. Particulars from Mr. E. Davey, Clerk, Guardians' offices, St. John's Road, Upper Holloway, N.

Manchester.—September 7th. Block tin, for the Tramways Committee. Mr. J. M. McElroy, General Manager.

New Zealand.—DUNEDIN.—November 3rd. City Council. Supply and delivery of insulated and bare copper wire in quantities for a period of two years. Specifications at Electrical Engineer's office, Market Street, Dunedin.—*New Zealand Shipping and Commerce.*

Reigate.—September 13th. T.C. Twelve months' supply of A.C. induction motor meters. See "Official Notices" to-day.

Shanghai.—September 24th. Municipal Council. One turbo-generator, 5,000 KW., and one or two of 10,000 KW., complete with condensing plant, &c. See "Official Notices" August 20th.

September 29th. E.H.T. switchgear, static transformers, and underground cables for 22,000 V., for the Municipal Council. See "Official Notices" August 27th.

South Africa.—JOHANNESBURG.—September 25th. For the T.C. Two turbo-alternator sets, condensing plant, switchgear, &c. Specification, &c., on deposit of £2 2s., from Mr. J. H. Dobson, General Manager.*

September 25th. Municipal Council. 1,595 electricity meters and 50 time switches.*

October 9th. Municipal Council. Water-purifying plant with a capacity of 75,000 gallons per 24 hours, for the generating station.*

Spain.—September 15th. The municipal authorities of Avila are inviting tenders for the concession for the electric lighting of the town during a period of 10 years, with a possible extension to 15 years.

Swindon.—September 18th. Corporation. Supply of steam coal. See "Official Notices" to-day.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The Hawthorn Tramways Trust has accepted a tender for the construction of the Melbourne-Burwood electric tramway, but the name of the successful firm and the amount had not been announced when our information left by the mail.

SYDNEY.—The City Council has accepted the following tenders:

Australian General Electric Co.—Disconnecting switch and fuses, £1,524.
N. Gutthridge & Co.—Indoor transformers.
W. G. Watson & Co.—Low-tension straight-stem insulators.

Belfast.—At a statutory meeting of the Belfast Harbour Commissioners on August 17th, the minutes of the Works Committee showed that a report had been made by the engineer as to Messrs. Alexander Chaplin & Co.'s contract for four 5-ton electric gantry cranes. The engineer was authorized to negotiate with Messrs. Chaplin for the completion of the contract on the lines suggested in his report.

Bristol.—The Docks Committee of the T.C. has accepted the tender of Messrs. Buchanan & Co. for the electric light installation at the new sheds at the Royal Edward Docks.

Coatbridge.—Messrs. Chamberlain & Hookham, Ltd., have received the contract for meters for the ensuing 12 months.

Coventry.—The T.C. Electric Light Committee has provisionally accepted the tender of the British Thomson-Houston Co., Ltd., for a 6,000-KW. set, and that of Messrs. Babcock & Wilcox, Ltd., for four boilers, for the electricity works.

Horsham.—The Council has accepted the tender of the Pritchett & Gold and Electrical Power Storage Co., Ltd., for the battery extension to which reference was made on page 261 of our last issue.

Reigate.—The B. of G. has accepted the tender of Messrs. Tamplin & Makovski for laying an electric light cable and a power cable from the transformer chamber, near the entrance lodge, to the switchroom in the basement of the new infirmary.

New Zealand.—NAPIER.—The tender of Messrs. Turnbull & Jones has been accepted for the installation of the electric light at the breakwater, at £320.—*New Zealand Shipping and Commerce.*

Salford.—The Electricity Committee has accepted the tender of Messrs. J. Gerrard & Sons, Ltd., for alterations and additions to buildings and the construction of foundations at the electricity station, Frederick Road, Pendleton, required in connection with the additional 5,000 KW. turbo-alternator, for £1,341. The following tenders have been accepted for the supply of coal during the 11 months ending July 31st, 1916:—

Clifton & Kersley Coal Co., Ltd.—16,000 tons of best washed slack, at 17s. per ton.
A. Knowles & Sons, Ltd.—8,000 tons of best washed slack, at 17s. per ton,
Earl of Ellesmere.—6,000 tons of best washed slack, at 17s. 6d. per ton.

FORTHCOMING EVENTS.

British Association.—The Manchester meetings will commence on Tuesday, September 7th, when Prof. Schuster will deliver his Presidential Address in the evening, in the Free Trade Hall. The concluding meeting will be held on Saturday morning, September 11th. Some of the papers to be read at the meetings are mentioned on page 214 of our issue of August 13th.

Institute of Marine Engineers.—Tuesday, September 7th, at 7 p.m. Presidential Address by Sir Arch. Denny, Bart., LL.D.

NOTES.

Electrical Company Heavily Fined.—On Tuesday last, at the Bow Street Police Court, the Concordia Electric Wire Co, Ltd., of Cricklewood, was fined £250, and 25 guineas costs, and two of the directors—Robert Fifer, of Hampstead Garden suburb and Leopold Aron, of Wembley, were fined £250 each, the company for failing to give the Public Trustee particulars of all the shares of the company held for the benefit of an enemy, and the two directors for being parties to the default. The information was concerning 13,993 shares held for the benefit of the Fabrik für Drahter zu Elektrischen Zwecken Vorm, of Aldershof, near Berlin, and the proceedings were taken under the Trading with the Enemy Act. Mr. Travers Humphreys appeared on behalf of the Director of Public Prosecutions. According to the report in the *Daily Telegraph*, he stated that the company was registered in 1902 for the purpose of trading as a branch of a German company called the Fabrik für Drahter zu Elektrischen Zwecken Vorm, of Aldershof, near Berlin. The whole of the share capital was held by persons in England in trust for the parent company; the company was managed from Berlin, and the profits were remitted to Berlin. At the outbreak of war the subscribed capital of the company consisted of 14,000 £1 shares, of which 13,988 were held by the two directors Aron and Fifer, as nominees for the enemy alien concern in Germany. In May of this year Aron seemed to have got a little nervous about his position, he was expecting to be interned, and desired to get rid of his shares. He therefore approached two employés of the company, and suggested that they should each take half of his 7,988 shares. Neither of them was in a position to buy the shares, but they each gave a promissory note for £1,000, and an arrangement was made that as dividends were declared on the shares the money should be taken by Aron. So far as Fifer was concerned, he still held 6,000 shares as nominee for the parent company. No notice was sent to the Public Trustee of these enemy shareholdings, and probably the matter would never have come to the knowledge of the authorities but for an accidental circumstance. It happened that a woman was summoned at the police-court for the non-payment of rates. She mentioned that her husband had been employed by this company, which she referred to as a German company in a way which caused the police to make inquiries. Detective-inspector Ferrier went to the office and saw Aron, who made a clean breast of the whole matter, and subsequently the necessary return was made, showing that all the share capital was held on behalf of the German company. The books of the company showed that for the year 1913 a profit of £3,294 was remitted to Berlin, and up to September, 1914, there was a profit of £2,292, which was invested in English securities. He was instructed to put the case before the Court as one in which there were no mitigating features.

Mr. Elliott, for the defendants, said his clients were unaware of the provision of the Act of Parliament which required these returns to be made. Since the outbreak of war no money had been transmitted to Germany, and there had been no act inimical or hostile to this country. The company was a prosperous one, which had been executing contracts for the Government in connection with the supply of wire for telegraphs and telephones. The defendants were both paid servants of the company, and had no further interest in the business. Aron was now interned, and Fifer, who was the son of Russian parents born in Berlin, was naturalised in this country.

Mr. Hopkins (the Magistrate) said that to tell him that two foreign directors of a foreign company did not know their liabilities under this statute was to tell him that which no amount of persuasion would make him believe.

Private Arrangements.—Phœnix Electric Heating Co. (1914), Ltd., electrical engineers, 17, Morwell Street, Tottenham Court Road, London, W.—In pursuance of the Companies' (Consolidation) Act, a meeting of the creditors of the above was held on Wednesday, when it was reported that the company had passed resolutions in favour of voluntary liquidation. The liquidator stated that the company was registered in September, 1914, with a nominal capital of £3,000 in £1 shares, to take over the business of manufacturers and dealers in electrical apparatus, which had previously been carried on by Mr. S. D. Cox, under the style of the Phœnix Electric Heating Co. The company took over the business as from January 1st, 1914, and the purchase price of the assets transferred was £750, which was satisfied by the allotment to the vendor of fully-paid shares. The company also gave the vendor an undertaking to fulfil all contracts and indemnify him against any claims. The directors of the company were Mr. S. D. Cox and Mr. B. L. Clements, and they each held 751 shares. The total number of shares issued was 1,503, and on the shares held by Mr. Clements there was a liability due to the company of about £240. In 1914 the company made a loss of £458. That loss was chiefly attributable to a strike which took place. During the present year there had been a further loss on the trading owing chiefly to lack of working capital. Work in hand could not be carried out for that reason. The company had a contract with the Admiralty, but the proceeds of the contract had been assigned to the bank, who were creditors for about £200. The landlord had distrained for rent, and was still in possession. The liquidator could not see his way to advance the money to pay out the landlord, and unless the business could be sold as a going concern the landlord would sell the assets, and there would probably be nothing for the creditors. The liabilities of the company amounted to between £600 and £700, while the only free asset consisted of the book debts, which were estimated to realise £60 or £70. The other assets were office furniture, plant and tools valued in the books at £200, and stock-in-trade £300. At a forced sale the stock and plant would not produce anything like the figure at which it appeared in the books, and might not produce sufficient to satisfy the landlord's claim. Efforts were being made to sell the business as a going concern. No resolutions were passed, and therefore the voluntary liquidation of the company will be continued with the liquidator appointed by the shareholders.

Institution and Lecture Notes.—Iron and Steel Institute.—At the autumn meeting, which is to be held at th Institution of Civil Engineers, Great George Street, S.W., o Thursday and Friday, September 23rd and 24th, Mr. Arthu Cooper, LL.D. (immediate Past-President) will preside, in th absence of Mr. Greiner. The following is the list of papers that ar expected to be submitted for reading and discussion:—

Wesley Austin, M.Sc.: "Influence of Oxygen on Some Properties of Pur Iron"

T. H. Byrom: "Note on the Carburisation of Iron at Low Temperatures i Blast Furnace Gases."

Prof. E. D. Campbell: "Influence of Heat-Treatment on the Specific Resistance and Chemical Constitution of Carbon Steels."

Prof. C. A. Edwards, D.Sc., and H. Kikkawa: "Effect of Chromium an Tungsten upon the Hardening and Tempering of High-Speed Too Steel"

W. H. Hatfield, D Met.: "Phosphorus in Iron and Steel."

Prof. K. Honda and H. Takagi: "The Magnetic Transformation o Cementite."

R. H. Smith: "Sulphur in Malleable Cast Iron."

Prof. N. Tschischewski: "Iron and Nitrogen."

By-laws.—As Rule 20 requires that no alterations of the by-law shall be made except at the annual general meeting, and notice o any proposed alterations shall be given at the general meeting t be held in the autumn, the Council will, at the forthcomin meeting, give formal notice of their intention to submit to th annual meeting in May, 1916, the following new rules for additio to the existing by-laws:—

1. In the event of a state of war existing between Great Britain and an other country, or State, all members, honorary members, and honorary vice presidents who shall be subjects of such enemy country, or State, shall forth with cease to be members, honorary members, or honorary vice-presidents o the Institute, but they may, if the Council thinks fit, be reinstated after th termination of the war.

2. The Council shall have absolute power to remove from the list o Members of the Institute the name of any member, whether ordinary o honorary, for wilful contravention of the by-laws or for any other reaso which seems to them sufficient, and such ordinary or honorary member shal thereupon cease to be a member of the Institute.

Institution of Mining Engineers.—At the annual meetin which takes place at Leeds on September 15th, several papers wil be read, including one by Mr. Sam Mavor on "Compressed Air fo Coal-Cutters," and one by Mr. M. H. Mills on "Gas Producers a Collieries for Obtaining Power and By-products from Unsaleabl Fuel."

Royal Engineers (Wireless Section).—There ar several commissions available in the Wireless Section of the Roya Engineers for general service during the period of the wa Applications are invited from candidates with good technica knowledge of wireless telegraphy and used to the control of me Applications should be addressed to Major Handley, M.I.E.E., O.C Wireless Training, Oxford Cottage, Sandown, I.W.

Fatality.—A seven-year-old child was killed by electri shock on the North-Eastern Railway Riverside Branch whil trespassing. He climbed over the wall on to the railway, and wa found with his face, fingers and knees in contact with the li rail. On July 21st a boy of 11 was prosecuted for trespassing a the same place.

Educational.—King's College, University of Londo Faculty of Engineering.—Next term begins on October 6t Particulars are given in our advertisement pages.

Electrically-driven Letter-Sealing Machine.—H.M Trade Commissioner for New Zealand reports that one of the Ne Zealand Government Departments makes inquiry for the nam of United Kingdom manufacturers of electrically-driven lette sealing machines. The device at present being used is of foreig manufacture, is self-feeding, and is stated to work much mo rapidly than any hand or treadle machine. At the same time it apparently not so durable as could be wished, and no spare par are obtainable. Communications should be addressed to H.M. Tra Commissioner for New Zealand, P.O. Box 369, Wellington, Ne Zealand.

Shirkers Fined.—We observe that some 28 youth engaged at the works of Messrs. Stewarts & Lloyds have been fin for leaving their work because of the heat of the tube-weldin furnaces. Their action stopped three furnaces, put 22 men out work, and wasted 20 tons of metal. A reminder that our men Gallipoli and in Persia were having a far hotter time failed influence them. The chairman of the Bench at Halesowen sa that our men were fighting up to their knees in water, and pr bably required these tubes for draining the trenches.

Volunteer Notes.—Engineering Institutions' Volunteer Training Corps.—Headquarters, Marconi House, Strand, London, W.C. Drill Centre.—By kind permission of Lieut.-Col. A. E. Le Rossignol, R.E., Headquarters of London Electrical Engineers, 46, Regency Street, London, S.W.

Company Orders.—By Lieut.-Col. C. B. Clay, V.D., Commandant, or week ending September 11th, 1915 :—

Monday.—Drill, 6.30-7.30 ; 7.30-8.30. Section 3, Technical nstruction ; Section 1, musketry at the miniature ranges ; Sections 2 and 4, Squad drill.

Friday.—Drill, 6.30-7.30 ; 7.30-8.30. Section 4, Technical nstruction ; Section 2, musketry at the miniature ranges ; Sections and 3, Squad drill.

Signalling.—It is proposed to form a signalling class, and the names of those wishing to join should be given at once to the Section Commanders.

Good progress is being made with the Training Corps both in drill and in the technical work for which the Corps is specially preparing itself.

Arrangements have been made for the use of a rifle range, and members can attend not only at the hours of drill, but at any time onvenient to themselves, for practice, instructors being in attendnce and rifles provided.

There are still vacancies for recruits, either among those attached to the Engineering Institutions or others to whom the echnical work of the Corps appeals.

Applications should be made to Lieut.-Col. C. B. Clay, V.D., the Commandant of the Corps, at Marconi House, Strand, W.C.

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, September 2nd, 1915 :—

Captain of the Week, Mr. W. Ridd ; Orderly Officer, Mr. C. S. George.

Week-end Parades.—Saturday.—The Battalion will parade at Liverpool Street Station (low level entrance G.E.R.), at 1.50 p.m., or entrenching purposes. Dress : Uniform complete with brassard. Arms will not be carried. The Battalion will return at 6.42 p.m.

Sunday, 7 a.m., Réveillé ; 10 a.m., Church Parade ; 10.20 a.m., Battalion Parade (Bridging) ; 10.30 a.m., Sketching Class only for hose detailed ; 2.30 a.m., Bridging.

Resignations.—The following members have resigned their membership :—C. G. Botting, S. W. Carey, H. W. Saunders.

Musketry.—The names of men of "A" Company who art members of a club shooting at Bisley, but are not on the list of those ntitled to shoot on the Corps targets at Bisley, to be sent at once o the Second-in-Command.

There will be firing at both Acton and Bisley Ranges on Saturday next, the 4th inst. Men who have sent in their names will parade at the usual times.

Test Paper.—All answers to the Test Paper to be sent to the Second-in-Command of "A" Company by the 10th inst.

A. G. Joiner, *Captain and Adjutant.*

Appointments Vacant.—Junior switchboard attendant (24s.) for West Bromwich Corporation ; shift engineer (45s.) for Beckenham U.D.C. ; leading fireman (37s. 6d.) and switchboard attendant (35s.), for Stockport electricity department. Particulars are given in our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. W. Eastwood, of Halifax, has been appointed second assistant at the electricity works of the Hebden Bridge U.D.C.

General.—Mr. Parker, electrician, 2a, Ashworth Street, St. Mark's Road, Leeds, having joined the Army, has discontinued his business.

Mr. Harry H. Sheppard, for many years in charge of the armature shop of the Sheffield Corporation, has resigned, having accepted a position with Messrs. C. A. Vandervell & Co., electrical engineers, London.

A Central News dispatch from New York states that Mr. T. A. Edison is suffering from an injury to his eyes which he received while making experiments with potash.

We learn that Mr. J. B. Tucker, of Messrs. J. H. Tucker & Co., Birmingham, has just been given a commission in the Royal Engineers.

Roll of Honour.—Private J. Wilcock, of the 2nd Battalion South Lancashire Regiment, who has been killed in action at St. Eloi, had been employed for seven years at the Warrington electricity works. He was 38 years of age.

Private Samuel Bardsley, of the 1/5th Battalion Lancashire Fusiliers, formerly employed at the Heywood electricity works, has been wounded at the Dardanelles. He was 21 years of age.

A New Zealand paper says that Private H. P. Hopkins (Canterbury Battalion), killed in action at Gallipoli, was an electrician in the Tramway Board's service, which he entered in February, 1914.

The Military Cross has been awarded to Temporary Second-Lieut. George Wheldon Wanstall, Royal Engineers, for conspicuous gallantry on several occasions during the operations on the Gallipoli Peninsula, especially on June 19th, 1915, when he successfully repaired the telegraph lines, with the assistance of three men, making 35 joints in a space of 150 yards, whilst under heavy shell fire. Lieut. Wanstall performed similar valuable service on July 5th and 7th, on all occasions under shell fire.

Rifleman Albert Golding, King's Royal Rifles, who was electrician at the Hotel Metropole, Whitby, has died from wounds received in action in France. He joined the regiment last October, and went to the Front in May.

Sapper G. N. Halliwell, of the 1st Field Company, East Lancashire Royal Engineers, formerly employed at the British Westinghouse works at Trafford Park, has been killed in action at the Dardanelles.

Rifleman Frederick Lee, of the 8th Battalian Rifle Brigade, who was on the staff of Messrs. Willans & Robinson, Ltd., electrical engineers, of Rugby, has been killed in action. He enlisted on September 7th, and went to the Front after his marriage on April 28th.

The *Times*, in referring to the death of Second Lieut. Henry Gwyn-Jeffreys Moseley, M.A., of Trinity College, Oxford, which occurred at the Dardanelles on August 10th, states that after taking his degree in the Natural Science School (Physics), he was appointed Lecturer and Demonstrator in Physics, under Prof. Sir E. Rutherford, in the Victoria University, Manchester. "There, after two years, he was awarded the John Harling Fellowship for Research. On returning to Oxford he continued his work of research in Prof. Townsend's laboratory. His numerous publications treat chiefly of radio-activity and X-rays, and his latest work on the high-frequency spectra of the elements led him to important conclusions on the structure of atoms and the number of the elements, an achievement by which he will be best known. The early death of this brilliant young physicist is a great loss to science. At the outbreak of the war he was in Australia, but returned to England at the first opportunity, and was at once given a commission in the Royal Engineers."

Sergeant Alfred P. F. Veitch, of the 1/6th Battalion Manchester Regiment, formerly employed at the British Westinghouse works at Trafford Park, who has been twice wounded in the war, is this week officially reported to have died from wounds. He had been serving for some time in the Dardanelles.

Sapper J. Broderick, of the Royal Engineers, East Lancashire Division, who has been killed at the Dardanelles, resided in Manchester, and was an electrical engineer. He was 26 years of age.

Obituary.—The death occurred last week of Mr. Harold Campbell, of Warrington, who had for five years past been connected with the St. Helens Cable and Rubber Co., Ltd. After serving at the Warrington works for some time he went to London for about a year as a representative of the firm, and subsequently he returned to Warrington as an assistant departmental manager. He was only 23 years of age. At the funeral on Thursday last week representatives of the St. Helens Cable Co. acted as bearers, and floral tributes were sent by the staff, the London office staff, and the office girls.

The death took place on Thursday, August 26th, at 78, Chapel Lane, Headingley, Leeds, of Mr. Alfred Beaumont, electrical and mechanical engineer. The deceased gentleman was 68 years of age.

The death has taken place of Mr. Herbert Mitchell, formerly in business as electrical engineer at Brockholes, Huddersfield, and lately residing at Weymouth. Deceased met with an accident while cycling and died from the injuries he received.

We regret to note that the death occurred on August 28th, at 109, Ladbroke Grove, W., of Mr. Henry Crookes, A.R.S.M., M.I.E.E., F.C.S., in his 57th year. Mr. Crookes was the eldest son of Sir William Crookes, O.M., president of the Royal Society.

Will.—The late Baron H. de Reuter left £39,442 gross and £33,371 net personalty.

NEW COMPANIES REGISTERED.

Milton Accumulators, Ltd. (141,409).—This company was registered on August 27th, with a capital of £1,000 in £1 shares, to carry on in the United Kingdom or elsewhere the business of manufacturers, builders, repairers, constructors, designers, importers and exporters of accumulators, motors, motor and other cycles, and all accessories and appliances relating to motoring, conductors of schools of instruction for motoring, constructors of hangars and other buildings, aeroplanes and flying machines, and accessories and appliances relating to aerial navigation, aeronautical, mechanical, electrical and motor engineers, etc. The subscribers (with 250 shares each) are : M. Wolff, 9-15, Whitecross Street, E.C., merchant ; A. J. Mardlin, 84, Milton Street, E.C., merchant. Private company. The number of directors is not to be less than two or more than five; the first are M. Wolff and A. J. Mardlin (both permanent). Qualification, 100 shares. Registered office : 84, Milton Street, E.C.

Whipp and Bourne, Ltd. (141,413).—This company was registered on August 27th, with a capital of £35,000 in £1 shares, to take over the business carried on at Switch Gear Works, Castleton, Rochdale, as Whipp & Bourne, to carry on the business of switch gear makers, electricians, mechanical engineers manufacturers and workers of and dealers in electricity, motive power, light and heat, etc., and to adopt an agreement with S. Whipp, C. W. D. Bourne, and F. Whipp. The subscribers (with one share each) are : S. Whipp, Derrynane, Castleton, Rochdale, electrical engineer ; C. W. D. Bourne, Sparthfield Avenue, Rochdale, electrical engineer ; F. Whipp, Bamford Cottage, Bamford, Rochdale, electrical engineer. Private company. The number of directors is not to be less than two or more than five ; the first are S. Whipp, C. W. D. Bourne, and F. Whipp (all permanent managing directors, subject to holding not less than 5,000 of the shares allotted to them under purchase agreement). Qualification of other directors, 100 ordinary shares. Solicitor : J. A. Hudson, The Butts, Rochdale.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hong-kong Tramway Co., Ltd.—A memorandum of satisfaction to the extent of £500 on July 19th and £100 on August 3rd, 1915, of trust deed dated July 1st, 1903, securing £195,000, has been filed.

Pitter's Ventilating and Engineering Co., Ltd.—Land Registry Charge, Charge, and Assignment of Contract on lands and premises in Woolwich and certain moneys, all dated August 6th, 1915, to secure all moneys due or to become due from company to London and Provincial Bank, Ltd., 3, Bank Buildings, Lothbury, E.C.

Direct United States Cable Co., Ltd. (11,597).—Capital, £1,300,000 in £10 shares. Return dated May 11th, 1915. 121,420 shares taken up; £1,214,200 paid. Mortgages and charges: Nil.

London Aluminium Co., Ltd.—Mortgage, dated August 12th, 1915, to secure £3,350, charged on certain land and premises at Witton, Birmingham. Holders: W. J. Halsey, Ray Lodge, Maidenhead; and A. A. Barnard, The Wilderness, East Molesey.

Bude Electric Supply Co., Ltd. (95,137).—Capital, £15,000 in £1 shares. Return dated May 1st, 1915. 10,000 shares taken up; £10,000 paid. Mortgages and charges: £2,500 mortgage debentures.

CITY NOTES.

Electric Supply Co. of Victoria, Ltd.

The directors, in their report for the year ended March 31st, 1915, give the following comparative statement of the figures for the past three years:—

LIGHTING DEPARTMENTS—Lamps Connected.

1912-13.	1913-14.	1914-15.
107,108	130,357	150,132

TRAMWAY DEPARTMENTS—Passengers Carried.

1912-13.	1913-14.	1914-15.
5,707,842	5,566,470	5,177,368

TRADING ACCOUNT—Receipts and Expenditure.

	1912-13.	1913-14.	1914-15.
Revenue	£87,088	£89,024	£86,800
Expenditure	57,922	57,524	56,990
Gross profit	£29,165	£31,500	£29,810

The trading profits show a decrease, which is accounted for by the abnormal conditions which have prevailed for the past nine months of the financial year. A very serious drought, lasting about seven months, was experienced in Victoria, resulting in a serious depression of the general trade of the colony. The present war has seriously affected the receipts from the tramways in Ballarat and Bendigo, as is the case in other large cities in Australia, enlistment of the population having affected the traffic receipts. The balance to the credit of profit and loss account, including £3,626 brought forward, and after deducting debenture interest paid and amount transferred to debenture stock redemption account, is £17,524. It is proposed to pay on account of arrears of preference dividend £14,659, to write off discount and commission on debenture stock account £865, and to carry forward £2,000. The annual meeting was held at Liverpool on August 25th.

Brazilian Traction, Light and Power Co., Ltd.

The report for 1914 (as abstracted in the *Financial Times*) states that a few of the outstanding shares of the Rio de Janeiro Tramway, Light & Power Co. and the Sao Paulo Tramway, Light & Power Co. were acquired, and a large controlling interest was secured in the Companhia Rede Telephonica Bragantina, a telephone company carrying on business throughout the State of Sao Paulo. This was a very desirable acquisition, having in view the telephone business carried on by the Rio de Janeiro Tramway, Light & Power Co. through the Rio de Janeiro and Interurban Telephone Companies. This investment was made without the necessity of providing cash for the purpose, the Bragantina shares being acquired on the basis of the purchase price being satisfied by the issue of fully-paid ordinary shares of this company's capital stock. The company has also acquired an important interest in the Cia Telephonica do Estado de Sao Paulo. The total share capital of this company issued on December 31st, 1914, was $116,217,500, divided into 1,062,175 ordinary shares of $100 each and 100,000 six per cent. cumulative preference shares of $100 each. The year has been one of general business depression in Brazil on account of the local conditions, both financial and commercial. The outbreak of the European war had the effect of stopping the usual method of remittances by means of bills of exchange, and for several months it was practically impossible to remit money from Brazil for the purpose of the payment of coupons and dividends. As this situation did not improve, the board decided in October to remit its funds—which by that time had accumulated to a very large amount—in coffee, as they felt that this method of remittance was a sound and safe procedure, and one which, under the circumstances, should prove satisfactory. As the Rio de Janeiro Tramway, Light & Power Co. has under charter a fleet of steamers for the purpose of carrying the coal and other material required by the companies in Rio de Janeiro and Sao Paulo, the board employed these on their return journeys for freighting the coffee purchased in Brazil to the New York and European markets, and as coffee is a staple product in commerce, it offered a safe and, at that time, the only practical means of remitting the company's fund Up to the end of the year there had been purchased an shipped from Rio de Janeiro and Santos 278,400 bags coffee, to the value of 11,695 contos of reis, all of which h since been disposed of in New York at prices which hav enabled the company to net an average of 13 54-64d. p milreis, which is materially in excess of the average rate exchange during the same period, even if it had been possibl to buy bills for such a large amount of money. The resu of the company's operations for the year have not been satisfactory as anticipated. As a result of the monetar stringency and other adverse conditions in Brazil, the fa tories began to run on short time or suspend business completely, and with the large number of employés thrown ou of work, due to the cessation of commercial activity, th earnings of the tramway systems in Rio de Janeiro and Sa Paulo were seriously affected, but, notwithstanding such ba business conditions, the gross income of the combined companies in Brazilian currency has shown an increase over th previous year. The revenue in gold has, of course, been u favourably affected by the drop in exchange. The revenu from securities owned and under contracts with subsidiar companies amounted to $7,523,695 and interest on advance to subsidiary companies $535,117, together $8,058,813. Gener and legal expenses, administration charges and interest o loans were $392,280, leaving a surplus available for dividend of $7,666,532. Dividends Nos. 4, 5, 6 and 7 on six per cent preference shares at 1½ per cent. each absorb $600,000 and Nos. 6, 7, 8 and 9 on the common shares a 1½ per cent. each $6,257,119, leaving surplus carried t profit and loss $809,412. After payment of the regula dividend of 6 per cent. per annum on the ordinary shares credit balance of $3,822,410 has been carried forward. I view of the serious financial conditions developing in Brazil and later the much more serious financial situation throug out the world, all possible expenditures on capital account i connection with the development of the property were suspended, but there was a large amount of work under wa which it was necessary for the different subsidiary companie to complete. A considerable amount of construction wor had also to be carried out in order to comply with the obligations of the different concessions. In this connection th different companies have performed all of the necessary work both for capital account and as regards maintenance an renewals. Mr. Alexander Mackenzie has been appointed t fill the vacancy caused by Dr. Pearson's death. Appende to the directors' report is one drafted by the late Dr. Pearso on the operations and finances of the subsidiary companie during the year 1914. This report was prepared by him whil on the *Lusitania*, and has been adopted by the board, wit such additions and changes as seemed necessary. It wa found in his pocket after the recovery of his body, and represents, therefore, his last work for the company.

Quarterly dividend of 1½ per cent. on fully-paid cumulativ preference shares is payable on October 1st.

Manaos Tramways & Light Co., Ltd.

Mr. Geo. Watson presided over the annual meeting held o Tuesday at the offices, 9, Cloak Lane, E.C. In moving th adoption of the report, he referred to the absence of th Chairman of the Company (Mr. Geo. Booth), who, he sai was devoting the whole of his time to the service of th country in organising the supply of munitions. The revenu account showed that the tramway receipts were £68,992, a against £87,028 in the previous year, a reduction of over 2 per cent. The operating expenses were £61,029, agains £71,031, a reduction of 14 per cent. The lighting receipt amounted to £40,397, against £44,395, and the expenses t £22,436, against £24,684. Both receipts and expenses showe a reduction of about 9 per cent. The revenue from construction and supply was £1,030, against £1,453, a reduction o over 29 per cent., and the expenses to £774, against £1,133, reduction of nearly 32 per cent. The total receipts amounte to £110,420, against £132,877, a reduction of about 17 pe cent., and the expenses to £84,240, against £96,848, a reductio of about 13 per cent. The result was that they carrie £26,180 to profit and loss account against £36,028 last year, reduction of £9,848, or just over 25 per cent. The reductio in the total receipts of about 17 per cent., and in the tota expenses of about 14 per cent., showed, according to genera experience, a very reasonable and satisfactory proportion Whilst the revenue of a company like theirs depended s much upon local conditions—sometimes beyond the control o the directors—the expenses could be cut down, but only to point where further reduction would prejudice the efficiency He thought they would agree that the figures he had give indicated that the management had kept careful watch on th expenditure, and had succeeded in reducing it to a reasonabl proportion of the total revenue, and from the fact that the had received no complaints regarding the efficiency of th service, they might take it that the reduction in expenditur had not been carried beyond the legitimate limit. He woul go further, and say that the directors had always kept i view their obligations under their contract with the Government in that respect, and the cordial relations which existe between the company and the Government proved that the believed the company had so far carried out, and would continue to carry out, loyally the spirit of its contract. In th profit and loss account they would find interest on loan an office expenses stated separately. The interest on the loan amounted this year to £1,615, as against £1,271 last year, and the office expenses to £1,452, as against £2,790 last year; a very considerable reduction. The loss on exchange was £6,180, as compared with £212 last year, which was a very serious matter. The Chairman commented at some length on the question of exchange, which, he pointed out, was a very important matter in a company like theirs, in which the revenue was all practically in currency, but where there was a considerable sterling obligation for interest on bonds. He thought, however, that Brazil was in a stronger position to resist a serious fall in exchange than it was years ago. It would be generally admitted that the result of the year's operations was disappointing, but the general prosperity of Brazil had, on the whole, been at a low ebb owing to the low price of rubber, the general financial crisis, and the European war. People had received less money, and many who had enjoyed the luxury of riding on their tramcars had to be content with walking. The only consolation they had for such enforced economy was the hope that it would be ultimately for the good of the people, and that when normal times returned to this enormous district money would be wisely spent in developing the country, so that it would not have to depend so much upon a single product. So that his remarks might not be too depressing, he might say they had had some encouraging results from the extensive experiments they had made in regard to fuel. As they would realise, this item of expenditure had been seriously affected by the present conditions. They had made an effort to burn local wood fuel as far as possible, and the results had been so successful that they were now using wood fuel exclusively, and only maintained a stock of coal against any possible shortage of wood. This change of fuel had benefited the company in several ways. The cost was much less than coal; it was paid for in currency instead of in sterling, and, therefore, the loss in exchange in their heaviest item of expenditure was saved; and it also circulated money locally, which helped towards maintaining their tramway and lighting business. Another encouraging fact was with regard to their account against the Government for lighting. For many years they had had a large claim against the Government, which on April 30th, 1915, amounted to £37,637, which would pay off their present loan and leave a considerable margin in hand. During the year under review the directors considered that, as the revenue of the company was decreasing to such an alarming extent, some special endeavour should be made to make the Government realise the position, and, after considerable negotiation, they succeeded in getting an exchange of accounts last January whereby the rental due by the company on that date was charged against the debt due to the company by the Government. They had received further consideration in the official pronouncement that for the present it would not be necessary for the company to provide cash against the payment of rental, and until certain things took place they would not be called upon to do so. This, of course, was only a provisional arrangement, but strong representations had been made to the Government to place the annual rental due by the company against the debt until such time as the Government was in the position to pay off the balance. They hoped the Government would see the justice of their claim, and that some permanent arrangement would ultimately be arrived at.

Mr. W. Burton seconded the motion, and it was carried.

STOCKS AND SHARES.

Tuesday Evening.

The second August of the war has affected Stock Exchange markets much less forcibly than the first one did. The latter had the effect of paralysing business, of laying as complete a check upon financial enterprise of all sorts as anybody in this generation has ever seen. For a few weeks, Stock Exchange markets were literally numb. Even negotiations came to something like a full stop. The only people who attempted to do anything were the bears, who saw their opportunity to replace stock at figures which showed them profits, the extent of which was only equalled by the heavy losses which they, the bears, incurred upon other securities that they happened to hold as bulls.

It was not until the end of the month that any kind of inquiry on the part of the public began to arise, whereas in these latter days there is still a quiet business being done which is, at all events, sufficient in extent to enable the realisation of a fair number of securities. The Stock Exchange is open; this time last year it was closed for five months. The competition which it was feared would arise, by reason of the Treasury restrictions imposed upon the House as a condition of its opening last January, has not materialised. The *Daily Mail* suspended its stock and share exchange last week, giving as its reasons for doing so, the stagnation of Stock Exchange business and pressure of war news upon its space.

The trouble in the coal trade would no doubt have had a most depressing effect upon Stock Exchange prices had the markets been in their normal condition. As things are now, the incomprehensible attitude of the miners will have far more influence, unhappily, upon war requirements than upon Stock Exchange securities. Electric lighting shares are dull, without being flat. Home Railway stocks have drifted back, until London & North-Western, for example, stands lower than it has done for half a century. Industrial companies, which are largely dependent upon their prosperity for an adequate supply of coal at reasonable prices, are not influenced as regards the prices of their stocks and shares. When sellers predominate, the dealers simply say so, declining to buy unless they know where to find support, but refusing, at the same time, to alter the nominal quotations of the securities. There are, be it understood, no official prices in the regular sense of those words, and so quotations can be left standing without the insistence of would-be sellers that these levels should be put down if stocks cannot be realised.

The position of the New York exchange continues to excite a lively and an anxious interest in financial circles. The popular proposal for remedying the unnatural state of affairs which has arisen, through the preponderance of imports into the United Kingdom from America over the exports sent across the Atlantic, is the floating of a British loan in New York. Wise and experienced brains are focused upon the problem; but, in the meantime, it is worth noticing how the rise in American railroad and industrial shares continues merrily. Were there to be a large British loan in New York offered at a tempting price, it would have the same effect upon American securities as the June War Loan had on stocks and shares over here, to wit, the lowering of existing standards, and the establishment of a new criterion by which investment yields would be judged. New York Telephone 4½ per cent. bonds are now just 100, whereas the British 4½ per cent. War Loan can be bought at 97¾.

With reference to bonds the interest on which is payable in London and New York, a curious position has arisen in connection with this fall in sterling exchange. Underground Electric income bonds are amongst those of this class, and the New York Telephone 4½ per cent. coupons can also be cashed in both cities. With the rate of exchange down to its present level, it pays a holder handsomely to send out coupons to New York and to receive from there a dollar cheque which he can convert, upon its return to London, into sterling. By this means, he can make about 4 per cent. of the coupon value additional; that is to say, the £3 Underground income coupon would realise, roughly, £3 2s. 6d. at to-day's exchange. Holders of big lines of stock have probably recognised this, and sent out their coupons to be collected on the other side, arguing that it is a morally legitimate transaction, inasmuch as the money has to be returned to this country, and spent here. Others, however, have an uneasy feeling that it is scarcely playing the game, although they have some difficulty in explaining their scruples. The exchange is likely to be rectified before long, so that the opportunity is scarcely likely to recur; but it is certainly a freakish outcome of the war, and worth mentioning, if only as a financial curiosity.

Electric Lighting shares, as already nôted, are somewhat dull, and some of the issues which are quoted ex-dividend have given way rather more than the amount of the deduction. In the industrial group there is no particular change. Edison & Swan debenture went back 2 points to 58. British Westinghouse preference retain their rise. British Insulated ordinary are still on offer, but there are buyers about of the preference shares.

Eastern Extensions at 11½ are 10s. to the good, and a small inquiry for United River Plate Telephones advanced the price to some extent Marconis have been keeping steady at a trifle under 2. On the other hand, American Marconis receded to 17s., in response to one of the spasmodic reactions in American industrials which occur every now and then to check the boomlet amongst "war specials." Canadian Marconis are steady at 6s. 1½d., and in other Marconi issues no movements have occurred.

Profound disappointment is felt at the inaction of the United States with regard to Mexico. The demonstration made at Washington two or three weeks ago, when a conference was summoned of representatives of the principal parties to the strife, has so far produced no result at all. Of news there has been practically none for a fortnight, and, in consequence, prices of bonds, stocks and shares connected with Mexico have fallen back to much the same levels as they occupied before hopes were raised by the calling of the Washington conference. Mexico Tramways 5 per cent. first mortgage bonds at 40 show another loss of 5 points; and while no quotable changes have occurred in the other securities—one feels rather that the last word ought to be put into inverted commas—the market in them is once more flat and inert.

Brazilian Tractions and most of the other issues connected with the country show a reactionary tendency, because the rate of exchange has dropped once more to a shilling. This may be due to gambling in sterling, but it has had the effect of restraining business, and there is not much doing in Brazilian Tractions at the moment.

Most of the copper shares are firming up again. The course of the market for the metal is more favourable to holders, and prospective buyers, who have been waiting for prices to touch bottom, are now hastening to pick up cheap stock. In the rubber market, prices are well held, and there is quite a fair amount of business going on amongst the investment shares. The armament group is steady, but quotations vary little from day to day, and even from week to week, demand and supply being on an unusually regular scale just now.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Aug. 31, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	7½ xd	—	£6 13 4
do. 7 per cent. Pref.	7	7¼ xd	—	4 16 7
Charing Cross Ordinary	5	3¾	— ¼	6 13 4
do. do. do. 4½ Pref.	4½	3¾	— ¼	6 0 0
do. do. City Pref.	4½	3¾	— ⅛	6 0 0
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4⅜	—	5 14
do. 4½ Deb.	4½	88	—	4 17 10
City of London	9	12¼ xd	—	7 7 0
do. do. 6 per cent. Pref.	6	10¾ xd	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10½	—	6 13 4
do. do. 6 per cent. Pref.	6	10½	—	5 14 3
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6¼	—	7 4 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4¾ xd	+ ¼	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	3½	2½	— ¼	7 0 0
do. 4½ per cent. Pref.	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6¾	—	7 8 2
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 1/16 xd	—	6 14 0
Westminster Ordinary	9	6¾	—	6 13 4
do. 4½ Pref.	4½	4¼	—	5 9 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	98	—	6 2 6
do. Def.	1½	21¼	—	7 1 2
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8¼	—	6 1 3
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11½	+ ½	*6 19 1
do. 4 Deb.	4	79	—	5 2 1
Eastern Tel. Ord.	7	115	—	*6 19 6
do. 3½ Pref.	3½	70	—	5 0 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	9½	—	*7 4 4
do. Pref.	6	10	—	6 0 0
Gt. Northern Tel.	22	35	—	6 5 9
Indo-European	10	50	—	6 10 0
Marconi	10	1 31/32	—	5 1 6
New York Tel. 4½	4½	100	+1	4 10 0
Oriental Telephone Ord.	10	2	—	5 0 0
do. Pref.	6	1⅛	—	5 6 8
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5 9/16	+ 1/16	*8 4 0
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	11½	—	*6 19 0
do. 4 Deb.	4	81	—	4 16 5
Home Rails.				
Central London, Ord. Assented	4	72	—	5 11 1
Metropolitan	1½	23½	—	5 6 5
do. District	Nil	14¼	+ ¼	Nil
Underground Electric Ordinary	Nil	1½	—	Nil
do. do. "A"	Nil	5/9	—	Nil
do. do. Income	6	78½	— ½	*9 15 0
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref.	5½	3⅞	—	7 1 11
do. 2nd Pref.	5½	3½	—	7 17 2
do. 4 Deb.	4	71	—	5 12 7
do. 4½ Deb.	4½	72	—	6 5 0
do. 5 Deb.	5	72	—	6 19 0
Brazil Tractions	3½	47½	—1	7 7 4
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds	—	40	—5	Nil
do. 6 per cent. Bonds	—	35	—	Nil
Mexican Light Common	Nil	25	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	40	—	—
Adelaide Sup. 6 per cent. Pref.	6	5 xd	+ ⅛	6 0 0
do. 5 Deb.	5	98	—	5 2 0
Manufacturing Companies.				
Babcock & Wilcox	14	2 3/16	—	6 8 5
British Aluminium Ord.	5	1 1/16	—	4 14
do. Pref.	6	18/3	—	6 9
British Insulated Ord.	15	10⅝	—	7 1 2
do. Pref.	6	5⅞	—	5 2 2
British Westinghouse Pref.	7½	32/6	—	9 7 6
do. 4 Deb.	4	68	—	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref.	5	4½	—	5 11 8
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	3¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	58	—2	6 18 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/-	—	7 7 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	14	—	*8 8 8
do. 4½ Pref.	4½	4¾	—	4 14 9
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	8¾	—	5 14 3
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

Mackay Companies.—Quarterly dividends are announced of 1 per cent. on the preferred shares, and 1¼ per cent. on the common shares.

Davis & Timmins, Ltd.—Interim dividend at the rate of 6 per cent. per annum on ordinary shares for the past half-year.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 1st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a " Nitric	"	..	..
a " Oxalic	per lb.	1/-	..
a " Sulphuric	per cwt.	..	..
a Ammoniac Sal	"	£49	..
a Ammonia, Muriate (large crystal)	per ton	£40	..
a Bleaching powder	"	£9	..
a Bisulphide of Carbon	"	£23	..
a Borax	"	£23	..
a Copper Sulphate	"	£28	..
a Lead, Nitrate	"	..	..
a " White Sugar	"	..	..
a " Peroxide	"	..	..
c Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %)	per ton	..	..
a " Chlorate	per lb.	1/4½	1½d. dec.
a " Perchlorate	"	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	"	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers	"	£11 10	..
a " Recovered	"	£8	..
a " Lump	"	£8 10	..
a Soda, Caustic (white 70/72 %)	"	..	..
a " Chlorate	per lb.	1/3	1d. inc.
a " Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	5d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	..	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	..	..
b " Sheet, in ton lots	"	..	..
p Babbitt's metal ingots	"	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/1¾ to 1/2¼	
c " Tubes (solid drawn)	"	1/1 to 1/1¼	..
c " Wire, basis	"	1/1 to 1/1¼	..
c Copper Tubes (solid drawn)	"	1/1½ to 1/1½	..
g " Bars (best selected)	per ton	£98	..
g " Sheet	"	£98	..
g " Rod	"	£98	..
d " (Electrolytic) Bars	"	£84 10	£2 10 inc.
d " " Sheets	"	£102 10	£2 10 inc.
d " " Rods	"	£91 10	£2 10 inc.
d " " H.C. Wire	per lb.	11⅛d.	⅛d. inc.
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	1/10	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/4¾	..
j Iron Pig (Cleveland warrants)	per ton	65/1½	..
l " Wire, galv. No. 8, P.O. qual.	"	£26	..
g Lead, English Pig	"	£23 5	£1 5 inc.
g Mercury	per bot.	£17 5	£1 dec.
e Mica (in original cases) small	per lb.	4d. to 2/6	..
e " " " medium	"	3/- to 5/-	..
e " " " large	"	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	"	Nom.	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/2 to 1/3½	..
p " " rolled strip & sheet	"	1/3½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£80	..
g Tin, Block (English)	"	£152 10	10/- inc.
n " Wire, Nos. 1 to 16	per lb.	2/7	..
p White Anti-friction Metals	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Oxford Electric Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum on the ordinary shares for the past half-year.

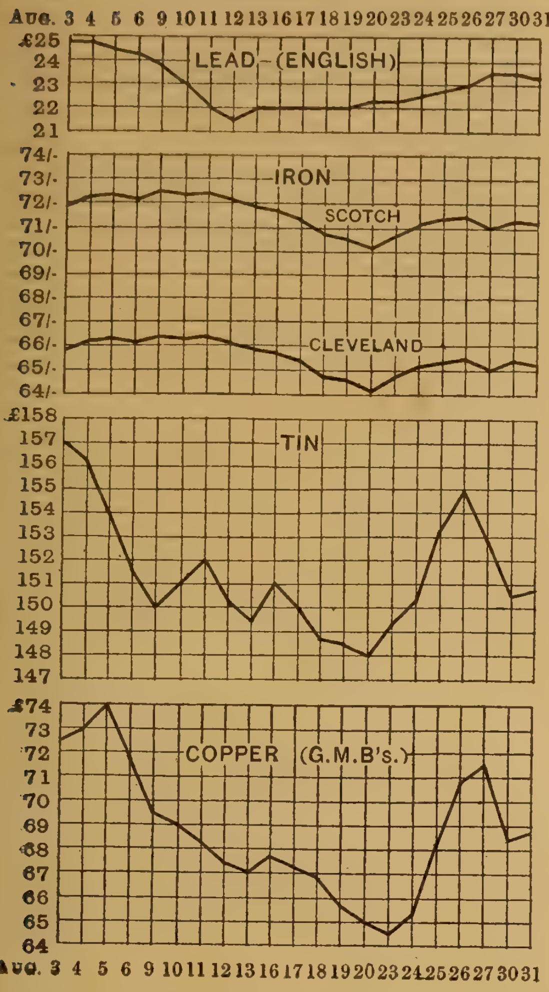
Fairbairn Lawson Combe Barbour, Ltd.—It is announced in the Press that on account of war conditions the directors do not consider it advisable to declare an interim dividend on the preference and ordinary shares for the half-year ended June 30th. Last year there was no interim dividend on the ordinary shares.

Dumbarton Burgh and County Tramway Co., Ltd.—After providing for interest on debenture stock, the profit for the past year, including balance brought forward, was £10,790. After paying a dividend of 1½ per cent. on the ordinary shares, £3,595 is to be carried forward.

South Metropolitan Electric Light and Power Co., Ltd.—The warrants for dividends on the 7 per cent. cumulative first preference shares, and 6 per cent. cumulative second preference shares, were posted on Monday.

METAL MARKET.

Fluctuations in August.



A Wrecked Power Plant.—Our contemporary *Power* describes the collapse of the power plant of the Knickerbocker Portland Cement Co., at Hudson, N.Z., owing to the slipping and subsiding of the earth on which it was built. The plant stood on a terrace of brick clay, 50 ft. thick, and a substratum of shale, which had become a semi-fluid mass at the water level of an adjoining creek. The combined weight of the building and about 50,000 cb. yd. of crushed stone piled in a stock yard, overloaded the ground, and caused it to shift sideways, and settle from 15 to 25 ft. below its original level. The building had concrete foundations, and contained six water-tube boilers supplying steam to two 2,000-KW. Curtis turbine sets. The boilers did not burst, but escaping steam from broken pipes was probably the cause of death of five men and injury to four others. Judging from the illustrations, the power-house was completely wrecked; a 175-ft. reinforced concrete chimney on its base slid, base and all intact, from its original position to the creek, a distance of 75 ft., before falling over. Various other plant on the site subsided; for instance, a 60-ft. elevator sank 30 ft. and swung out of plumb. It is not known how much of the machinery will be found re-serviceable, but the damage is estimated at $300,000.

Federated Malay States.—Our contemporary *Eastern Engineering*, in a recent issue described the workshops of the F.M.S. Railways. The whole of these works are electrically-driven, and in addition 120 coaches are electrically lighted on the Stone system. For the works, situated three miles north of Kuala Lampur, three-phase current at 5,500 volts is obtained from a hydro-electric plant 10 miles away, and transformed down at the works to 400-430 volts, for transmission by overhead wires to the various shops. The works sub-station also contains a 75-90 KW. three-phase belt-driven set, coupled to a Robey undertype engine and used for working overtime. The motors now installed total over 1,019 H.P., in various sizes from 1 to 40 H.P., supplied by the British Westinghouse, British Thomson-Houston, Lancs. Dynamo, Siemens and Oerlikon Companies. A 60-ton traverser is worked by a 20-H.P. motor: there are four overhead cranes of the three-motor type; and all the wheel lathes and larger and more modern tools have individual drive, the smaller machines being group-driven. It may be noted that the company operates two electric lifts, 1,988 30, 60 and 100-watt lamps, 54 arcs and 187 fans distributed over its system. The Port Swettenham power scheme will also be running before long.

ENCOURAGING THE USE OF ELECTRIC MOTOR VEHICLES.

A SCHEME which has long been advocated in connection with the use of electric motor vehicles—that of central station companies supplying interchangeable fully-charged batteries—has lately been inaugurated in Boston, U.S.A., as a result of the joint efforts of the Edison Electric Illuminating Co. of that city, and the General Vehicle Co., of Long Island City, N.Y. The scheme relieves the user of practically all responsibility concerning the charging and care of the batteries, and also enables him to obtain practically continuous service, if necessary, through the interchange of discharged batteries for fully-charged ones. The arrangement, which is equivalent to a leased equipment service has been made possible through the adoption by the General Vehicle Co. of a universal cradle, whereby rapid exchange of batteries can be effected. For that reason, the service is at present only open to purchasers of industrial motor vehicles of this one make.

Under the new system, the purchaser buys his electric vehicle without a battery, thereby saving from 25 to 35 per cent. of the first cost, while the battery and renewals and all charging, are supplied by the Edison Co. on a monthly payment basis. The cost of the service is made up of two parts—a flat rate per month, depending on the carrying capacity of the vehicle, and a running charge based on the mileage indicated by the odometer and determined according to a sliding scale. For a 7 or 10 cwt. vehicle, running 1,100 miles in the course of a month, the total cost for battery and current works out at slightly over £9.

The system has not been in operation a sufficient length of time to enable a close comparison to be made between the cost of operation under the new method, and that under the conventional flat-rate charging system in which the batteries are provided and maintained by the vehicle owner. It is the expectation of the Edison Co., however, that the service will represent an actual economy to the consumer of at least 15 per cent., quite apart from the greater freedom from battery worries that the user will enjoy.

Under the terms of the agreement with electric vehicle owners, the electricity supply company undertakes to equip the customer's vehicle with a lead battery of sufficient size and capacity, ready for use, and to either recharge it or exchange it for a fully-charged battery whenever necessary. Upon application, the company also agrees to furnish the driver at the time of supplying the battery with a coupon stating the number of miles the battery should be able to propel the vehicle under ordinary conditions. If the battery fails to perform this stated mileage, the company will pay the cost of towing the vehicle back to the garage. It is also part of the agreement that the customer shall keep his vehicle thoroughly greased and oiled, and in proper repair; he must also allow inspection to be made by the electricity supply company's officers, and immediately remedy any defective conditions to which his attention is called.

The rates per month for vehicles of different capacities are shown in the appended table:—

	Fixed monthly charge.	Running costs per mile—1st 500 miles.	500 to 750 miles.	750 to 1,000 miles.	Over 1 000 miles.
7-10 cwt. vehicle ...	£3 10 6	1½d.	1¼d.	1⅛d.	1d.
18 " " ...	4 7 6	1¾d.	1½d.	1¼d.	1⅛d.
36 " " ...	5 16 6	2½d.	2¼d.	2d.	1¾d.
3-3½ ton " ...	6 17 6	3d.	2¾d.	2½d.	2¼d.
4½-5 " " ...	7 10 0	3½d.	3¼d.	3d.	2¾d.

Though the scheme has so far only been adopted in a limited way and put in operation at a single central station in Boston, it is already attracting considerable attention, and is regarded as a departure that is fraught with many possibilities. The Edison Co. states that the extension of the idea to other points in the city only awaits the advent of a sufficient demand. While often discussed in the past, the realisation of such a scheme has long been delayed by the lack of a universal battery system and the difficulty of establishing the necessarily harmonious arrangements between the electric vehicle builders and central station engineers; consequently the new departure will be watched with interest by all associated with the electrical vehicle movement.

PROGRESS IN HIGH-FREQUENCY ALTERNATORS.

[COMMUNICATED.]

The impossibility of securing from arc or spark a train of radiographic waves of that degree of uniformity desirable in wireless telegraphy, and imperative in radio-telephony, has directed a vast amount of attention towards the discovery of a means of generating very high-frequency currents by dynamo-electric machinery. It is impracticable to attain any suitable frequency by adhering to standard alternator design; pole pitch, air gap and winding space become impracticably small, and insulation and iron-loss difficulties insuperable. No radical progress was made for 20 years after Tesla built his 1-K.V.A., 5-kilocycle machine in 1889. It is true that Alexanderson completed in 1909 a 2-K.V.A., 100-kilocycle alternator, but even this machine, the fruit of five years' labour, gave inadequate power, though it generated current of the right order of frequency. To combine extra-high frequency with reasonable power output, it was necessary to employ new principles. A series dynamo in an oscillating circuit annuls the resistance of the circuit, which thus becomes the seat of undamped oscillations, but the high pressures induced at high frequencies in the short-circuited turns render commutation impracticable. The Dolezalek alternator suffers from no such limitation, and has the great advantage of requiring no rotor winding. As first built for testing purposes, the machine comprised a direct-current electromagnet with pointed pole pieces, before which a toothed iron disk rotated, and thus induced high-frequency currents in coils wound on the magnet poles. Béthenod's 1907 alternator built on this principle is illustrated diagrammatically in fig. 1. High-frequency current generated in the single winding E by rotation of the toothed and laminated disk D, is superimposed on the continuous exciting current, and excites the antenna A through a transformer T; an inductance S and condenser C are used to exclude alternating current from the primary source P. For a given number of teeth and revolutions per minute this alternator provides double the frequency obtainable from any ordinary type of alternator, but at the time of its introduction serious objections were raised against the use of iron at high frequencies.

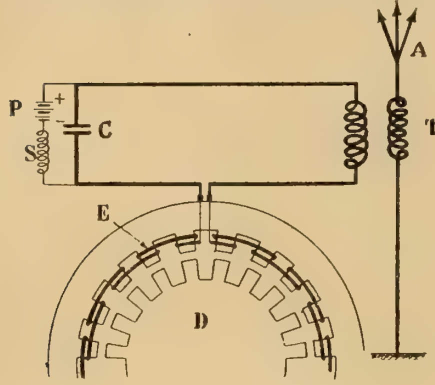


FIG. 1.

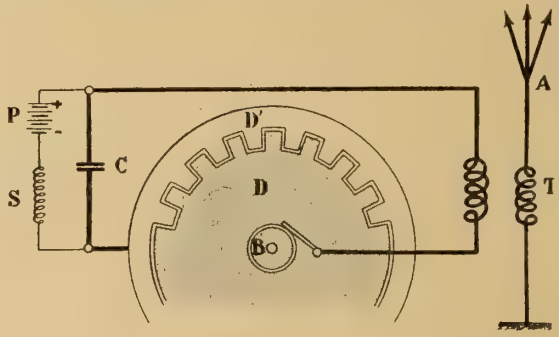


FIG. 2.

The machine illustrated in fig. 2 was devised to meet this objection by using toothed disks D D^1, constituting a rotary condenser of rapidly varying capacity. Iron losses are eliminated, but the high exciting pressure necessary introduces insulation difficulties, and the air gaps necessary on these grounds preclude the obtaining of considerable output. Resonating particular harmonics of a magnetic field affords one means of obtaining high-frequency currents, but the difficulty is to secure sufficient amplitude in high-frequency harmonics; and to attempt to do so by using special pole shapes introduces constructional difficulties, frequently greater than those involved by adapting standard types of alternator to high-frequency work. The principle which has given best results so far is that of "cascading" machines or windings, so as to superpose on mechanical rotation the rotation of high-frequency magnetic fields. Jarvis Patten proposed in 1894 to use n cascaded single-phase alternators in conjunction with suitable resonating circuits to produce current of n times the frequency of a single machine. Ten years later Latour showed how squirrel-cage machines could be used in this connection, but not until 1907 did Goldschmidt effect a radical improvement by utilising a single machine for several successive frequency conversions.

In order to facilitate comparison with the Béthenod alternator, the characteristics of the Goldschmidt alternator may be enumerated briefly. Referring to fig. 3, the stator and rotor are provided with single-phase windings E E^1 of as high frequency as possible. Closing the key M sends direct current through the stator winding E, and thus induces current of frequency $f = w/2\pi$ in the rotor. The reactance of the circuit $m\ n\ q\ p\ m$ is adjusted to practically zero for current of frequency f, and the relatively large current thus obtained induces stator current of frequency $2f$, to which the circuit $a\ e\ f\ b$ offers as little reactance as possible. The circuit $m\ r\ s\ n$ is resonated to the triple-frequency current next induced in the rotor, and the quadruple frequency finally induced in the stator is applied to the antenna at the points $g\ d$. With given peripheral speed and polar pitch, four times the frequency of an ordinary alternate-pole machine is obtained. The shunt $g\ f\ d$ absorbs no current of frequency $4f$, since it is not tuned to this frequency. The condenser $g\ e$ compensates the $2f$ reactance of E, hence resonance of the $a\ e\ f\ b$ circuit is not disturbed by exciting the aerial. The principle of augmenting frequency by "reflexion" has no theoretical limit, the stator winding carrying currents of frequencies 0, $2f$, $4f$, $6f$, &c., and the rotor the odd frequencies f, $3f$, $5f$, &c., but in practice it is hardly possible to utilise higher than the quadruple frequency, owing to the complexity of the resonating or "filtering" circuits for higher frequencies. Nevertheless, the latest Goldschmidt alternators are capable of providing 150 KW. at 40 kilocycles, there being 384 wound poles and the speed (3,100 R.P.M.) being low enough for direct driving from a continuous-current motor.

In the Béthenod alternator represented diagrammatically in fig. 4, four machines are used in a common carcass. Continuous current is fed to the stator A$_1$ to induce two-phase current of frequency f in the rotor B$_1$, which is connected to that of the rotor and produces current of frequency $2f$ in B$_2$. Proceeding thus, there is available from B$_4$ two-phase current of quadruple frequency. The axial space between the cascaded alternators need actually be no greater than ventilation ducts, and the rotors B$_1$ A$_2$, B$_3$ A$_4$ can be provided with common windings of the squirrel-cage type, so that the constructional complexities are no greater than in the Goldschmidt machine. The fact that two-phase current is used involves at least two coils per pole

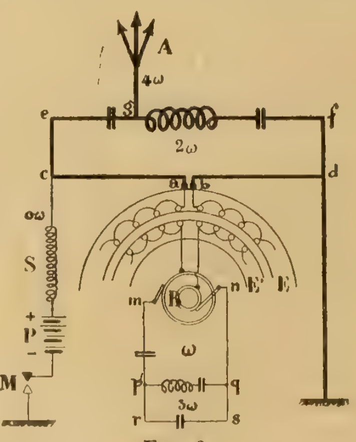


FIG. 3.

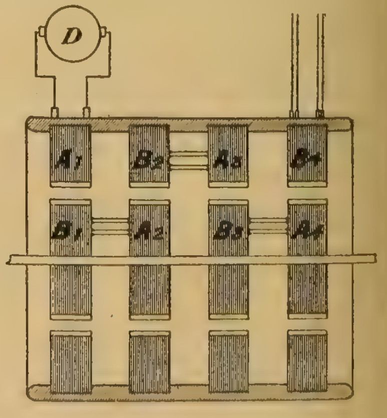


FIG. 4.

pitch, but this is a less serious objection than might appear to be the case, because an industrial machine must have a certain minimum air-gap, and hence a pole pitch which permits two slots without increase of pole pitch on the ground alone.

The method by which both phases of the current are utilised in the aerial is indicated in fig. 5, where E_1, E_2 represent the two phases of B_4, fig. 4. One winding E_2 is connected directly between aerial and earth, through a tuning inductance and capacity, L_2 C_2. The other phase excites the aerial through a transformer T. If C_1 C_2 be adjusted to compensate self-induction in their respective circuits, if R represent the apparent (radiation) resistance of the aerial, and M the coefficient of mutual induction of T, the condition that the currents in E_1, E_2 be of equal amplitude and displaced $\pi/2$ in phase, is :—$M = R/4\pi \, . \, mf$, where (mf) = frequency of the last alternator in the cascade. The E.M.F. and current in each phase being in phase, the equipment works under very favourable conditions. From a machine running at 6,000 R.P.M., with a rotor 15 in. in diameter and 240 slots in rotor and stator, M. Béthenod obtains 5 KW. output at 24 kilocycles, and states that machines of 100-150 KW. output at this frequency are under design.

The advantages of polyphase generation in respect of freedom from parasitic fields are combined with the constructional advantages of a single-phase winding on the rotor, in Latour's two-phase induction machine with single-phase rotor short-circuited on itself. If f be the rotor frequency produced by continuous-current excitation of the stator, the Latour machine converts two-phase current of frequency kf to $(k + 2)f$ frequency, and may be connected to the aerial as shown in fig. 6. The continuous-current source P produces current frequency f in the rotor E, and this, by the action already described, produces currents of double and quadruple frequency in the resonant circuits L_2 C_2, L_4 C_4. Limiting ourselves to the production of sextuple frequency, the aerial is connected to the resonant circuit L_6 C_6, a condenser L and C being so connected that the phases E′, E″ yield wattless leading and lagging currents of equal intensity and set up a field rotating oppositely to the rotor, and cancel the parasitic field due to circulation of the sextuple frequency working current in the stator windings. Unless this compensation be arranged, the stator windings become equivalent to a simple single-phase winding.

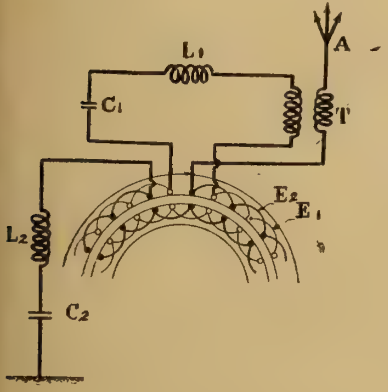


Fig. 5.

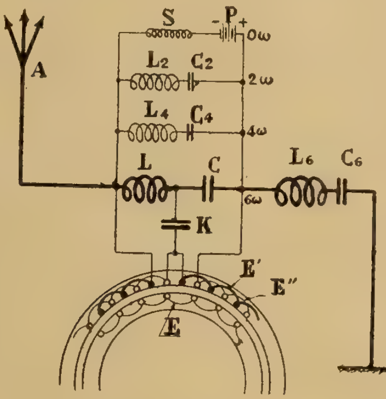


Fig. 6.

The conclusions reached by M. Béthenod, in discussing these developments in an address to the Société Internationale des Electriciens last summer, were that industrial alternators of acceptable efficiency could now be built for outputs of 100 to 150 KW. at 10 to 40 kcy., running at a peripheral rotor velocity of from 24,000 to 30,000 ft. per minute, but that, since the difficulty and cost of construction increase rapidly with frequency even in the above range, the industrial success of high-frequency alternators, as applied to wireless telegraphy and telephony, depends on the adoption of long wave-lengths—probably several tens of kilometres. So far as one can see, the accuracy of this conclusion must be admitted, but the writer well remembers how, a few years ago, one who ranks undoubtedly among the greatest experts on radio-telegraphy, "proved" on paper that alternators exceeding a few watts capacity, could not be built on the Goldschmidt principle. Moreover, the proof was, at that time, convincing, and its subsequent refutation was only another demonstration of the need for caution in placing any limitations on the development of radio-telegraphy in general and high-frequency alternators in particular.

THIRD-RAIL CONSTRUCTION ON THE L. & Y. MANCHESTER–BURY LINE.

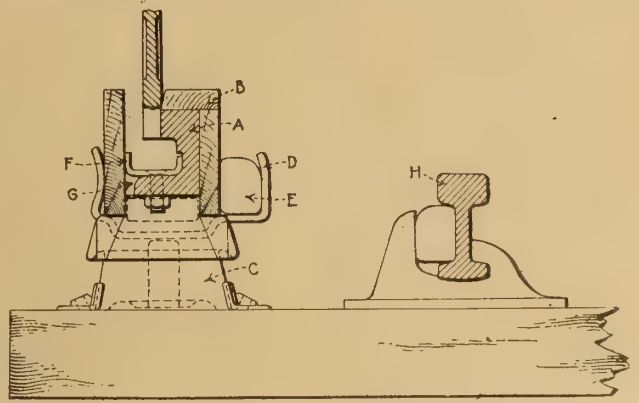
Our contemporary, the *Electric Railway Journal* (New York) referring recently to the placing in commission of the Lancashire and Yorkshire Electric line between Manchester and Bury, described a novel form of 1,200-volt third-rail contact system which is the invention of the general manager of the company, Mr. J. A. F. Aspinall. The distance between Manchester and Bury is 9½ miles.

The essential features of the invention are clearly shown in the accompanying illustrations, the most novel ones having to do with the side bearing of the contact device upon the rail and the method of surrounding the rail with wood guards.

Referring to the cross-sectional view, which shows the preferred form of contact rail, it will be noted that a channel form of rail is used with a head sufficiently thick to provide a wide contact surface on the side. The form of rail was selected to provide a low centre of gravity to prevent overturning even when the rail is not fastened down. While any form of rail can be used, this is one also well adapted to enclosing with protecting wood guards. The contact rail is set upon insulators provided with lugs to prevent lateral movement. It is almost entirely enclosed with boards of Australian karri timber which cannot be set on fire. The only openings around the rail are a slot at one side of the cover for the accommodation of the current collector, and drainage holes, as G, are provided to prevent accumulation of water in the groove formed between the guard and the collector rail. There is not a nail or bolt anywhere in the protecting guards.

The angle-shaped guard, B in the illustration, rests directly against the rail surface, but the invention covers insulation therefrom if such is found necessary. The guard on the slot side is spaced away from the rail by means of a wooden filler block, termed by Mr. Aspinall a packing or distance piece. Over the rail base is a bent metal distance piece F secured in place as shown. The guards are attached to the collector rails without bolts by means of detachable metal clamps D placed between insulators. In connection with these are used wooden keys E, preferably similar to those used in fastening the running rails in their chairs. In the diagram one of the running rails is shown at H, with the wedge holding it in its chair. The relation of the running and conductor rails, in regard to heights and spacing, are incidentally brought out in this figure.

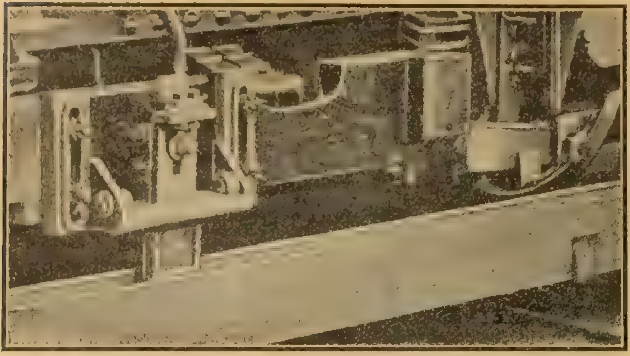
The contact device, which with its mounting is shown in an accompanying view, is hinged and is pressed against the contact rail by means of a coiled spring. The method of mounting upon an insulating support is clearly shown.



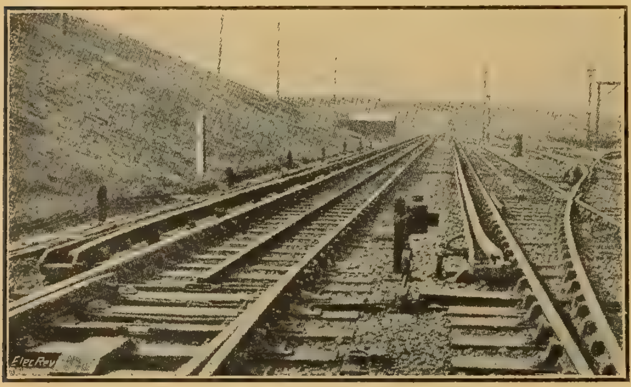
Sectional View, L. & Y. Protected Contact Rail.

The advantages of this novel construction over the usual one appear to be that very complete protection can be furnished and provision can easily be made for considerable vertical variations in the relative positions of rail and collector. The simplicity of the construction is such that the ordinary trackman or platelayer can keep the contact rail in order, with the exception of the bonding.

The Manchester papers, in referring to the state of progress of this line, mention that the third rail construction is completed except as regards a short section near the Manchester end, and that the rolling stock is also ready, the cars being somewhat similar to those employed on the Liverpool-Southport section, being of the corridor type with seats for about 100 persons. Trains will consist of three to five cars. The Clifton Junction power station is to be in working order by the end of the year, but in the meantime arrangements have been made to obtain a supply of electricity from the Manchester Electric Supply Department, which has fulfilled a similar function in connection with experimental running. We gather that it is hoped to commence a service of some sort on the new line in October or November, which will connect at Bury with a short electrical branch line to Holcombe.



Current Collector and Contact Rail, L. & Y. Bury Line.



Manchester-Bury Electric Line, showing Entering Ramp of Contact Rail.

TURBINE PUMPS FOR COLLIERY PUMPING.

(*Abstract of paper read before a joint meeting of the* National Association of Colliery Managers and Association of Mining Electrical Engineers by R. H. Willis.)

Although turbine pumps are now being freely used in colliery work, there may be some to whom they are still something of a novelty. Many pumps of this type are at work, but it is not the best to use under all circumstances; for example, in the case of pumping near the face, when the supply of water is more or less intermittent and yet cannot be allowed to collect, a turbine pump is not suitable, as it cannot pump air and water, and would require constant priming; a ram pump is more suitable. Or again, if a small amount of water is to be lifted against a high head, then a turbine pump, while capable of doing the work, compares unfavourably with a ram pump. In such a case the number of chambers becomes excessive at reasonable speeds and the efficiency is low. As a rule, seven or eight stages are the maximum number which can be economically used.

The chief improvements which have enabled the modern turbine pump to deal with high heads have been the multiplication of impellers, the addition of diffusion vanes, and improved methods of manufacture. The most important improvement has been the diffusion vane, which receives the water after it leaves the impeller at a high velocity, and by guiding it through suitable passages causes the velocity to be comparatively reduced, the kinetic energy due to the velocity being thus converted into static energy.

With the turbine pump there is no actual displacement of water as in a ram pump, as the action depends on the velocity imparted to the water, due to the revolving impeller, which velocity is ultimately changed into pressure head. Owing to this feature there is no necessity to provide relief valves, as the pressure never rises materially above that due to the velocity set up by the speed of the impellers. Consequently, this type of pump can be started up with the delivery valve closed. This fact is a great advantage, as the power then taken is a minimum, and there is no chance of accidents happening as would be the case if this procedure were adopted with a pump of the ram type. As the water always passes through turbine pumps in one direction, and as it is acted upon equally by the impellers at all parts, the water leaves the pump in a constant stream, and there is no need to provide air vessels. This is an important advantage, as it prevents shocks to the pipe system and gives a steady uniform flow of water, allowing the use of the minimum size of delivery pipes.

One of the main difficulties which has had to be overcome in evolving this type of pump is that of end thrust. Two main methods have been evolved to overcome this difficulty, and these are practically the only methods now in use. The first and somewhat older method aims at balancing the whole out-of-balance thrust at one point, and the second aims at neutralising the end thrust where it is generated, viz., at each individual impeller. In the first system a metal disk of saucer shape is attached to the end of the shaft and rotates in an annular space, this disk being known as a balance plate or disk; on its edge is a turned face which corresponds with a turned surface or seat on the end chamber casting. The annular space surrounding this disk is connected to the suction side of the pump. Leakage water under pressure from the last impeller chamber passes to the interior of the disk, causing the same to lift off its seat, when the pressure water immediately escapes to the suction. If the supply of leakage water ceased, then the disk would be drawn back on to its seat by the end thrust. As leakage is constantly going on, the disk takes up a more or less permanent position, allowing as much water to escape as will keep the disk in equilibrium and balance the end thrust. This system works well, but the disk is liable to excessive wear if there is any grit in the water, and the amount of water passed may become excessive; or the amount of leakage water due to wear may so increase that a state of equilibrium can no longer be maintained, and the pump will soon require a new disk and probably a thorough overhaul.

The second system is somewhat simpler; in this case there is no large balance disk, but each impeller is provided with two neck rings, and the spaces on either side of each impeller are put into communication with each other by means of special passages in the main castings which pass round the diffusion vanes. The pressures on the two sides of each impeller are thus in equilibrium, and any out-of-balance thrust is counteracted and corrected. This system, having no mechanical parts, is not subject to wear. Turbine pumps are essentially high-speed machines, and consequently lend themselves readily to coupling to electric motors. For D.C. motors it is advisable not to exceed 1,800 R.P.M. for the smaller and about 1,000 R.P.M. for the larger sizes. Recently, however, specially designed D.C. motors having commutating poles and compensating windings in the main pole faces have been successfully used for high speeds and powers.

The writer recently installed a motor of 250 H.P., 440 volts, running at 1,500 R.P.M., direct-coupled to a turbine pump, which has given very good results. For A.C. motors, 1,500 R.P.M. synchronous speed is about the maximum, although some motors have been installed running at 3,000 R.P.M. This speed, however, with 50 cycles, involves a two-pole motor, which is a somewhat difficult machine to build.

While referring to the question of pumps' speeds, attention should be drawn to the effect which variations of voltage have on the behaviour of a turbine pump when coupled to a D.C. motor. If the voltage rises, the motor speed rises, with the result that the pump endeavours to accelerate the column of water and to increase its quantity, and thus an overload is thrown on the motor. If, however, the voltage drops, then the speed drops and the pump ceases to deliver water, and if then the voltage should suddenly rise, a heavy overload is thrown on the motor by the pump endeavouring to suddenly accelerate the water column, which may result in a flash-over on the motor or the blowing of the fuses. This difficulty can be met by arranging that the minimum speed at which the pump will deliver water is below the minimum due to the greatest voltage drop. It is important, therefore, that the supply voltage be kept as constant as possible and the motor be so designed that it has a minimum speed variation for any given voltage variation. Another point is the possibility of the motor being overloaded if the pump is working against a lower head than that for which it was designed. This is due to the fact that the surplus power expends its energy in increasing the velocity of the flow of the water (consequently the quantity) in all parts of the piping and pump. The friction head is thereby increased and the efficiency decreased, and this artificial and inefficient load may exceed the normal power of the motor. When inquiring for a turbine pump the fact should be borne in mind that there is no actual displacement of water, and that the impellers have to be designed to suit a certain head. If this head is greater than that for which the pump was designed, there will be no delivery of water. If this head is less than that for which the pump was designed, then the quantity of water delivered will be more than the designed amount, and the motor will be overloaded. It is a general practice to make the motor some 10 per cent. larger than is required for the normal duty in order to provide a margin of power to meet the above conditions. Turbine pumps can be provided with special impellers so designed that the variation of horse-power due to the variations in head is only a very small percentage. This is not altogether an advantage, as it often results in reduced efficiency. There are some special classes of colliery pumping for which the use of turbine pumps may not as yet have become general, such as dip pumping, and sinking, although both classes of work have been successfully performed by this type of pump.

The turbine pump lends itself very readily to the unwatering of vertical shafts; it is compact, takes up little room, and weighs less than a ram pump or steam pump. For this purpose the motor and pump are arranged with vertical spindles and carried in a frame so arranged that the whole combination can be lowered down the shaft to follow the water as the level is reduced. In this case it is usual to prevent overloading of the motor by screwing down the valve on the delivery side so as to add an artificial head to the actual head on the pump, giving a total head approximately equal to the designed head, the valve being gradually opened as the pump is lowered in the shaft. Dip pumping is very often required in colliery practice, and some engineers are of the opinion that this problem is one which is unsuitable for turbine pumps, but the difficulties can be overcome as follows:—The pump is mounted on a trolley which is so designed as to keep the pump horizontal. The pump is so arranged that a varying number of impellers can be brought into operation from time to time, the chambers not required being replaced by dummy stages, which are removed as required. The pump starts to work against a minimum head, and with only one impeller, say, in a four-stage pump, in operation, all the remaining chambers in the pump being dummies with, of course, a clear waterway through them. The motor is some 10 per cent. larger than is actually required, and is of the variable-speed D.C. type. As the pump is lowered shunt resistance is inserted in the motor field, and the motor speeded up until a point is reached when the head dealt with is equal to that of two impellers when running at the lowest speed of the motor. Two impellers are then put in the pump and the motor worked at its lowest speed. The same cycle of operations is followed until ultimately the pump has its full number of impellers. By this method the maximum of water is obtained with the minimum amount of current throughout the whole period, and the total result compares favourably with the performance of a ram pump which has generally been used for this purpose. Practically the same arrangement can be followed when the pump is driven by a three-phase motor, but owing to the motor speed being constant, the working is not quite so flexible as with a direct-current motor, and resort has to be made to throttling by means of the valve on the delivery side after changing the number of impellers, so as to prevent the motor overloading itself at this point of the operation.

For boiler feeding purposes turbine pumps are very suitable. Their freedom from all risk of serious pressure rises should all the openings into the boilers be closed while the pump is running at full speed, and the constant flow of water, are very desirable features.

The efficiency of this type of pump varies somewhat with the output from, say, 67 per cent. to 71 per cent., the most efficient result being obtained when the gallons delivered per minute are about 25 per cent. more than an amount equal to the head in feet. When interest on capital, depreciation and maintenance charges are taken into account, it will be found that the cost of running is about the same, notwithstanding the higher efficiency of ram pumps. If the pumping is done in a few hours, then the advantage lies with the turbine pump; if the pumping must go on more or less continuously, then a ram pump is more favourable.

When considering the purchase of turbine pumping plant the following points should be carefully considered:—(*a*) The pump should be capable of being easily dismantled and erected. In this connection the author does not advocate the type of pump in which the chambers are placed inside a cast-iron containing shell; (*b*) all wearing parts should have ample area and be capable of renewal on site; (*c*) all similar pumps should be made interchangeable, and effective methods should be adopted to obviate the end thrust.

When installing a turbine pump the following points should be borne in mind:—(*a*) The pump should be fixed as close to the water to be lifted as possible, and the suction pipe must be made airtight, leakage of air being a fruitful source of trouble with this type of pump; (*b*) the suction pipe should be provided with foot valve and strainer, and if the water contains grit or dirt, a dividing wall in the suction pond to allow the dirt to settle before reaching the suction pipe is an advantage; (*c*) a vacuum gauge is an important accessory on the suction side as it indicates if there is any leakage of air; (*d*) on the delivery side all sharp bends in the pipe line should be avoided; (*e*) a sluice valve and non-return valve should be fixed between the pump and delivery pipe, both provided with a by-pass valve so that the pump may be primed from the water in the rising main. A pressure gauge is also a useful addition.

When starting the pump it is important to see that the sluice valve is closed and then to open the air cocks on the pump and open the small by-pass valves until the water runs out of the air cocks; the air cocks are then closed, and also the by-pass valves, and the motor started. When up to speed, the sluice valve is opened until the needle on the ammeter shows full-load on the motor. To shut down, the sluice valve is closed and the motor switched off. The whole operation is very simple and the risk of damage is reduced to a minimum. It is advisable to make a gauge of the length between, say, a mark on the shaft and a fixed point, such as the nose of the bearing, and to check this length from time to time, so as to be able to note any tendency towards end movement. If such movement is observed, then the makers should be advised.

OIL CIRCUIT BREAKERS: NOTES ON ARC PHENOMENA AND TENDENCIES IN DESIGN.

In a paper read recently by Mr. K. C. Randall before the American Institute of Electrical Engineers, the author dealt with the above subject; the following is an abstract of his remarks:—

In an alternating-current arc formed in an oil breaker, opportunity is afforded for cooling and condensing the arc gases as the current passes through zero, and if these are completely condensed or removed and replaced by sufficient oil distance, the current will not be re-established, because the medium intervening between the separating contacts has been changed to an insulator of sufficient dielectric strength to withstand the potential tending to re-establish the current. With an ideal oil breaker the current will not continue after the first zero value following the first complete separation of contacts.

In actual practice, on large powers, possibly few breakers comply with this ideal, because the current continues beyond the first zero value, due to (1) insufficient separation of the contacts; (2) large amount of gas formed in the arc; (3) reduction of insulating value of oil between contacts owing to suspended metal and carbon particles condensed after each successive half-cycle arc. If the particular breaker application is too far from the ideal the re-establishment of current after the first and subsequent zero values will continue indefinitely, or at least be repeated so many times that the breaker will be damaged or destroyed. Increase in capacity of a system, failure to maintain breakers either as to mechanism or insulation, change of current limitations, changes in methods of operation, faulty relays, etc., all may act to increase the duty on a breaker, even to destruction.

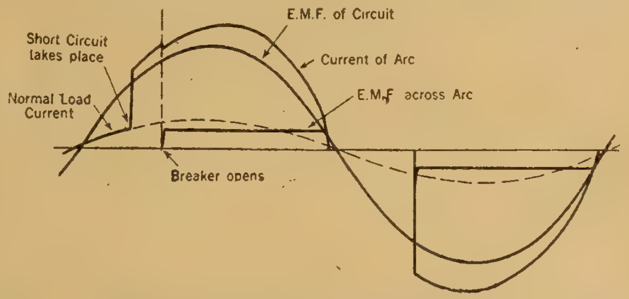


Fig. 1.—Voltage and Current Curves for an Oil Circuit-Breaker Arc in a Non-inductive Circuit.

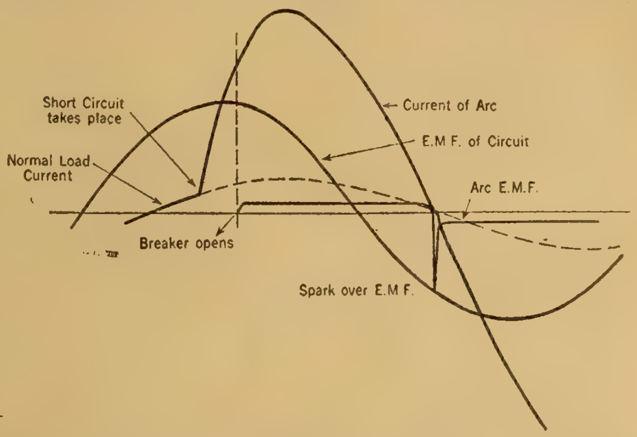


Fig. 2.—Voltage and Current Curves for an Oil Breaker Arc in an Inductive Circuit.

Plainly, it will be very difficult to interrupt an alternating current abruptly during any half cycle, for the same reason that an abrupt rupturing of a field current of a generator is difficult or dangerous. So it is that the endeavour of the breaker is focused upon providing against the re-establishment of current after normal zero value. Clearly, each time the current is re-established and continues to the next zero value, energy is dissipated in the breaker tank, due to the arc. The oftener this is repeated the more the contacts are burned, the more the oil deteriorates, and the less the chance is of finally interrupting the current.

Assume a breaker, operating on a 15-cycle circuit of a given current and voltage, begins separation of contacts just as the current is normally passing through zero, and that the separation of contacts (acceleration) is such that the current ceases at the next zero. This same breaker operated in the same way on a like 60-cycle circuit will dissipate the same energy, if the current is of like volume and continues for the same time; that is, ceases at the fourth zero point. But, had the breaker been accelerated to prevent re-establishment of the current after the first half (60 cycles), the minimum energy could have been dissipated. Similarly, on 30 cycles, the speed of opening should have been twice that for 15 cycles; and in general, the rate of contact separation should be proportional to the frequency of the system when endeavouring to attain the ideal condition of terminating current at the end of the first half cycle.

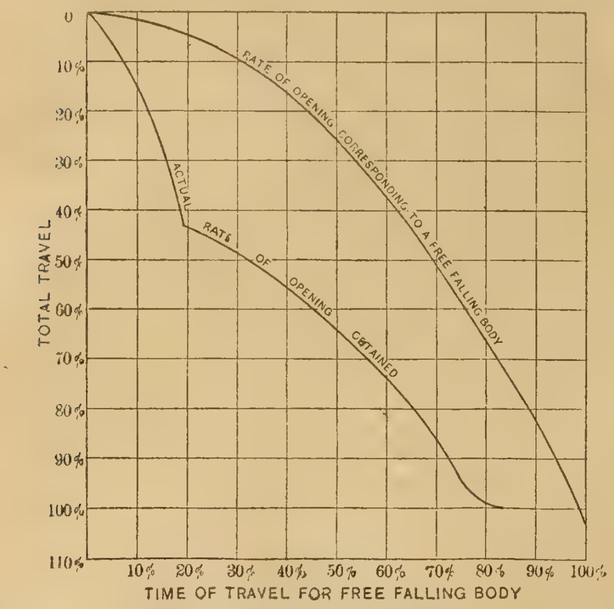
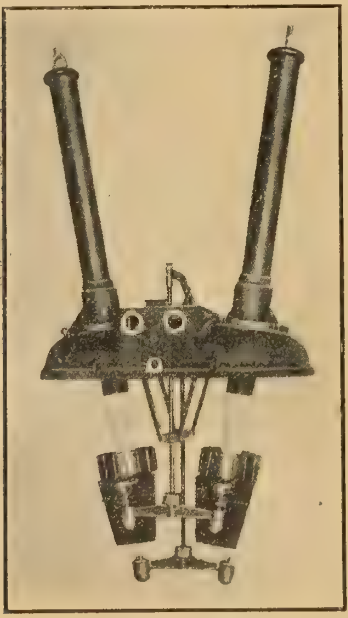


Fig. 3.—Curves of a Free Falling Body and specially Accelerated Breaker built for E.H.T. Service.

The extinguishment of the arc will be near the normal zero point regardless of the speed of opening, because, whatever the rate of separating the contacts may be, tending to rapidly insert a dielectric in the form of cold oil, a potential tending to maintain the circuit current will be developed, and this, in general, will be adequate to break down the intervening dielectric. Thus the current will be sustained until practically its normal zero point is reached. This will be true even if the whole breaker travel were accomplished in, say, ⅛ or ⅓ cycle; the current would still continue to practically the normal zero point, as each higher rate of current reduction gives a correspondingly higher sustaining voltage for maintaining it.



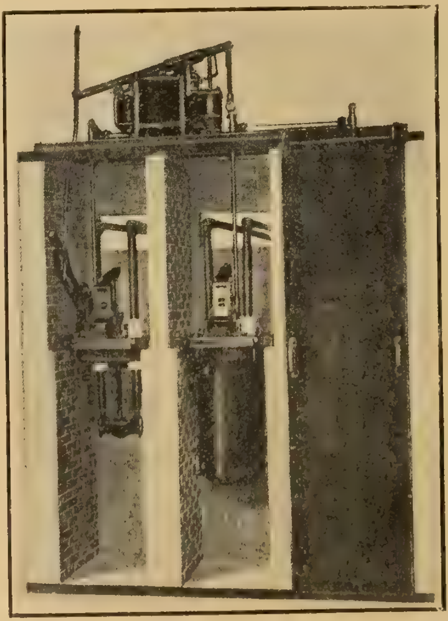


Fig. 4.—100,000-volt Reactance Breaker; Main Contacts separated and Reactance in Circuit; Final Break about to occur.

Fig. 6.—Breaker adapted to Pressures up to 35,000 Volts; Accelerating and Retarding Device shown in Figs. 7 and 8.

Furthermore, neglecting the voltage peaks required for re-establishing the current, the maximum steady voltage attainable across an arc is limited, regardless of the length of arc or current volume, and hence, the same loss is developed regardless of the rate or length of opening, provided the current and time of arcing is the same. This is explained as follows: With practically any current encountered in serious breaker problems, the ionisation in the arc space will be quite complete and, therefore, it will constitute an excellent conductor, becoming better as it is further heated by increased currents, so that the drop will remain practically constant independent of the current volume provided it does not fall sufficiently to threaten deionisation. The distance between contacts when the arc space is completely ionised has very little effect on the drop across it, provided the currents remain large as in ordinary breaker practice. This, therefore, demands for the best breaker results, that the speed and length of opening be such that current may never be established after the first zero value of current following the separation of the breaker contacts.

In general, high-frequency currents will be interrupted with the smaller demonstration and lesser breaker duty than similar lower frequency currents, and the energy dissipated will be, on the average, for an ideal breaker, about inversely proportional to the frequency.

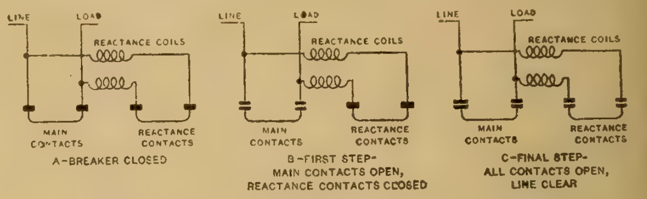


Fig. 5.—Terminal and Contact Arrangement with Reactance Coils of H.T. Reactance Breaker.

After fixing the proper design of conducting details, allowing liberally for the continuous current-carrying capacity and for insulating distances—dielectric strength, such that liberal tests are successfully withstood—the problem of rupturing capacity still remains. On the higher potentials the insulation problems largely govern the dimensions. On the lower potentials mechanical considerations may largely dominate.

Oil, being the accepted insulating medium, should, particularly on higher potentials, be of high grade. At the lower potentials the dielectric value of the oil is not so important. Oils of low volatilisation, slow carbonisation and fair insulating value are desirable for average applications. For very low temperatures non-freezing oil should be used, but these are usually so volatile at ordinary summer temperature that another oil must be used. A large oil volume is considered favourably, as through it the shock from the largely explosive action of enormous arc currents is reduced and absorbed. A large head of oil over the contacts means a heavier pressure on the arc bubble with consequent increased tendency to confine and quickly replace it with fresh oil. Facility of ionisation of arc gases is decreased by higher vapour pressure, thus making re-establishment of the arc more difficult. The reduced volume of the gas bubble, due to the increased oil head, also disturbs the main oil body less, a very important matter when near the limit of rupturing capacity, especially of single-tank units.

The length of break is all-important, but if consideration of arc gases could be entirely eliminated, the length of break should only be sufficient to interpose an oil distance which would not be punctured by the available potential. As a rule, this would require but from 1 to 10 per cent. of the actual travel available, as it takes 50,000 volts to puncture ¼ in. of moderately good oil. Therefore, the travel represents a very large margin, but it is necessary due to the reduced dielectric strength—in fact, conducting condition—prevailing during the arcing period. In a number of tests on a 25-cycle power circuit at 12,000 volts, about 15,000 amperes were interrupted at the end of a 4-in. travel (one-half cycle), although the contacts finally separated 9 in.

An increased number of breaks in series, entirely neglecting method of accomplishment, would seem desirable, as the simultaneous opening of several breaks will accomplish the intervention of a given oil distance more rapidly than will a fewer number of breaks, assuming that the rate of contact separation remains roughly the same for both. A scheme to increase the arc voltage would not be welcome, but a plan to reduce it, and yet retain conditions opposed to current recovery after the first normal zero value is desirable, as in this way the total energy dissipated would be reduced. Whether a multi-break design is to be preferred over the usual break will be decided by what may be accomplished by the common two break construction, when highly accelerated. It is plain that the additional mechanical complications and consequent larger masses of the multi-gap breaker that must be moved, will constitute a very serious problem.

Consideration of fig. 2 makes apparent the general effect of self-induction on current interruption. On a non-inductive circuit (the current and voltage in phase) the chance of current re-establishment is much less probable than with an inductive circuit wherein—with lagging current—voltage is available for re-establishing the arc as the current emerges from the zero value. For this reason interruption of the current at the higher frequencies will be more difficult as the current lag for any given circuit is greater and the voltage tending to re-establish progressively more as the frequency is increased. On the other hand, the total self-induction of high-frequency circuits will usually be less than on circuits of lower frequencies, and, therefore, the termination of the arc current will be facilitated.

In the breaker arc, as chilling occurs near the zero value of current, the ionisation of the gases ceases and conductivity in the arc space is so reduced that the current can only be established by a potential capable of puncturing the resulting dielectric which has become very much stronger than it was previous to deionisation. Very high arc currents, giving increased gas volume, make deionisation much more difficult, thus rendering successive re-establishment of current easier. The enormous energy dissipated by very large currents as the contacts first separate is a demonstration of an explosive character. Breaker tanks have been blown off with practically no contact burning, showing violent pressure of short duration; so large currents are most difficult to interrupt. Facility of deionisation of the arc gases will depend upon temperature and pressure of the surrounding oil, shape and volume of contacts, and on their heat conductivity and vaporising temperature. A small breaker, on the score of volume and shape of contacts alone, is more severely tried than a larger unit. This plainly emphasises the desirability of large contacts of smooth shape.

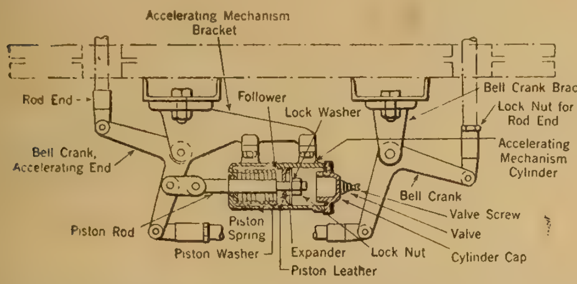


Fig. 7.—Accelerating and Retarding Device applicable to manually or electrically operated Breakers.

Gravity-actuated breakers never open quite as rapidly as a free falling body, and sometimes the retarding influence of the mechanism is very serious, so that accelerating devices are now common, and the rate of opening is in many breakers much more rapid than that obtainable from unimpeded gravity alone. The matter of stopping the moving parts as they approach the end of the stroke has to be carefully considered, in the case of larger breakers, even when unaccelerated; but when highly accelerated the problem is more serious and may even be complicated. Fast closing is important like fast opening. An explosive action is likely as the arcing tips of a slow-closing breaker touch when closing against a short circuit, due to the violent energy dissipation and consequent volatilisation of contacts and oil. This action is identical with that occurring in a slow-opening unit. Modern practice, particularly on the score of general simplicity, favours the solenoid operation for all remote-controlled oil breakers, save when manually operated.

Tending to limit the maximum capacity that may be ruptured by a single plain breaker, large current volumes are the most serious problem because of their practically explosive action. Probably the maximum power that plain breakers as now built, could rupture, will approximate the power that would be delivered through a shunt-tripped breaker at the time of opening, by 150,000 k.v.a. of modern high-reactance generators on a single bus, feeding a maximum short circuit, so that the current is limited only by the generator impedance. In general, it will be easier to handle the given short circuit at, say, 15,000 volts, because at higher potentials the chance of re-establishment may be greater, while at lower potentials the volume of current would seriously increase the total amount of energy to be dissipated in the arc, and therefore the difficulty of terminating the current. A breaker adapted to such a station for 15,000-volt service is illustrated in fig. 6, and is constructed with particular regard to obtaining the strong tank and supporting details, so that even with violent energy dissipation in the arc, the mechanical details will withstand the shock. This breaker will require for installation a space approximately 7 ft. 4 in. by 2 ft. 1 in. by 9 ft. high.

In endeavouring to raise the limit of power to which plain breakers may be applied, without employing permanent current-limiting reactance, originally the resistance and later the reactance breakers were developed. Because of difficulties in the design and application of resistance, reactance was substituted, and a considerable number of such breakers has been built. The reactance breaker followed the form of the later resistance breakers, in that two steps were employed; one to introduce the current-limiting reactance, and the second to open the circuit. A still later development of the reactance breaker idea has somewhat simplified the matter. Instead of employing interlocked mechanism, such that the first mechanism introduces the reactors, and the second opens the circuit, two similar breaks are now employed operating simultaneously from a common mechanism—one of which is shunted by a reactance coil. It is well known that the shunted arc is inclined to be unstable, and in actual test it has been found that the shunted breaker does its duty promptly and with very little effort. The final break, of course, will only involve the current permitted by the limiting reactance.

For some time breakers were supplied according to the judgment of the designer of the equipment, or according to the ideas of the purchaser. Now, installations are quite generally receiving individual consideration in the breaker applications, and the desirability of a uniform method of rating is growing constantly more pressing. A method, developed from experience, tests, and consideration of common problems, assumes the breaker to be installed directly on the bus and to protect same against near-by short circuits. In determining the maximum breaker duty a generator equipment of 8 per cent. impedance—capable of delivering 12½ times normal current at the first instant of short circuit, is assumed. It is also assumed that by the time breaker opening occurs, this maximum current value will have decreased to one-half the initial, namely, to 6¼ times normal. In this way, when a breaker design has been fixed as capable of rupturing a certain current at a certain voltage, the k.v.a. rating of the system to which it may properly be applied is one whose normal current rating is obtained by dividing the breaker current rating for the particular voltage by 6¼. Thus a breaker rated at 160,000 k.v.a., three-phase, 44,000 volts, contemplates 2,100 amps. per phase in the arc, and may properly be applied to a station having a normal current of 335 amps. 44,000 volts, three-phase.

All this contemplates instantaneous tripping. If time tripping is employed, application may be made to a still larger station, provided the maximum current mentioned is not exceeded. The time to reach the sustained short-circuit currents will vary widely; possibly from 15 to 50 cycles on 60-cycle systems, and from 5 to 20 cycles on 25-cycle systems. With time elements set for these periods or longer, the maximum duty on the breaker will approximate interrupting double current, and in general, for such installation the capacity of the plant may be at least doubled as against the safe application on instantaneous tripping.

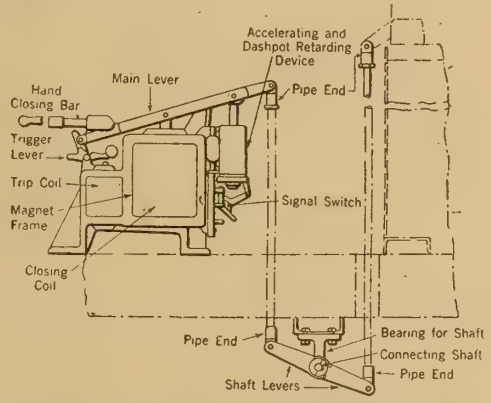


Fig. 8.—Solenoid Mechanism for operating Electrically Controlled Breaker; Incorporating Device shown in Fig. 7.

The best method of specifying breaker equipment for a given service is to indicate the duty which the breaker will be expected to perform by giving the maximum current that it may be called upon to interrupt, as well as service voltage.

The present tendency in circuit breakers is largely to improve mechanical details. Insulation of designs has generally been adequate. Among the notable mechanical features found in modern breakers are: (1) Increased strength of tanks with supports and fittings so as to safely withstand the shock of rupturing large powers. (2) Rapid acceleration of breaker so as to obtain high rates of contact separation with the attendant early termination of arcs, and consequent reduced energy dissipation. (3) Provision for vented expulsion chamber over the oil from which gases may escape, without entraining much oil, thus reducing the high and otherwise destructive pressures occurring in heavy duty. (4) Arrangement for liberal and easily replacable contact parts of minimum cost, in even small as well as larger capacities. (5) Employment of larger capacity (single) pole units, suitably assembled, and operated from a single separate mechanism, instead of using multipolar units assembled with individual mechanisms.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

URUGUAY.—The Government have been authorised to prohibit the exportation from Uruguay of the following articles: Unworked metals and worked metals in the form of waste articles or scrap of iron and steel, copper, tin, lead, zinc, aluminium, antimony and combinations of same, such as tinplate, galvanised iron, bronze, solder, brass and yellow metal; wire; surgical instruments or physical instruments for medical use; hospital apparatus and materials. The Executive may, however, in special cases permit the exportations of articles of the kinds specified.

VENEZUELA.—The Government have passed a new stamp tax law, as follows: On documents covering transactions of an estimated or determined value of from 25 to 50 bolivars, a stamp of 5 cents; between 50 and 100 bolivars, 10 cents; between 100 and 200 bolivars, 20 cents; between 200 and 300 bolivars, 30 cents; between 300 and 400 bolivars, 40 cents; between 400 and 500 bolivars, 50 cents; between 500 and 1,000 bolivars, 1 bolivar; over 1,000 bolivars, an additional bolivar for each 1,000 bolivars or part thereof. Civil or mercantile documents of whatever value will be covered by a stamp of 10 bolivars. Sales by credit will pay a stamp tax double that of the above-mentioned tariff, according to the value of the sale. As regards Customs documents, manifests of importation or exportation will carry a stamp of 2 bolivars for each 1,000 bolivars of the value manifested or fraction thereof.—Note: 25 bolivars = £1.

UGANDA PROTECTORATE.—The free importation of the following articles has been provided for: Electric cable or wire, the posts for carrying the same, and all other material required for the purposes of generating, storing, or distributing electrical energy, whether for power or lighting, on satisfactory proof being given to the Director of Customs that such articles and materials have been imported solely for such purposes. Such exemption shall not, however, include lamps or their fittings or materials other than industrial machinery required for the purpose of using electrical energy. The above item has been substituted in lieu of the following item, which has now been deleted: Apparatus and appliances used in connection with the generating and storing of electricity, but not including lamp-posts or lamps and their fittings.

SIERRA LEONE.—The Government have instituted a surtax of 25 per cent. on the duty leviable on all goods subject to the *ad valorem* duty of 10 per cent.

FRANCE.—The Government have issued a new decree abrogating the decree of February 12th in virtue of which graphite was allowed to be exported from France without special authorisation when consigned to the United Kingdom, the British Dominions, Colonies and Protectorates, Belgium, Japan, Montenegro, Russia, Serbia, and the United States.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

11,790. "Short-circuiting and brush-lifting gear for alternating-current motors." Lancashire Dynamo & Motor Co., Ltd., H. B. Whitmore, and R J. Roberts. August 16th.

11,795. "Contact devices for ceiling roses, cut-outs, connectors, rosettes and like electrical fittings." H. B. Prentice & W. A. McKerchar. August 16th.

11,818. "Electrolytic refining of tin." W. J. Mellersh-Jackson (American Smelting & Refining Co., United States). August 16th. (Complete.)

11,831. "Transmitters for wireless telephony." Marconi's Wireless Telegraph Co., Ltd., & Soren Oluf Emil Therkelsen Trost. August 16th.

11,889. "Electric or gas light fittings." C. Holly & W. H. Drucquer. August 17th.

11,910. "Accumulator cell boxes for train lighting and other purposes." H. D. Earl. August 18th.

11,935. "Dynamo-electric machine." A. H. Neuland. August 18th. (Complete.)

11,938. "Electric distributing systems for motor road vehicles." H. Lucas and C. L. Breeden. August 18th.

11,957. "Electrical egg-testing devices." H. J. Gentry. August 18th.

11,961. "Method of generating high-frequency electric currents." T. F. Wall. August 19th.

11,974. "Method of and apparatus for controlling dynamo-electric machines or the like for use principally in connection with the lighting and/or heating of trains, motor road, and other vehicles." W. F. W. Rhodes & J. Firth. August 19th.

11,976. "Sound-transmitting means." J. Liddle (Universal High-Power Telephone Co., United States). August 19th. (Complete.)

11,981. "Electrical flasher." W. Reed-Lethbridge. August 19th.

11,990. "Thermostats." W R. Clark & W. T. Davies. August 19th.

12,000. "Electric supply systems particularly for use with internal-combustion motors." E. C. R. Marks (Motor Ignition & Devices Co., United States). August 19th. (Complete.)

12,039. "Electric signalling apparatus." J. W. Mackenzie (Otto G. H. E. Kehrhahn, United States). August 20th.

12,055. "Sparking plug for internal-combustion engines." R. W. Happe. August 21st.

12,075. "Sealing means, more particularly for use in connection with accumulator cases." C. A. Vandervell. August 21st.

PUBLISHED SPECIFICATIONS.

1914.

3,902. Circuits for Telephone Exchanges. Siemens Bros. & Co., Ltd., E. A. Laidlaw, and W. H. Grinsted. February 14th.

10,110. Gas-detecting Apparatus for Portable Electric Hand Lamps. G. J. Ralph. April 24th. (September 14th, 1914.)

11,940. Electric Signalling Installations. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges.). May 14th.

11,993. Magnetic Chucks and like Holding Devices. Norma Cie Ges. May 15th. (May 17th, 1913.)

12,018. Subaqueous Sound Signal Receivers. Signal Ges. May 15th. (May 29th, 1913.)

12,210. Enclosed Electric Fuses or Safety Cartridges. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke). May 18th.

12,372. Means for Producing High-frequency Currents. P. Dresla. May 19th.

12,443. Insulator for the Overhead Conductors of Electric Lines. F. Libano. May 20th. (May 31st, 1913.)

12,479. Electric Welding. Allgemeine Elektricitäts Ges. May 20th. (May 20th, 1913. Addition to 8,595/14.)

12,682. Electric Switch for Incandescent Lamp Fittings. W. J. Mellersh-Jackson (Geb. Jaeger). May 22nd.

12,814. Slip-rings for Dynamo-electrical Machinery. Siemens Schuckertwerke. May 25th. (May 31st, 1913.)

13,136. Regenerative Braking of Electric Polyphase Commutator Machines. Siemens Schuckertwerke. May 28th. (June 21st, 1913.)

13,213. Tightening Devices for Overhead Electric Conductors. Siemens-Schuckertwerke. May 29th. (May 29th, 1913.)

13,520. Radiating System for Signalling by Electric Waves from Aeroplanes. Signal Ges. June 3rd. (Addition to 736/13 and 23,728/13.)

13,541. Manufacture of Incandescent Lamps. C. Gladitz. June 3rd.

13,553. Vehicle Lighting Plants Working with Dynamo and Storage Battery. Ges. Für Elektrische Zugbeleuchtung. June 3rd. (July 11th, 1913.)

13,554. Vehicle Lighting Plant working with Dynamo and Storage Battery. Ges. Für Elektrische Zugbeleuchtung. June 3rd. (April 28th, 1914. Addition to 13,553/14.)

14,278. Rotors for Dynamo-electric Machinery. Siemens Bros. Dynamo Works, Ltd., & E. O. Kieffer. June 13th.

14,378. Process for Starting Electrically-connected Rotary Converters and Asynchronous Generators. Siemens Bros. Dynamo Works & C. A. B. D. Koettgen. June 15th.

14,379. Implement for Laying Cables or Wires in the Ground. R. H. Fowler (W. Turner). June 15th.

14,381. Rendering Tungsten Ductile. C. Trenzen. June 15th.

14,384. Switching Arrangements for Rotary Converters. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke). June 15th.

14,483. Electric Transformers and other High-tension Electric Apparatus. Meirowsky & Co. Akt. Ges. & K. Fischer. June 16th.

14,561. Spark Plugs. M. Rall. June 17th. (July 10th, 1913.)

14,683. Tensioning Arrangements for Overhead Electric Conductors. Siemens Schuckertwerke. June 18th. (June 21st, 1913.)

15,024. Receiving Device for Subaqueous Sound Signals. Signal Ges. June 23rd. (July 24th, 1913.)

15,471. Circuit Arrangements for Telephone Systems. Siemens Bros. and Co., Ltd. (Siemens & Halske Akt. Ges.). June 27th.

15,546. Selecting Devices for Telephone or other Circuits. Siemens Bros. & Co., Ltd., T. Pettigrew & D. A. Christian (partly Siemens & Halske Akt. Ges.). June 29th. (Addition to 818/13.)

15,642. Apparatus for the Control or Operation of Railway and the like Points or Switches. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges.). June 30th.

15,871. Interrupting Devices for High-tension Electric Currents. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges.). July 2nd.

15,881. Detector for Electro-magnetic Waves. Deutsche Telephonwerke. July 2nd. (January 24th, 1914.)

15,958. Windings of Dynamo-electric Machinery. Siemens Bros. Dynamo Works, Ltd., & E. O. Kieffer. July 3rd.

16,063. Process for the Manufacture of Electrolytic Electrodes. Schott and Gen (firm of). July 6th. (July 21st, 1913. Addition to 17,759/13.)

16,945. Electrometers. B. Szilard. July 16th. (October 15th, 1913. Divided from 20,008/13.)

17,949. Starting Switches or Controllers for Dynamo-electric Machinery. Siemens Schuckertwerke. July 29th. (July 29th, 1913.)

18,033. Telephone Systems. J. G. Blessing. July 30th. (July 31st, 1913.)

18,290. Writing or Copying Telegraph System. A. G. Bloxam (Telepantograph Ges.). August 7th.

18,302. Electric Hoisting Apparatus. A. H. Colley. August 7th.

18,494. Measuring Electrical Energy. J. C. Wilson. August 10th. (August 14th, 1913.)

18,496. Electric Heater Units for Fluid Meters. H. A. Gill (Cutler-Hammer Manufacturing Co.). August 10th.

18,497. Relays for Electric Voltage Regulators. British Thomson-Houston Co., Ltd., A. P. Young, & A. H. St. C. Watson. August 10th.

18,502. Electrical Switches. Siemens Schuckertwerke. August 10th. (November 22nd, 1913.)

18,565. Circuit Arrangements for Operating the Selecting Devices of Telephone Installations by Number Impulses. Siemens Bros. & Co., Ltd., and Pettigrew. August 11th.

18,566. Incandescent Electric Lamps. Allgemeine Elektricitäts Ges. August 11th. (August 18th, 1913.)

18,685. Electric Resistances. British Thomson-Houston Co., Ltd. (General Electric Co.). August 14th.

19,882. Electric Cable. C. J. Beaver & E. A. Claremont. September 7th.

20,603. Attachment to Prevent Theft of Electric Lamps or Globes. H. Maddick. October 6th. (February 19th, 1914.)

21,785. Electric Circuit Breakers. British Thomson-Houston Co., Ltd. (General Electric Co.). October 30th.

22,897. System of Control for Maintaining the Relative Speeds of a Number of Electric Motors. F. C. Anderson & C. A. Atchley. November 23rd. (Cognate application, 6,086/15.)

23,121. Vibrating Rectifiers for Electric Currents. British Thomson-Houston Co., Ltd. (General Electric Co.). November 26th.

23,366. Control System for Electric Motors. Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). December 1st.

24,039. Maximum Current or Overload Circuit Breakers. W. J. Mellersh-Jackson (Soc. Anon. Movo). December 14th.

24,429. Binding Posts for Electric Conductors. H. F. Adickes. December 21st.

1915.

1,928. Magnetic Skelp-charging Machines. W. T. Garlitz. February 6th. (February 7th, 1914.)

5,089. Telegraph Key. Sterling Telephone & Electric Co., Ltd., and T. D. Ward-Miller. April 1st.

6,117. Electrical Distribution Apparatus. W. T. Henley's Telegraph Works Co., Ltd., and E. E. Judge. April 23rd.

6,222. Combined Electric Switches and Plug Couplings. G. Markt. April 26th.

THE
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VOL. LXXVII. SEPTEMBER 10, 1915. No. 1,972.

ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: September 10, 1915. [No. 1,972.

Page
Science and War 321
"Enemy" Goods Passing as "Neutral" 322
The Consular Service Again 323
Lead 323
Matthew Hamilton Gray (*illus.*)... 324
New Electrical Devices, Fittings and Plant (*illus.*) 325
Electric Remote Indicators for Rifle Ranges (*illus.*) 326
America and Electrical Export Trade 327
Convertible Combustion Engines (*illus.*) 328
Correspondence—
  Automatic Lift Accidents 330
  American Trade 330
  "For Those in Peril on the Sea 330
  Trade Entente after the War: The Other Side of the Question 330
  Selling Organisation in the Electrical Industry after the War 331
  Advertising 331
The British Association 332
  Presidential Address to the Engineering Section, by H. S. Hele-Shaw (*illus.*) 332
Legal... 333
War Items 333
Business Notes 334
Notes 339
City Notes 342
Stocks and Shares 343
Electric Tramway and Railway Traffic Returns 344
Share List of Electrical Companies 344
The Trend of Electrical Development (*concluded*) 345
An Electric Ferry (*illus.*) 346
The Double Audion Receiver for Continuous Waves (*illus.*) ... 347
The Selling Side of Electricity Supply.—IV. 348
The Electrical Equipment of the Argentine Battleship *Moreno*, by H. A. Hornor (*illus.*) 348
New Patents Applied for, 1915 352
Abstracts of Published Specifications 352
Contractors' Column ... ... Advertisement page xx

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SCIENCE AND WAR.

THE British Association this year is meeting under conditions without precedent during its history of 84 years, and naturally its proceedings are deeply tinged with the influence of the conflict which is raging throughout Europe. All social functions have been omitted from the programme, which is confined strictly to the reading and discussion of papers and reports, and to visits to works and other places of scientific interest. The subjects to be dealt with in many cases are more or less directly related to the war and matters arising out of it, and the address delivered by the President, Prof. Arthur Schuster, on Tuesday evening, which treated of the common aims of science and humanity, contained many allusions to the struggle for existence through which our civilisation is passing, while that of Prof. H. S. Hele-Shaw, president of Section G, was devoted wholly to demonstrating the necessity of utilising the services of every agency at our command not only during the war, but also in the industrial war which will inevitably follow the conclusion of hostilities.

The former was couched mainly in the abstract and philosophic vein, dealing with the affairs of the intellect. The President drew attention to the fact, which we regard as one of the most valuable and hopeful phenomena resulting from the "great catastrophe," that the common danger has dissolved our individual differences, which were dividing the community into groups with widely divergent and sometimes opposing interests, and has revealed that after all the clash of interests is merely superficial, and that we are all united by a solid bond of sentiment and purpose. Terrible and deplorable as are the immediate results of warfare, there is firm ground for hoping that the nation will emerge from the ordeal spiritually awakened and revivified, with a new outlook upon the world of men and things, and with a broader and higher conception of the duties owed by men to the community from which they derive their privileges.

Referring to the position of the British Association and the functions which it should fulfil, the President showed that in the beginning it was intended to be of an exclusive character; in the words of Sir David Brewster, its principal founder, it was to be "an Association of our nobility, clergy, gentry, and philosophers," a definition which reflects the snobbish spirit of the time, and incidentally reveals the traditional attitude of the English people towards men of science, as persons of an inferior grade. Fortunately this narrow-minded policy did not prevail, and the Association, instead of becoming a scientific clique, has been able to exercise a powerful influence on the progress of science and on the dissemination of scientific knowledge amongst lay members of the public; but Prof. Schuster admits that its efforts have been spasmodic, and suggests that the present juncture affords the opportunity to secure greater continuity in its work and better co-ordination with other scientific organisations. In the Association we certainly possess a magnificent machine of established reputation and efficiency, and it seems obvious that it ought to be utilised to greater advantage than is possible under the existing *régime*; its load factor is lamentably low, and we see no fundamental reason why it should not be enormously improved.

The bulk of the President's address related, as we have indicated, to the intellectual field, and it contains many interesting arguments and epigrammatic observations; the author inveighs against the popular tendency to differentiate between men of theory and men of practice, "without regard to the obvious truth that nothing of value is ever done which does not involve both theory and practice." He points out that "we must guard against accepting a man's estimate of his own power to convert his thoughts into acts. In the ordinary affairs of life a man who calls himself a man of action is frequently only one who cannot give any reasons for his actions."

While we are unable to devote space to a detailed consideration of the address, we feel that the following extract is so true and so significant that it should be quoted in full:—

> If we must avoid assuming special intellectual qualities when we speak of groups of men within one country, we ought to be doubly careful not to do so without good reason in comparing different nations. So-called national characteristics are in many cases matters of education and training; and, if I select one as an example, it is because it figures so largely in public discussions at the present moment. I refer to that expedient for combining individual efforts which goes by the name of organisation. An efficient organisation requires a head that directs and a body that obeys; it works mainly through discipline, which is its most essential attribute. Every institution, every factory, every business establishment, is a complicated organism, and no country ever came to prominence in any walk of life unless it possessed the ability to provide for the efficient working of such organisms. To say that a nation which has acquired and maintained an empire, and which conducts a large trade in every part of the world, is deficient in organising power, is therefore an absurdity. Much of the current self-depreciation in this respect is due to the confusion of what constitutes a true organisation, with that modification of it which to a great extent casts aside discipline and substitutes co-operation. Though much may be accomplished by co-operation, it is full of danger in an emergency, for it can only work if it be loyally adhered to; otherwise it resembles a six-cylinder motor in which every sparking-plug is allowed to fix its own time of firing. Things go well so long as the plugs agree; but there is nearly always one among them that persists in taking an independent course, and, when the machine stops, complains that the driver is inefficient. The cry for organisation, justifiable as it no doubt often is, resolves itself, therefore, into a cry for increased discipline, by which I do not mean the discipline enforced at the point of the bayonet, but that accepted by the individual who voluntarily subordinates his personal convictions to the will of a properly constituted authority. This discipline is not an inborn quality which belongs more to one nation than to another; it is acquired by education and training. In an emergency it is essential to success, but if it be made the guiding principle of a nation's activity, it carries dangers with it which are greater than the benefits conferred by the increased facility for advance in some directions.

The lack of discipline—how prominent a feature is it in the recent history of this nation! We have seen it in politics, in trade unions, in commercial circles—even during the war it has been exhibited, especially in the ranks of labour. It is fraught with danger to the State, which, we grieve to say, has fostered it by injudicious legislation in the past, and it has proved a fatal obstacle to many a promising scheme for co-operation in trade matters. The individual who will not subordinate his personal views to the decisions of authority, and stubbornly persists in following independent lines, is the wrecker of all such hopes, as we have often regretfully observed, and it is particularly significant at a time when the star of our enemies appears to be in the ascendant that he is conspicuously absent from their ranks; the complete subordination of the German to the decrees of those in authority is a matter of common knowledge, and constitutes the chief strength of the nation.

It does not involve servility—on the contrary, the pride of the German is notorious—but it does involve self-sacrifice, than which there is no higher quality, and which is equally manifested by our foes. We would not follow the latter in many respects, but we should be well advised to copy such good qualities as they possess, and as Prof. Schuster states, in an emergency discipline is essential to success. The need of it will be felt not only during the war, but also in pursuing concerted measures afterwards to maintain and advance our commercial supremacy.

But the author sounds a warning note, lest we "beat the utilitarian drum too loudly"; he says: "the combination of the search for the beautiful with the achievement of the useful is the common interest of science and humanity"; "do we not find in the worship of material success the seed of the pernicious ambition which has maddened a nation, and plunged Europe into war?" and he concludes that in the struggle which convulses the world Science gladly gives all the power she wields to the service of the State, "because a war wantonly provoked threatens civilisation, and only through victory shall we achieve a peace in which once more Science can hold up her head, proud of her strength to preserve the intellectual freedom which is worth more than material prosperity, to defeat the spirit of evil that destroyed the sense of brotherhood among nations, and to spread the love of truth."

"Enemy" Goods Passing as "Neutral."

M. Steylaers, whose account of the efforts of German firms to dominate the electrical field in Belgium, and whose reference to the preparations that are being made for labelling German-made goods as "British-made" after the conclusion of the war are already familiar to our readers, tells us in our "Correspondence" columns to-day how German lamps are getting into Spain as "Swiss-made." So long as Italy was not at war such lamps were finding their way into Spain through that country, but since Italy threw in her lot with the Allies in their fight against Prussian oppression, German-owned lamp works have commenced operations in Switzerland whose product may or may not all be of Swiss manufacture though it is allowed to pass through France as such. Our correspondent not unfairly asks what we may expect after the war if such competition is permitted now. We may anticipate that German firms will not then immediately show a very burning desire to mark their products "Made in Germany"—are not those other labels mentioned by M. Steylaers already prepared?—and more things may claim to be Swiss and Dutch than are doing so even now. Such matters are very difficult to control completely under prevailing conditions, and there may be leakage at some points, but we trust that the French authorities who have adopted such thorough measures in dealing with enemy companies formerly owned and operating in France, will be on the alert and ready to confiscate imports of enemy taint.

In other ways the enemy has his agents at work in Switzerland, as the Reuter dispatches from Zurich at the end of August showed. It seems that many Swiss manufacturers and wholesale houses are forming private import trusts in such centres as Geneva, Zurich, St. Gall and Basle, which will give the guarantees that the Allies have demanded that none of the Allied manufactures that they are allowed to receive shall reach Germany and Austria. A vigorous German propaganda is said to have been employed to defeat this effort of the Swiss firms, and it is gratifying to observe that the latter will not yield before the artifices of the Teuton. The Swiss manufacturers will probably find that the products of "neutral" countries will be held in less suspicion by Allied buyers if they assist in the suppression of German exporting across Switzerland of manufactures which, in passing, conveniently change their "place of origin."

The Consular Service Again.

It may be argued that these are peculiarly ill-chosen times for repeating the old criticisms of the British Consular Service; Government Departments are snowed under with far more pressing matters in these days of anxiety, and really have no time, even if they have the inclination, to undertake revision and reorganisation of the system and service. Certainly there is a good deal to be said for that attitude; this horrible and colossal warfare in Europe has placed many world affairs in a state of flux, and all sorts of things are in the melting-pot. Yet when all this, and much more like it, has been said, are we not driven to ask "If not now—when?" "After the war"? when the international trade rivalry resumes, and when it becomes more remorseless than ever—unless statesmen and sentiment, trade ententes and financial conditions, combine to hinder. Reorganisation of the Consular Service in the interests of British industry, and along such lines as shall not weaken diplomatic strength—this is not an undertaking to be effected by a few strokes of the pen, a few substitutions of names, or a discussion in the House of Commons. It will be rather late in the day to begin to deliberate when, as a nation, we are, perhaps suddenly, we hope gradually, returning to the former operations of our industrial life. We have heard whisperings of a something that the Board of Trade was going to do—that it actually had in course of preparation, and probably, if we were permitted to examine the archives of that Department, we might be entertained with interesting disclosures. But in absence of anything definite to guide us on that point, we may be allowed to hope that in these days of war absorption the matter is not being left entirely alone. We never have thought that the Consular Service, if brought to the highest pitch of excellence and efficiency, should be expected to do many things that manufacturers and traders ought to do for themselves. It is not desirable that it should be regarded as a possible substitute for private initiative, but Consuls can help where private parties are helpless, and experience has proved that the Consuls of competing countries have done great things to assist the industries of those countries which their traders never could have accomplished without their aid. One of the strongest criticisms that have been levelled at the British Consular system is that it compares unfavourably with the Governmental official aid given to our competitors. Some comments that appeared in a recent issue of the *Chamber of Commerce Journal* have drawn a remarkable letter from a well-known West-End firm of cigar merchants and shippers (Martins, Ltd.), relating an experience of the British and American Consular services. We quote:—

> We were desirous of extending our business in various countries and we wrote to the British Consuls fully explaining our proposition and asking them to furnish us with a list of importers of good standing of our particular commodities. Although we approached some 30 or 40 Consuls, the response was most meagre and disappointing. One of the Consuls who responded to our inquiries called to see us when he was home a few months after, and we told him what our experience had been. His reply was: "Ah!—I'm afraid his Majesty Consuls are so conscious of the fact that they represent his Majesty, that they pay little or no attention to commercial inquiries."
>
> Well, being unable to get the desired information from the British Consuls, we made inquiries from the American Consuls, and practically every one of them responded, and, moreover, gave us a lot of useful local information. Can we wonder that British business men complain of the paucity and uninformative nature of our Consular reports as compared with those issued by the American Consular Service?

There may be little in common between cigars and electrical manufactures, but we fear that the exporting firms in both trades will find themselves generally in agreement with this complaint. Not that all British Consuls are inattentive or too superior—we have ourselves received letters from numbers of them showing their desire to assist us in certain matters; but compared to what one would expect, the result has been so negligible as to discourage too confident a reliance being placed upon such sources of assistance. Our pages have of late borne ample evidence to the thorough way in which U.S. officials have been reporting for the benefit of American firms on the electrical possibilities of different markets, and our own Department might with advantage take a leaf out of their book; the lack of desire in America to engage in extensive export operations is more to blame for the relatively small dimensions of such business than is its Government Commercial Intelligence Service.

The above letter, however, while it pays a tribute to American excellence, also discloses a point of questionable value from the American point of view. We are not sure that we should regard it as quite a mark of strength for the British Consular service to lay itself out to render assistance to the traders of other countries, though there may be very good reason in certain cases for reciprocal relations. We shall be quite content if something can be done to ensure a more generous and intelligent commercial assistance being given by British Consuls to British manufacturers.

Lead.

The lead market during the past few weeks has presented several interesting features. On the whole, the market has been irregular, and somewhat difficult, but there is a decided firmness, although at one time the demand for this metal was not quite so active and prices slipped back slightly. The factor which is mainly responsible for the present tone of the market is a lightening of the stocks. Recent arrivals have been far from heavy, and stocks are becoming more or less exhausted. Added to this the loss of a steamer carrying 700 tons to the Tyne has made the position more difficult. Shipments to the Continent, more particularly to Russia, continue heavy, and it seems likely that the bulk of lead arriving during the next few months will be urgently required for shipment to Russia, so that very little may be available for the home market. These shipments are under old contracts. The requirements of Russia are so urgent that it seems as though the question of price will scarcely arrest shipments, but recently very little has matured from the numerous inquiries from this quarter. Besides Russia, Holland and Sweden have been in the market for lead, but business with these countries is naturally difficult to consummate.

The American market has remained very firm, and in some quarters it is hinted that the possibility of fresh attempts being made at manipulation by interests across the Atlantic are not altogether remote. No step seems to have been taken in the direction of meeting the market here, and prices in New York are now £2 to £3 above London parity. The output in the United States is still very high, although naturally consumption, especially for munitions purposes, is great. The American interests in Mexico have diminished their smelting activity for the time being in consequence of the unsettled state of the country, but mines continue to operate. In spite of all the troubles through which Mexico has passed, and is passing, hope is held out for the future of the lead smelting industry in that country. It is believed that the new attitude assumed by President Wilson towards Mexico will produce some tangible results, and that United States smelters will be able to resume active operation of all their plants there at no distant date. Meanwhile Australian and Spanish lead is coming forward in very regular quantities, and as there is every prospect of an increase in the Australian smelting capacity in future, this country should not be so largely dependent upon supplies from across the Atlantic. It is understood that Broken Hill lead is now being tendered against due contracts.

Coal Prices.—At the meeting of the Swansea Electric Lighting and Tramways Committee on September 2nd, the chairman, Col. A. Sinclair, was cordially thanked for having been instrumental in inducing the Executive Committee of the Municipal Electrical Association to take up the question of the exclusion of existing contracts under the Coal Prices Limitation Act with the Government. The result, said Ald. Colvill, was that contracts entered into prior to the passing of the Bill would now benefit to the extent of 4s. per ton when the Act came into operation next November, the same as all other contracts. The Mayor (Ald. Daniel Jones) who proposed the resolution, said that not only Corporations but many private firms would benefit by the Government concession.

MATTHEW HAMILTON GRAY.

For the second time within less than 18 months has the old church at East Wickham been the scene of mourning for the death of a member of one of the most beloved and honoured families known to the telegraph and electrical industry and profession—the Grays of Silvertown. The late Robert Kaye Gray—whose loss is still so sadly felt—was laid to rest in the spring of last year; his signal services rendered to the profession and industry and to many a good cause brought him into some degree of public prominence, and a very large and representative gathering attended at the family grave to pay their homage to his memory. Again, on Monday afternoon last, amid the changing tints of early autumn, at the same hallowed spot, a second company of mourners gathered to lay to rest with honour a younger son of the same household—Matthew Hamilton Gray. The same gentleness and courtesy that had marked the nature and character of the late President of the Institution were also among the admirable traits by which the friends of the now deceased brother had learned to value his acquaintance. While Robert's activities and sterling qualities thrust him almost unwillingly into the public gaze, Matthew Hamilton, shrinking even more from publicity, confined himself to practical work in his own particular departments, keeping in most intimate touch with all classes of men in the course of these business operations, making hosts of friends, and never wearying in rendering useful service in comparatively private channels for the good of his company, his country, and for the welfare of mankind.

Matthew Hamilton Gray.

Photo. by] [*A. F. Mackenzie, Birnam, N.B.*

Robert was the eldest and Matthew Hamilton the third, son of the late Matthew Gray, of 106, Cannon Street, London, and Lessness Park, Abbey Wood, in Kent—a fine type of man whom those who knew him are never likely to forget. Both brothers were educated at Greenock and at University College School, London.

Matthew Hamilton Gray retired from the active service of the India-Rubber Co.—the Silvertown company—about seven years ago, but he always continued to take a lively interest in the company's various operations. He passed away at Glenquaich, Perthshire, on Thursday last week, September 2nd, at the age of 61 years, having been born in June, 1854, at Glasgow.

Having decided to adopt the profession of mining engineer, he attended the necessary courses at Jermyn Street, and qualified at the earliest moment as A.R.S.M. To obtain further experience before actually practising, he made a two years' sojourn in South America and the U.S.A., where he visited the most important copper, silver and gold mines; he then became employed in the East, where he remained some three years, organising work in the cinnabar mines and collieries in Borneo (Sarawak), and prospecting in the up-river districts, afterwards visiting China and other places. He then returned home suffering from a severe attack of fever, and when he had, in a large measure, recovered from this attack, he, at the urgent request of his father, joined the service of the India-Rubber Co., of Silvertown, first as assistant engineer and finally as engineer in charge of all submarine cable-laying operations dealt with by that company.

As assistant he aided in the laying of the cables in Mexico and the large system of the Central and South American, the further link to Valparaiso, besides the cables from England to Spain and many others. He did a great deal of pioneer work in connection with the Pacific Cable system.

As chief engineer he effected the laying of many cables; to mention a few, the Spanish National from Cadiz to the Canaries, the further link to Senegal, and the work of connecting Senegal to Brazil across the Atlantic by way of Fernando Noronha. In addition, he was in charge during the laying of other Continental connections with England, and the repairs of many cables throughout the world, a not unimportant portion of the submarine telegraph engineer's work.

For services rendered to life and humanity generally whilst on expeditionary work, he received presentations from the English Government and from the German Emperor, and the Portuguese Government presented him with the Order of Commander of Villa Vicosa.

A very capable all-round engineer, any work he undertook was invariably carried out quickly and successfully, and it is not an exaggeration to state that he was loved by all who knew him for his attainments, his deep reading, and his charm of manner; he was generous to a fault.

He was a good linguist, and apart from the philanthropic work in which he found his great pleasure, he followed with particular interest all geological and seismological studies.

> "He was a man, take him for all in all,
> I shall not look upon his like again."

Among those present at the funeral at Wickham Church, on Monday last, were the following:—Mr. and Mrs. C. H. Gray, Mr. and Mrs. Wm. Gray and Miss Gray, Miss Margaret Gray, Mrs. Cameron, Miss Cameron, Lady Ann Marsham, Miss Tucker, Mrs. Mitchell, Mr. P. V. Luke, Mr. George Todd, Mr. Herbert Blyth, Major Robertson, Dr. Davidson, Col. Mostyn, Mr. A. S. Johnston, Mr. R. H. Hedderwick, Mr. Stuart Russell, Captain H. Benest, Captain Morton, Mr. J. Jeffrey, Mr. E. Geale, Mr. J. Rymer Jones, Mr. E. March Webb, Mr. Bailey, Mr. H. Alabaster, and Mr. T. E. Gatehouse.

Mr. E. Raymond-Barker sends us the following tribute to the late Mr. Gray:—"On September 2nd died Matthew Hamilton Gray, one of the best-known men of his day in submarine cable engineering enterprise, and, for many years, sea-going engineer-in-chief under the administration of his late distinguished eldest brother, Robert Kaye Gray, who was managing director of the 'Silvertown' company, and (home) engineer-in-chief of that organisation's submarine department. The news of 'Mat' Gray's demise at Glenquaich, in Scotland, must have come as a shock to the many who loved him. It brought a pang to the writer, who for many years, at home and abroad, ashore and afloat, had regarded his departmental chief with that loyal devotion naturally induced by any personality built on the lines of 'Mat' Gray; and now to this kindly and generous-minded soul—who loved children, and was beloved by them—the hitherto Invisible has become the Visible. Fortunately the value of an obituary is measured by the sincerity of its tribute to the departed one; not by the superficial area of the paper it covers. Matthew Hamilton Gray, after passing through University College, London, and other University courses of study on the Continent—specialising in Science and Engineering—took up mining engineering in Borneo, where, engaged in arduous work, he contracted severe malarial illness, which laid the seeds of much intermittent trouble later on. In this matter the writer—himself hard hit by the results of illness contracted in Senegal—can write in all sympathy. Regarding the work Matthew Hamilton Gray subsequently took up in the Silvertown Submarine Department, much might be written, and a long list of cable-laying expeditions might be given. Many of these 'M. H. G.' was in charge of. Later on, when his health began to fail, he carried on at home much useful, organising and supervising work, whilst others took the cable ships to sea. Regarding, however, the work M. H. G. carried out or supervised, is it not to be found in the engineering libraries in a shelf full of printed volumes; records pertaining to the manufacture and laying of many ocean cables in various parts of the world? A final word—The writer found in M. H. G. a true friend; on some occasions of stress, he might have been an elder brother. May God rest his soul.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A Boiler-Cleaning Machine.

The American Consul in Goteborg reports that an electric machine for cleaning steam boilers was invented about a year ago by Messrs. Sandholm and Olsson, of Goteborg. A corporation, Elektriska Pannrensnings-Bolaget, of Goteborg, was organised by the inventors to have the machine with necessary accessories manufactured and to operate the same. The electric power needed for the apparatus is small, and, in comparison with the old method of cleaning boilers, the time required is very short.

Robust Switches and Fuses.

A special line of knife switches and fuses of particularly robust construction, which should prove of interest to central station engineers and others, has been introduced by the **Electric and General Works, Ltd.**, of 15, Victoria St., S.W. We illustrate a triple-pole switch and porcelain handle fuses of the type in question, from which it will be seen that they are provided with porcelain insulators and cast-iron base, thus rendering this type of apparatus eminently suitable for mounting direct on a wall or on ironwork, or for building up "skeleton" switchboards. This special adaptability will suggest many uses to engineers, and the fact that all connections are on the front and extremely accessible will increase their usefulness in certain spheres.

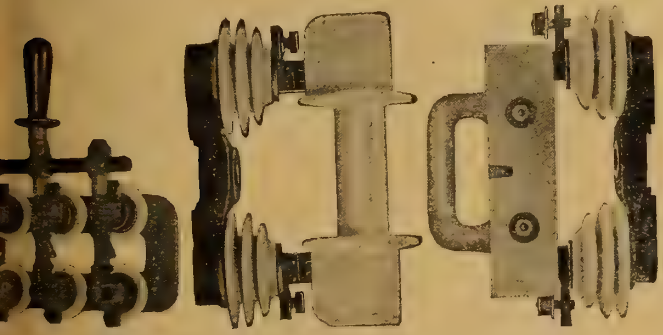


Fig. 1.—Self-Contained Switch and Fuses.

All current-carrying parts are dull nickel-plated, these parts being thus protected against corrosion. In fact, the switches are thoroughly suitable for mounting in dusty and damp premises.

Holophane Industrial Fittings.

During recent years marked attention has been paid to the subject of economical and suitable factory lighting; indeed, in 1913 the Home Secretary appointed a special committee to study this question, which has just issued its first report. Bad or indifferent lighting must result in slowing down the output, and is no doubt responsible for many accidents. With a view to meeting the growing demand for efficient industrial lighting, **Messrs. Holophane, Ltd.**, of 12, Carteret Street, S.W., have introduced a series of industrial reflectors for local and general lighting, and for low or high candle-power lamps up to 2,000 c.p. half-watt lamps.

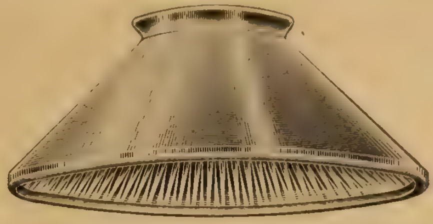


Fig. 2.—Industrial Reflector for Local Lighting.

Full particulars of these reflectors, and a good deal of useful information on the subject, are contained in a list just issued by the firm. The Holophane industrial reflectors are composed of scientifically designed prismatic glass shades, over which aluminium cases are spun in such a manner that they seal up both ends of the glass; in the result, excellent reflecting properties are obtained, and as both inside and outside surfaces are smooth, they are easy to clean and maintain in efficient condition.

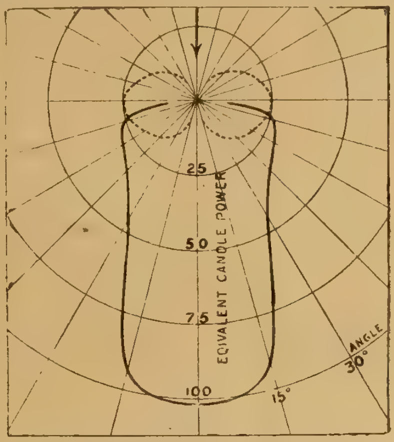


Fig. 3.—Candle-power Curve of Lamp, with and without Shade, shown in Fig. 2.

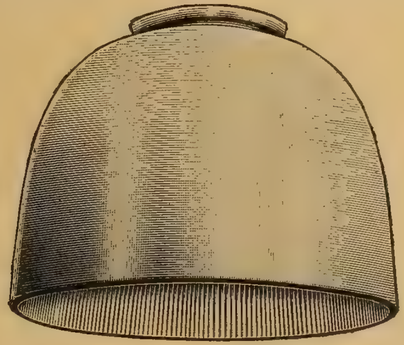


Fig. 4.—Extensive Type Half-watt Reflector.

We illustrate in figs. 2 and 3 one of the firm's reflectors for local lighting, and photometric curves for the same.

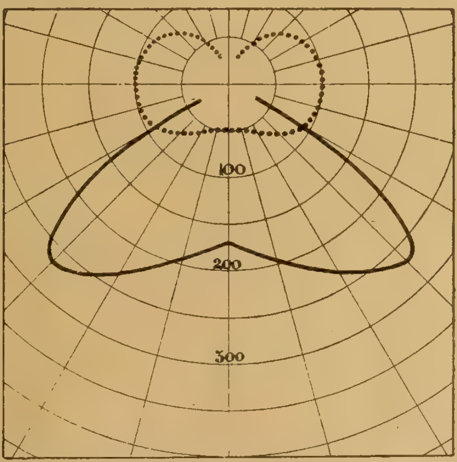


Fig. 5.—Candle-power Curves of Lamp, with and without Shade, shown in Fig. 4.

Figs. 4 and 5 similarly illustrate an "extensive" type of reflector to use with half-watt lamps in the general lighting of factories.

ELECTRIC REMOTE INDICATORS FOR RIFLE RANGES.

Attempts have occasionally been made to employ electrical apparatus in rifle ranges for signalling the value of each shot, but the arrangements so far devised have usually been of a rather rudimentary description, and could be used only in conjunction with the usual mechanical indicators.

The Marksmen's Society, of Spandau, near Berlin, just before the outbreak of war took a decisive step in this direction, by having all its rifle ranges fitted with electric remote indicators on the Siemens system. The installation, which was supplied by the Siemens Co., offers a number of novel features, and may be briefly described.

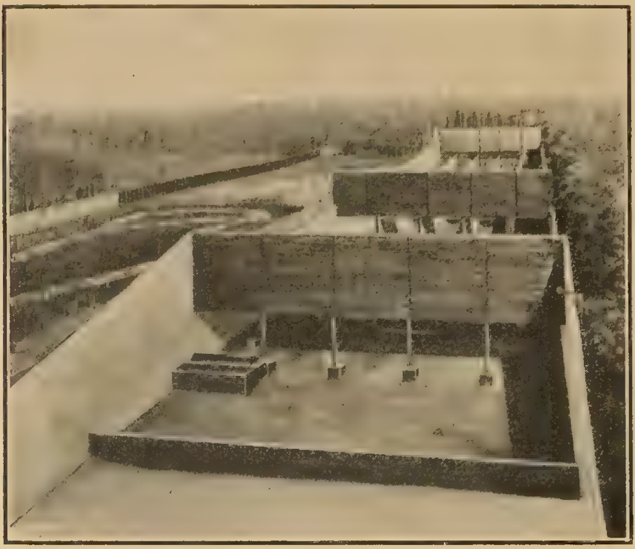


Fig. 1.—Rifle Ranges at Spandau.

The Society owns extensive shooting grounds, comprising three 300-m., 12 175-m., and two 100 m. ranges, and one of 35 m. Each range is fitted with a transmitter and a receiver, serving to signal the number of the rings hit each time. Each of these apparatus, connected together by electric cables, possesses a scale, the 23 divisions of which bear the inscriptions 0, 1, 2, 3, ... 20, "telephone" and "stop." The transmitter is installed to the left of the target, between the guide bars of two contiguous targets (fig. 2), there being no need to provide any special room for it, as in connection with previous installations. The receiver is arranged at the firing point, to the left of the marksman (fig. 3), and is readily read and checked by the latter, as well as by the secretary seated immediately behind him. Each transmitter and receiver comprises an index fitted with a handle, which is easily adjusted by hand, the pointer and handle of the transmitter being connected, in the interior of the casing, with an adjusting arrangement resembling a small electric motor (fig. 4), which ensures perfect agreement in the readings of the two apparatus. The index of the receiver is shifted by a similar system, and, being protected by a glass plate, cannot be interfered with by the marksman.

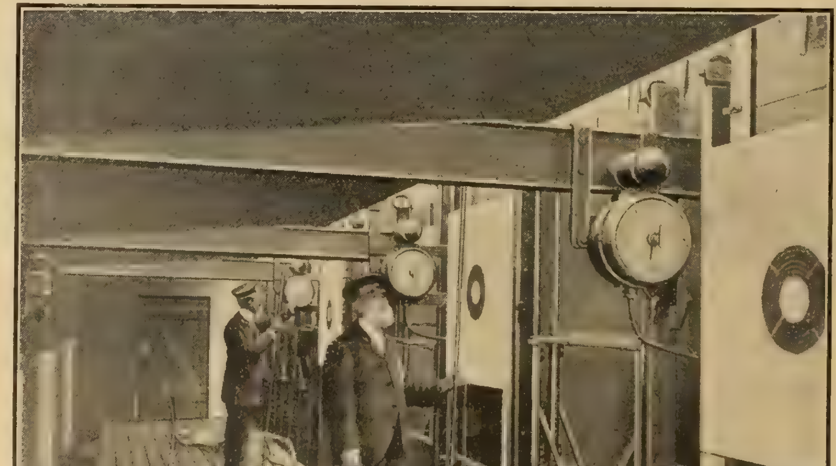


Fig. 2.—Transmitters at the Butts.

With each new reading marksmen are advised by a short acoustic signal given by an electric buzzer, at the transmitter and receiver, which is readily distinguished from the bell signals employed for other purposes. At the marksman's post and on the desk of the secretary seated behind him, there are push buttons actuating simultaneously the buzzers of the transmitter and receiver, which are distinguished by their different timbre.

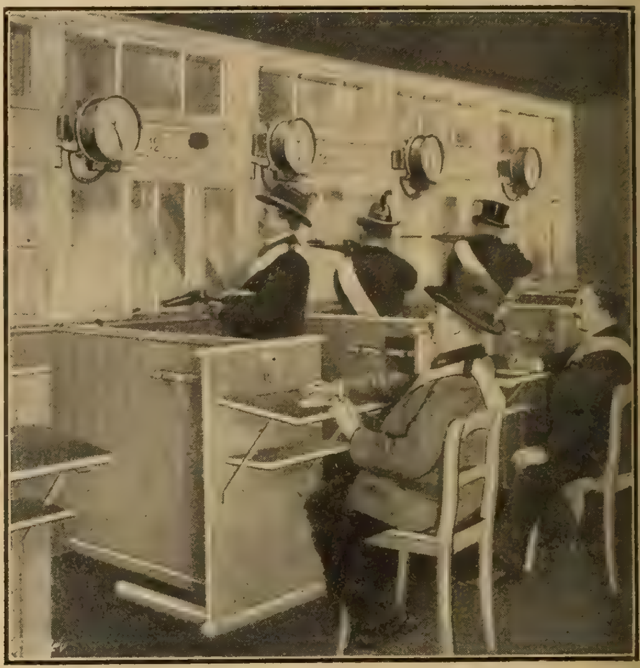


Fig. 3.—Firing Point, Showing Receivers.

The installation further comprises a telephone plant. Watertight telephones, arranged in the passage-way of each range, are connected up to an indicator switchboard installed in a special cabin, whence each telephone is readily called. In order to get a connection with his marksman, the man entrusted with the operation of the transmitter has only to adjust the index of the latter to the division "telephone," thus causing the receiver index to take up immediately the same position, and advising the marksman that he is wanted on the telephone. The telephone plant has been designed on the central-battery system, the battery being installed so as to be protected against atmospheric influences. The telephone apparatus are joined together by means of armoured cables.

The installation works as follows:—After taking up his post at the firing point and firing his shot, the marksman presses down the push button on his left, thus actuating the buzzers of his receiver and transmitter and calling the attention of the operator. The latter looks for the mark left on the target by the shot just fired, pointing out with a small rod the section in which this mark is found (top, bottom, right or left). Having then taken down the target, he adjusts the transmitter index to the number of the ring hit by the marksman. While he is shifting this index, the electric buzzers of the transmitter and receiver are sounded simultaneously, and the receiver index takes up the same position as that of the transmitter. The operator finally pastes some paper on the mark made by the bullet, after which the target is ready for another shot.

The first cost of this electrical outfit is in most cases more than made up for by the saving of ground and accommodation. Operating expenses are extremely low. At Spandau, three-phase current at 220 volts, 50 cycles, is available for feeding the apparatus, thus allowing a very simple type of alternating-current indicator to be used. The 18 shooting ranges are arranged in six groups each of three, and as each group has an armoured underground cable of its own, any breakdown in operation will be limited to the three ranges of a given cable. Each group communicates with the electric mains through a transformer stepping down the pressure from 220 to 55 volts. The consumption of power of each transmitter-receiver set is about 28 watts.

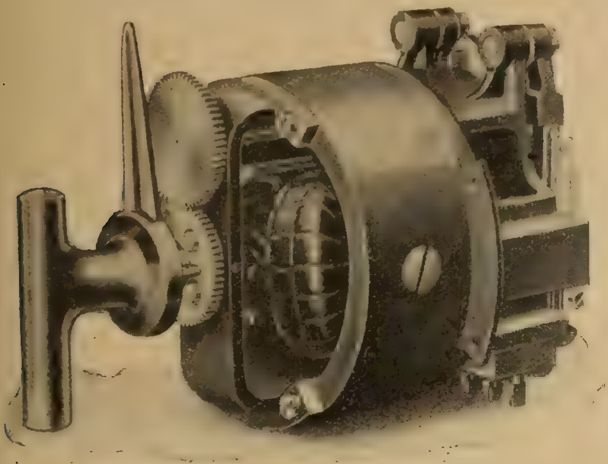


Fig. 4.—Mechanism of Transmitter.

An additional advantage of the electrical indicator is the possibility, as brought out by actual experience, of shooting at a rate 50 per cent. higher than usual, which is especially important on the short winter afternoons.

AMERICA AND ELECTRICAL EXPORT TRADE.

In its last Session the United States Congress passed legislation setting up a Federal Trade Commission. The proceedings of that organisation have lately had direct reference to the future possibilities for American electrical manufactures in foreign markets. A very entertaining account of statements made by leaders of U.S. electrical industry when appearing before the Commission, appears in the *Electrical Review and Western Electrician* (Chicago) for August 14th. The writer of the report, Mr. Waldon Fawcett, begins by quoting a statement by Mr. E. M. Herr, of the Westinghouse Electric and Manufacturing Co., to the effect that the American Home Market has been so good that little attention has hitherto been devoted to the exploitation of foreign business. "Now we are suffering for it." It is recognised that the volume of that business is insufficient to even up the fluctuations in domestic business which are inevitable. Mr. Herr mentioned that out of a total Westinghouse business of between £5,000,000 and £6,000,000, something above £600,000 (10 per cent.) was foreign. During the past six months, while things have been disturbed in South American territory, one of Mr. Herr's assistants (Mr. Townley) has made a tour of investigation throughout the entire South American Continent, for he believes that his company ought to, and, under proper conditions, he thinks it could, do a very much larger trade. What Mr. Herr finds to be most pressing is the ability to get proper financial connections in the South American countries, and better transportation opportunities. "We are considerably handicapped in the matter of finance, but . . . that is being remedied" by the recent exploitation in South American countries of U.S. branch banks, whose help is destined to be very useful. Mr. Herr added that his company (in America) did very little export business to Europe, considerable to Africa, but very little to South America. The Westinghouse interests were represented by companies in Europe—British, French and Italian. They did not compete with those companies. The American company had heretofore handled the South American countries, and the British company had had representatives there. "You might say it was competition, because they sold goods and we sold goods in the same territory. Of course, we were very close to their representatives." They would, of course, have very great interest in co-operating with their foreign companies, and it might be possible under proper conditions that they could co-operate with other electrical manufacturers. The importance of this matter lay in the fact that their foreign competitors had no restrictions whatever in that respect, and the American company were meeting very drastic conditions as to prices from German, French and British electrical competition. The Germans were, perhaps, their most severe competitors in South America up to the outbreak of war.

British and French manufacturers were there also in competition, but the American company had suffered most from German competition. Mr. Herr feels that the Germans have a great deal more assistance in the arrangements that they can make under the law than Americans have, and he thinks that this is a field where the American manufacturers can be very greatly helped. "That has got to be done with due regard for the possibility of these foreign competitors of ours establishing agents and sub-branches in our country to enable them to get into any organisation or arrangements that might be made for American manufacturers. It might work to our very severe detriment." In Mr. Herr's estimation America's very greatest interest in foreign trade, aside from the mere broadening of the field and extending the business, is the evening up of the load upon the factory.

> It is very difficult, and very expensive, to administer a manufacturing business under constant fluctuation of that business. During the times of depression our overhead expenses naturally go on in very large volume; and the costs necessarily go up. It is extremely advantageous to have a business, as the foreign business in our line has been heretofore. When we are depressed here our foreign business tends to even up the load upon our manufacturing facilities. It tends to keep our employés more steadily employed, and enables us to produce our goods at better costs than we could possibly do if we had that kind of a load to even up and did not have our foreign trade to help us.

Some members of the Federal Trade Commission appeared to be under the impression that American electrical exports consisted largely of supplies rather than of extensive installations, and Mr. Waldon Fawcett in his article states that this erroneous impression was corrected by Mr. Herr, who explained that in addition to doing a supply business his firm furnished large equipments of all kinds in South America and Africa. He spoke of the excellent reputation of American electrical goods for quality—"we are frequently specified as against foreign competition," but other countries

> cut the price on us so severely and are able to produce goods and enter combinations (entering the market in ways that are very much to our disadvantage) so that we find it very difficult to negotiate these high class products when produced in competition with them. The financing of large projects through German and British financiers has affected us very seriously, of course, but there are still other agencies.

Mr. Herr went on to disclaim any personal knowledge of the reported purchase by the Siemens-Schuckertwerke people of the plants of competitors in Italy and France, and he was unable to give first hand information concerning the operation of the German electrical cartels.

> We get the information that they are able to exploit by means of the assistance not only of combinations among themselves, but also by direct Government assistance. They are favoured in their export trade as against their domestic trade due to freight discriminations, &c.

It is the need of proper financial connections that Mr. Herr appears to regard as of great importance:—"We are extremely handicapped in almost every foreign country by the lack of financial information available." His own company had not adopted any methods in foreign trade since the war that were particularly different from those employed before. In some few cases customers were caught and could not get their goods, largely owing to the depression in South American territory.

Mr. Calvert Townley, of the same company, and already named above, was able to give the Commission interesting and up-to-date information as a result of his South American trip. He declared that Latin-American markets were closed to a considerable share of Yankee-made electrical goods, for two reasons. One explanation was that a large share of public utility enterprises was financed by European capital, and consequently orders for equipment went to European firms. The other explanation lay in the leakage of information, "due to the circumstance that the banks through which American firms must do business were conducted by foreigners," and Mr. Townley referred to reports, generally current—but unvouched for by himself—to the effect that German banks in South America copied American bills of exchange and invoices, with the result that the information thus gleaned as to American competition, prices, &c., was quickly placed in the hands of German firms. Mr. Townley sees difficulties in the way of common selling agencies abroad, and the chief of these is the difficulty of arranging combinations between producers of high-grade and low-grade products. He fears that the high-grade manufacturers might refuse to go in. He does not think that there would be objection to such a pooling of sales machinery in certain lines, and he cited as an example the incandescent lamp business, there being on the market many lamps of high grade but different in quality—a state of affairs which affords no objection to all the lines being handled by one representative. He summed up his opinion of the South American electrical market in one sentence thus: "Generally speaking, electrical equipment follows the investment."

Mr. Maurice Coster, export manager for the Westinghouse Co., furnished the Trade Commission with inside facts about the export trade in electrical goods to Russia, South America, &c. One of his most interesting disclosures was with respect to German competition in South America:—

> The Germans have been able to reduce their selling expenses by making agreements between themselves as to the territory to be exploited. For instance, a few years ago, we would hardly ever meet any German competition in the Argentine except that of the A.E.G. Co. On the other hand, in Chile we would have nothing but the Siemens-Schuckertwerke competition, whereas we would find all the leading American electrical companies competing with each other in Argentina and Chile.
>
> By reducing their selling expenses the Germans have been able to sell cheaper apparatus. I think if we were to go to our principal competitor in this country and make such an agreement we might be called to task on the ground that we were moving against the provisions of the Sherman Act. We should like to make such an agreement because South America is an immense field. It can easily be divided up. In Brazil, for instance, there is a very decided pro-American feeling. We do not need to meet German competition in Brazil—not always. On the other hand, in the Argentine, where there is so much German and English and Italian capital, we absolutely have to meet competition.

Mr. Walter C. Fish, of the General Electric Co., discussed especially the labour equation in the electrical industry with reference to its effect upon foreign trade. He said:—

> A great many people think there is no nation so industrially efficient as we are, but I am sorry to say that is not so. There are portions of Europe fully as efficient as we are and paying one-half the wages. This brings to my mind the question of not only obtaining foreign trade but of subsequently retaining it. I haven't the slightest doubt that we are going to get more of it. Especially will we get foreign business where the per cent. of labour, so to speak, in the value of the product is comparatively small. Our start in increasing foreign business will be along such lines.

He advocates selling combinations among firms operating in the foreign field for the purpose of cutting down general expenses and likewise to prevent business houses from "needlessly knifing each other." Furthermore, he urges "playing up to the coming generation" by establishing trade schools and apprentice systems. He protests, however, that the industry cannot afford the restriction of output which is to-day manifest in many directions, supposedly due to the influence of labour leaders, &c. "Our costs in this country," concluded Mr. Fish, "must be as low as possible—and fair at the same time—if we are to have any show whatever where labour constitutes an appreciable part of the value of the product to be exported. I am familiar with the costs in many European countries of articles quite similar to those which I chance personally to manufacture, and I tell you we cannot afford to go backward."

Several firms in the electrical field that have not, individually, any need for common selling agencies, have declared for them to the Trade Commission on the theory that such sales facilities abroad would aid the smaller concerns in the industry.

Combination with competitors to work out problems in connection with specifications is the need of the hour.

Mr. Everett Morss, president of the Simplex Wire and Cable Co., said:—"If we are going to make a real drive for export it might be necessary for us to make a combination in some way with a number of our competitors in order to work out the question of specifications. Practice in Europe is quite different from what it is here. We have in many instances got to change the point of view of the foreigners before they will take our goods and combination is necessary to educational work—to overcome prejudice."

If Mr. Morss were to study the "leading English electrical trade journals" he would find that making the market to meet the goods, instead of the goods to meet the market, had been one of the great failings for which expert observers have condemned British traders.

CONVERTIBLE COMBUSTION ENGINES.

(*Abstract of paper read by* Alan E. L. Chorlton, *before the* Institution of Mechanical Engineers.)

It is not the object of this paper to advance the claims of either the gas or the oil engine, but rather to direct attention to the possibilities of a convertible engine designed to use advantageously both gas and oil. In surveying the problem in general, one might at first sight say that the combustion engine most ready to work on differing fuels would be of the self-ignition type, with a cycle approximating to that of constant pressure, in which the heat of compression is always sufficient to ignite the incoming fuel, whether solid, liquid, or gaseous, and the only change necessary in going from liquid to solid would be in the fuel-injection device. In practice, however, owing to the difficulty with solid fuel injection, such a type would not prove workable, and even when the fuel is first gasified the results do not justify the complication. The problem is better met by trying to combine known types for gas and oil in which good results are obtained at the present.

In the normal engines for both gas and oil, the chief difference lies in the degree of compression. Thus the compression of a modern gas-engine using coal as its basis fuel may vary from 90 lb. per sq. in., when using coke-oven gas, to 150 lb. per sq. in. for producer gas (and even higher if waste gases are used from blast-furnaces, &c.). For the liquid fuel engine, using crude or residual oils, the compression pressure may exceed 500 lb. per sq. in., as in the case of a Diesel engine using tar-oil, but may be considerably less if the temperature of ignition is obtained by uncooled surfaces, or if auxiliary or pocket-firing is used.

As between 500 and 150 lb. there is a great gap, the tendency is for practical reasons to combine the lower compression oil-engine and the higher compression gas-engine, and thus deal with a smaller compression pressure range. The desirable characteristics of the convertible engine are:—Simplicity and reliability; economy should be high for each fuel; first cost as little as possible above that of the standard engine for each fuel; easy convertibility; as nearly as possible the same power developed for each fuel.

The consideration of the subject may be more clearly undertaken by dividing the types of engines in use into three groups, with further subdivisions, due to peculiarities of design:—

1. Engines of low compression and low power.
2. Engines of high compression and higher power.
3. Engines of medium compression and higher power.

Group 1.—As an example of the first group, we may take an ordinary motor-car engine, having a compression up to 90 lb. per sq. in., which, with slight modifications, will run on:—

(*a*) Petrol or benzole.
(*b*) Good paraffin with an exhaust-heated carburetter.
(*c*) Town gas.
(*d*) Producer-gas made from coal or waste combustible materials.

It is designed for and works best on petrol; fairly well, however, but not so economically, on town gas; it requires very good paraffin; and is not efficient at the low compression with producer-gas.

To go further and extend the range of fuels, to use a commoner paraffin or a good brand of crude oil, means must be provided whereby more heat is available for the ignition and combustion of the oil, and this can be conveniently done by the addition of an unjacketed portion to the cylinder end, when the engine becomes of the hot-bulb type. A change of parts for such an engine does not present any difficulties, and these can be readily made to give with any adjustments of compression necessary for the producer-gas the greater heat required for ignition and combustion of the oil. The gas fittings are provided with electric ignition, also suitable when petrol is used, whilst the paraffin and good crude oil would be self-ignited by the hot bulb.

Comparative commercial results obtained from an engine lately built with success to work on all usually available fuels, for small powers, are as follows:—

	Compression.	Maximum pressure.	M.E.P.	B.TH.U. per B.H.P.-hour.
Paraffin oil ...	55	210	58	14,500
Producer gas ...	90	230	65	12,000

Group 2.—This group is represented by the Diesel engine, with a compression of over 500 lb. per sq. in., when using tar oils (unless an ignition oil is used). As the maximum compression for gas (in the normally used type of engine) does not exceed 150 lb. per sq. in., it will be readily seen that there are considerable mechanical difficulties in building an engine in which both of these compressions can be obtained, with a reasonable amount of modification. Further, the Diesel engine has an expensive high-pressure air-pump, which is unnecessary for the ordinary type of gas engine.

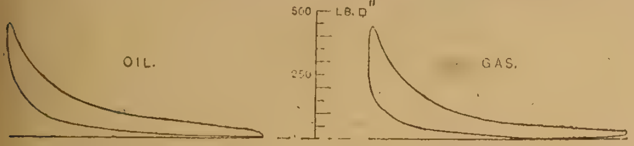


Fig. 1.—Engine Indicator Diagrams.

Apart from the mechanical difficulties, we may compare the commercial possibilities of this type, the oil and gas sides being as follows for engines of the same cylinder dimensions:—

	Compression.	Abnormal max. pressure.	M.E.P.	Approx. B.TH.U. per B.H.P.-hour.
Oil engine ...	500	Over 1,000	100-110 lb.	8,000
Gas engine ...	150	600	80 lb.	8,500

These figures show how incompatible the two designs are, for they illustrate that the Diesel structure must be built twice as strongly for the very high maximum possible pressure, due to the fuel valve sticking, &c. The higher M.E.P. used is some compensation for this extra cost and weight. The mean cylinder pressures reveal a still further disadvantage when the gas conversion is considered, for there is, besides this high first cost, a reduced power, owing to working at a lower M.E.P.—80 as against 100-110 lb. per sq. in. A convertible engine on these lines does not seem a commercial possibility.

Group 3.—Engines with a moderate compression suitable for developing higher powers. The range of the compression of these engines lies in between that of Groups 1 and 2, and usually is from 150 to 300 lb. The compression of 150 lb. is suitable for most forms of producer-gas, but it is not usually exceeded, for the reason that pre-ignition of the compressed charge is more prevalent in very high compression gas-engines. On the other hand, it is necessary for all compressions below self-ignition compression, as in the Diesel, to employ some auxiliary means to obtain the necessary height of temperature for the proper combustion of the residue oil. Normally, the additional heat is obtained by an unjacketed surface or combustion bulb at the cylinder end. For the lower compression, such as 150 lb., a satisfactorily running oil-engine is obtained; the economy, however, is not quite so high and the range of fuel not so fully extended.

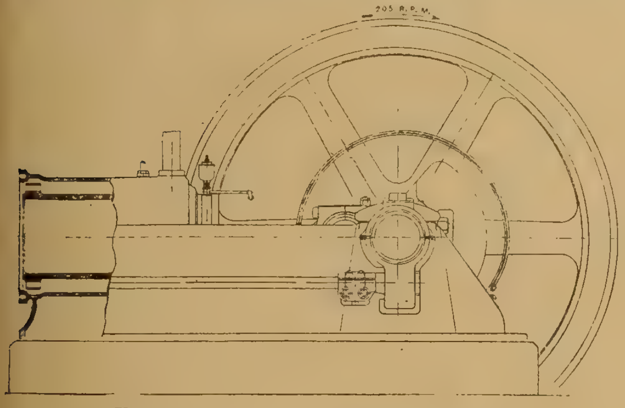


Fig. 2.—Ruston Convertible Engine.

The various devices employed in and around the question of temperature, compression, and convertibility of this group of engine, may be considered by subdividing it under the following heads:—

(*a*) Engines working with a compression not exceeding 150 lb. both for oil and gas, and which may employ pocket-firing with or without air-injection for one, and electrical ignition for the other, or some combination, the smaller compression not involving material mechanical change of the parts.

(*b*) Engines working with a higher compression for oil than gas, involving some modification of the combustion chamber by substitution of a part for oil as against a part for gas; otherwise maintaining the simplicity of both types.

(*c*) Engines obtaining the necessary change from gas to oil by temperature control of the air charge, together with alteration of the valve settings.

(*d*) Engines employing the super-compression of Dr. Dugald Clerk, to control effectively thereby the compression required for either fuel. (Final ignition temperature by other means.)

Under subdivision (*a*) there is a large number of engines which are used only for oil, but which might, without material alteration, become effective in the use of gas, although the whole combination is not as efficient as the highest individual member. As an instance of this division, there is the two-cycle Bolinder engine, at present only used for oil, although originally used by Day for gas. When made with a stepped piston, with uncooled cylinder-head replaced by a water-cooled one, a gas-engine for small powers is more or less effectively obtained.

For larger powers it is usual to separate the air and gas in the pump, and the engine becomes therefore not quite so simple a proposition to change over from the use of oil to the use of gas. In the four-cycle engine, the change from oil to gas involves an exchange of the unjacketed part of the combustion head for that of a gas type, with electrical ignition.

A variation of this type, employing air-injection for the fuel, combined with pocket-firing for the ignition of the charge, secures considerable economy when used with oil.

In considering division (*b*), a comparison of its possibilities for engines of the same cylinder dimensions is as follows:—

	Compression.	Abnormal max. pressure.	M.E.P.	B.TH.U. per B.H.P.-hour.
Oil engine ...	250/280	600	80	8,100
Gas engine ...	150	600	80	8,500

It will be seen that the outputs, &c., bear a great similarity.

Further, the diagrams actually taken with oil and gas are very similar (fig. 1).

The possibilities of this type of engine appear to be very great, and an engine of the kind, made in considerable numbers, is shown in figs. 2-4.

The only change involved in converting from oil to gas lies around the combustion bulb of the oil engine, in which the fuel oil is injected, and in the change from an oil-type to a gas-type piston.

Group (*c*).—The use of the arrangements grouped in this division may be said to be one of mechanical and constructional convenience, for they can hardly be defended on the score of efficiency. In one method the jacket of the cylinder cover or breech-end is formed to withstand a pressure, and is worked in the manner of a boiler. The increased heat is impressed in the charge of air during the compression stroke to raise the temperature sufficiently to afford ignition. This arrangement thus replaces the hot bulb or unjacketed end of the cylinder. It has some advantages, in that it is perhaps more controllable, and the steam generated may be used for some useful purpose, perhaps in conjunction with an exhaust-heated boiler for an auxiliary steam cylinder on the main engine. The water injection of some hot-bulb engines is also done away with. This type of engine is unusual in practice. When in use as a gas engine, such a convertible engine would have to dispense with the pressure-jacket temperature when using the lower compression and temperature needed for such an engine. The valve-setting of an engine may be modified to give suitable compressions for oil and gas; this can be worked in conjunction with the temperature arrangement just described.

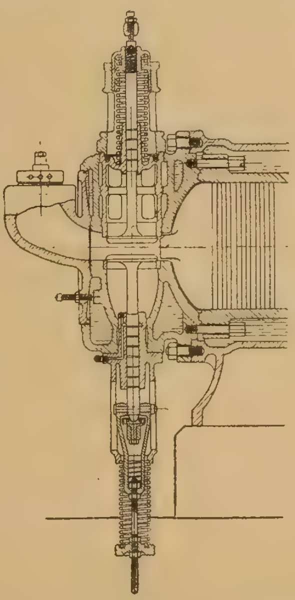


Fig. 3.—Arranged for Oil.

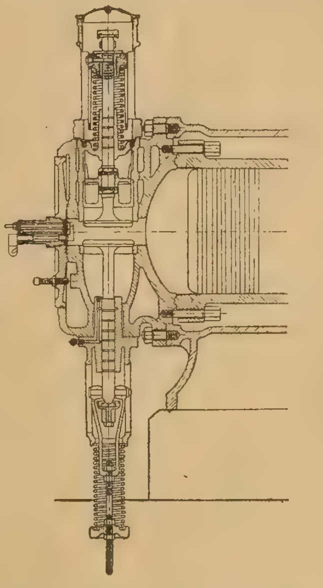


Fig. 4.—Arranged for Gas.

Group (*d*).—The Clerk super-compression engine is a much more suitable and promising type for dealing with the variable compression problem of the convertible engine. In this engine an extra charge of air or inert gas is added to the working mixture at the end of the suction-stroke. By this means, owing to the, so to speak, "watering" of the charge, much lower maximum flame temperatures are obtained and a higher mean cylinder pressure rendered possible. For the purpose of the convertible engine, it is mainly suitable, as by varying this amount of added air the compression can be adjusted between wide limits, the final tempera-

ture being controlled by any of the previously indicated means. For instance, with a compression of 300 lb. maximum, the full displacement of the air-pump may be used; for the lower compression of the gas-engine one can, by any suitable valvular means, such as an ordinary by-pass, reduce the amount of discharge as required.

The commercial value of this type has hardly been determined in practice, but it would almost appear that its possible usefulness will only come in for large engines.

The conclusion the author arrives at is that, for powers up to say 1,000 B.H.P., the type of engine represented by the "Ruston," Class B, is the most suitable as a convertible engine, whilst for still larger powers, when tandem engines and size and weight of removable parts become a problem, the Clerk super-compression type offers very interesting and hopeful possibilities.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Automatic Lift Accidents.

I was very much interested in the article by Mr. F. Broadbent under the heading of "Automatic Lift Accidents," also the correspondence which followed.

In Mr. G. Rosenbusch's letter, he mentions seven important requirements for an elevator. There is still one more in my mind, which is of very great importance, *i.e.*, that an appliance should be on the control board to prevent anyone taking the car away from the floor at which it has just stopped without giving the person inside the car time to open the door, which means that unless he presses the stop button, and then re-presses the floor he wants, he will be taken to that floor which the button is pressed from.

Only the other day I was in a push-button elevator with a gentleman friend, and we had landed at the middle floor, and he was just about to open the door, in fact, his hand was on the lock, when somebody at the top floor pressed the button, and started the elevator upwards.

I might mention that to open this lock one has to put his fingers in a small slot in the door, and it is quite possible that these can be caught; but, of course, there is a stop-button in the car. One may not think of this at the time, and perhaps if the hand was caught, he could not reach it, and a serious accident would possibly be the result.

There are many push-button lifts on this market which do not provide any safety in this respect, though I know of one or two which have special relays which make it impossible to move the lift after the button has once been pressed in the car, until the door has been opened and re-closed.

At the same time, the rule which has first consideration with many purchasers of an elevator is "What is the lowest price for which I can get an elevator?" without their taking into consideration what they are actually getting for their money, and as long as it goes up and down they seem satisfied.

In my opinion, an elevator that is not installed with regard to safety is dear at any price.

I trust this letter will not be too late. Unfortunately we are so far from the home country that we cannot enter into discussions on the different electrical subjects which are printed in your valued paper.

Harry E. Lintott.

Brisbane, *July 20th*, 1915.

American Trade.

Your correspondent "P.R." (Elec. Rev., July 30th) waxes sarcastic at my expense on American methods of conducting export business. However, as he places us in the same class with his own countrymen, I have no kick coming.

The point I was attempting to drive home was merely this: The exigencies of the business situation at present are such that the British manufacturers, apparently, are not able to supply their home commercial demands, while Americans, for the same reason, are suffering from a dearth of orders. From our point of view this situation, we think, cannot last for much more than a year, consequently, if we can help out our British cousins, the temporary relief would not be sufficient to go to any great expense, and hence the suggestion in my last letter. It is only a small matter for the British electrical engineer to study out, as the consumer would never know the difference.

America, that is, the U.S.A., is naturally selfish in its own interests, for our country is large enough to take care of its own products, and it is merely in cases of this kind, where the balance is so vastly upset, that we should try and adapt ourselves to circumstances while they last. Our export business, while apparently very strenuous on the surface, is really not much to boast of, as a casual perusal of some of our commerce reports will show. There is a vast array of figures and so-called facts, but, judging from a few inquiries among the trade, they don't seem to be thought much of. Many factories in this country object to any sort of export business. They consider it too much trouble to examine credits of prospective foreign customers, and, therefore, demand "cash with B.L." "P.R." points out the "take-it-or-leave-it" policy of the British manufacturers, and as a fairly extensive traveller I can vouch for the truth of it. The reason for this is that Britain's Colonies are so tremendous that they take, perhaps, 75 per cent. of her foreign exports. However, she is dealing with her sons or grandsons, who think "there is no place like home," and so are perfectly satisfied.

The reference to Germany is quite true and very *apropos*; she is, perhaps, the best "producing" nation, and she must have an outlet somewhere; consequently, her policy is "Get busy," no matter what the cost, nor how you do it, "get orders!"

E. W. Stevenson.

Brooklyn, U.S.A., *August 21st*, 1915.

"For Those in Peril on the Sea."

The further outrage on humanity in the sinking of the non-combatant liner *Arabic* is yet another reminder of the dangers to which our brave seamen are subjected. Since the declaration of the blockade by Germany, the crews, and, in many instances, the passengers also (including men, women and children), from no fewer than 42 ships have been received into the various Sailors' Homes and Institutes of the British and Foreign Sailors' Society. The rescued seamen have received food and shelter and medical attention at the hands of our missionaries, and in not a few cases an entire outfit of clothing has been provided. This work has been undertaken in our homes at Aberdeen, Barrow, Falmouth, Milford Haven (where the victims of the *Falaba* were received), Weymouth, Havre, Las Palmas, and Buenos Aires.

In addition to this practical ministry, the Society has distributed nearly 50,000 warm woollens to the men of the British Navy and mercantile marine, the mine-sweepers, lighthouse and lightship keepers, etc. At least two tons of bright, readable literature have also been dispatched. In view of the coming autumn and winter, may I venture to enlist the sympathy and practical support of your readers in this great work? In addition to funds, the Society would be very grateful for gifts of clothing—suits of clothes as well as underwear—woollen garments, magazines, books, games, etc., to be sent to our headquarters, The Sailors' Palace, Commercial Road, London, E.

Radstock,
President, B. and F. Sailors' Society.

The Sailors' Palace,
Commercial Road, London, E.
September, 1915.

Trade Entente after the War: The Other Side of the Question.

The writer of the "communicated" article in the Review under the heading "Trade Entente after the War," seems to have arrived at a number of conclusions in regard to the proposed action to be taken by the Allies in the commercial world after the war, and some of these are so extraordinary as to call for reply. He (the writer) appears to consider that a policy of masterly inactivity would be the most advisable one for the Allies to pursue. The present writer begs to disagree, and with all possible emphasis, and therefore he takes some of the statements concerned and will try to deal faithfully with them.

The first one to hand runs: "The purchase of the best goods in the cheapest market is the foundation of all successful trading. Any other system which, by imposing artificial restrictions, seeks to evade this unalterable fact, is certain to defeat its own end." That is to say, if the Allies adjust their tariffs, or introduce new tariffs, to restrict the entry of German goods into the Allied countries or their colonies, the arrangement would fail. The effect of German tariffs upon British goods is to exclude or penalise British goods, and what is sauce for goose is sauce for gander. "The purchase of the cheapest goods is the basis of trade": it is only one of the elements of successful modern business. Another element is to crush all competition and then make your own price, which is what the Germans will do with us if we do not alter. We must respect the laws of sound commercial trading, and let the German make his own.

Then our old friend, the Free Trade plank, turns up next, to wit, the argument of the special geographical or traditional or climatic advantages possessed by certain German products, in which we, the Allies, are lacking. We are told that we cannot hope to compete in toys. Well, our children will not be without toys this Christmas, in spite of the absence of the usual German article. We refuse to believe that British workers cannot make toys to compete in price or quality with the alien enemy once they are placed on equal footing as regards tariffs. The toy industry is instanced as a speciality of the Germans; on our side we have cotton in Lancashire, and South Wales steam coal, mentioned. He says: "The exports of cotton . . . . have maintained a steady level" (that is from Lancashire). In his book, "Fields, Factories and Workshops," Kropotkin says in Chapter I: "At the present time, *i.e.*, 1898, Germany remains tributary to Lancashire for the finest sorts of yarn only." Now the finest counts are necessarily the most expensive. So that the steady level mentioned is the level of value only, the quantity is greatly reduced from that of a few years ago; the Germans make the coarse counts and will gradually cease to buy even the fine ones. So much for the geographical advantage theory. We can make toys, and the Germans cotton goods, but we cannot sell our products in Germany if there is a tariff in Germany and none in this country.

Again, we are told that "in the electrical engineering sections the Germans have built up a colossal system of specialisation . . . the result being that British machine makers have been able to obtain certain machine parts from Germany cheaper and better made than from any other source. If these supplies are stopped . . . the British makers will either have to put in inferior parts, or pay extortionate prices." Quite so; the specialisation may be exemplified by the A.E.G., which makes electric trains, motor cars, tires, motors and dynamos, electric cables, colliery equipment, and so on; all the goods, in fact, which would be made by a dozen British firms of "specialists." The A.E.G. are thus enabled to specialise in selling all these goods in our markets at prices below our own cost prices. Some time ago the writer had occasion to work up some details in regard to a proposed agency in Germany for a British cable firm. The German goods were copied to the last stitch, and it was then found that their selling prices were 10 per cent. below our cost prices. And to our cost was to be added freight, duty, and profit. No one will be surprised to hear that we do not make a lot out of the German business. On the other hand, there are firms in London which sell German-made cable, but which figure as all-British cable firms. They have no cable works in this country. Again, we refuse to concern ourselves with any fear that British machine makers will be inconvenienced by the absence of any German-made parts or fittings, or that they will have to substitute inferior material. Rather will their own work be better in the absence of the cheaper German machines, which are protected in Germany by the "artificial restrictions" which the writer advises the Allies to avoid. When the Allied Governments give the lead, individual firms, and the various associations and business organisations will fill in the details, so that we can have a tariff or prohibition upon such articles as we can do without from Germany. We suppose that the construction of German tariffs was based upon the "sound economic principles governing the laws of fair and legitimate trading," and, if so, the same remedy will answer our purpose. Really, leaving the main issue for a moment, it is astounding to hear that the Huns are still entitled to "fair and legitimate" dealing; but perhaps the writer does not mean this.

Then the writer goes on to say that "the mutual interests of the Allies will be best served . . . not by artificial restrictions . . . but by improving and strengthening their own" commercial systems. This is rather a paradox, because the Allies can only improve their own lot by fighting the German with such "artificial restrictions" as they can command. For several decades the Germans have used their Zollverein union, their bankers' trade assistance and subsidies, in the war on British commerce. For the Allies to use the weapon of the tariff collectively and reciprocally against the common enemy would, we are asked to believe, be ineffectual. If that be true, it would be useful to have it explained in a little more detail. One thing it is certain a tariff would accomplish. It would close the doors of many offices in our towns and cities where hitherto Germans (naturalised and Anglicised, or not naturalised and unashamedly German) have hitherto been installed. Their mission has been to sell all sorts of German goods from electric cables to superheaters. The only rates they pay on account of their businesses are included in the office rent; their goods pay no toll to balance the rates and taxes of the native British factories, with whose products they compete. Even a beneficent Government gave them a vote in the affairs of the British Empire, so that they could support Free (and legitimate) Trade for the Fatherland in Britain and some of her Colonies.

Frankly, we do not believe the writer when he says that to cut off communication with the commerce of Germany would be to mutilate the whole body commercial. At any rate, with one or two exceptions we have jogged along quite nicely for one year without their products, and are arranging to do without the remaining one or two articles by making them ourselves. To so continue without their services will do more for us than to restore business after the war to the *status quo*. To counsel returning to business as usual is to place a strong inducement to our Allies to follow the line of least resistance, and buy again from Germany. Let us take warning from Italy, and say from now "Hands off." If the Kaiser had been asked five years ago as to the possibility of the Allies joining against him, would he have admitted the likelihood of such a contingency? Well, it has occurred, and, on the same line of argument, it is also possible to take joint commercial action against him. It is not necessary to discuss the means or process of such action, or whether this or that set of men will or can do it; we must not allow Germany to get a new footing, and we must take action in the British Empire, even though the joint action of the Allies does not ensue.

No drivel about "cold dispassionate laws of commercial systems" will avail us to day or on the day that peace is declared. The Huns have respected no laws, written or unwritten, have allowed no claim on the part of nations under signed treaty, have granted no protection on the grounds of either age or sex, and suffered no consideration of any sort to turn them from their determined course. Their only "cold dispassionate" law has been that might is right. The world will not be safe until they are out of action in both the military and business sense, for their commercial morality is about on a par with their military traditions, and a trade entente will, therefore, be for the Allies in the nature of a measure of self-defence and a means of completing the task which we hope the Allied armies will duly accomplish in the not distant future.

Commercial.

Selling Organisation in the Electrical Industry after the War.

It may be interesting for your readers to be impressed with a few facts which have just been brought to my attention.

Although they apply to the Spanish market, their general consequences will bear also on all neutral markets, and indirectly on the Allied markets.

As you may happen to know, the position of the electric lamp industry in Spain was, up to a few weeks ago, almost the following :—

Spanish industry produces Spanish-made lamps at cheap prices, yet there was an opening for foreign industry in spite of the heavy import duties in Spain.

Since the entry of Italy into the war, German lamps have been almost entirely prevented from entering Spain. Now, however, I have definite information that German well-known brands are entering again in Spain from Switzerland, *where factories have been started under Swiss names and their products are allowed to pass through France as being Swiss goods.*

In such a way those so-called Swiss lamps are offered approximately 30 per cent. cheaper than any other lamps from the Allied countries.

It is a matter of urgency that the attention of the French Government should be drawn to the fact that some Swiss products are not purely Swiss, but conceal German origin. If we fail to stop such kind of competition during the war, what will happen after the war when, apparently, all German goods will be naturalised Swiss or Dutch? This question is of the highest importance, and steps should be taken in France to examine the position.

Incidentally, I wish to point out that the very low quotations adopted now by German manufacturers in the lamp business for their export goods show that, as has been told in different quarters, the German industry is working heavily on stock and making ready to overflood all neutral markets, and thence our own countries, after the war, if we do not effectively stop the leakage, not merely with certificates of origin, but by an absolute control of the producing industries and their ultimate nationality.

We should be really too simple if, after the terrible strain put on all the Allied countries, we were not intelligent enough to reap also the benefits of our sacrifices.

R. Steylaers.

London, E.C., *September 2nd*, 1915.

Advertising.

I should like to ask the firms who advertise in the ELECTRICAL REVIEW why it is they do not give the names of their representatives or agents in foreign countries. Here in the Argentine Republic it is often difficult to find out the representatives of a certain firm, and reference to English technical papers very seldom helps one. Small matters such as these all help to strengthen British interests, which now more than ever should be strengthened, so that we may be the better able to secure a large proportion of the orders that will surely follow the cessation of hostilities.

River Plate.

August 9th, 1915.

Australian Steel.—A correspondent has sent us a copy of the admirable souvenir of the opening of the new steel works of the Broken Hill Proprietary Co., Ltd., at Newcastle, N.S.W., the illustrations in which show that a very serious and promising effort is being made to establish the manufacture of steel in the Commonwealth, and to turn to advantage the company's valuable deposits of iron ore, which has an average richness of no less than 68 per cent. metallic iron—more than twice the content of our Cleveland ore. The plant is of the most modern description, and has been laid out with a view to facility for extension ; at present one blast furnace is at work, and supplies pig-iron which is converted into steel in open-hearth furnaces, after which the metal is rolled into rails or merchant sections on the spot. The existing equipment has a possible output of 120,000 tons of steel rails per annum, but the average imports of rails into Australia amount to 150,000 tons per annum, and the demand will probably increase enormously ; in 1913 the total imports of iron and steel were valued at 7½ millions sterling, so there is obviously ample scope for the new works. Electric power is provided by a number of 500-KW. D.C. generators and vertical high-speed engines, apparently of British make, but details are lacking on this point.

THE BRITISH ASSOCIATION.

The Manchester meeting of the British Association for the Advancement of Science opened on Tuesday evening with the delivery of the presidential address by Prof. Arthur Schuster, in the Free Trade Hall. The scene was vastly different from that depicted in an old print of the B.A. meeting in Manchester in June, 1842, when Lord Francis Egerton delivered his presidential address in the Friends' Meeting House in Mount Street—less than a stone's throw from the Free Trade Hall—to an audience composed, in part, at any rate, of estimable ladies in poke bonnets.

Since the British Association first met in Manchester, over 70 years ago, civilisation and science and industry have made rapid strides. The year 1842 was a year in which "people still talked of electric cables with bated breath," as one Manchester man has aptly described it; and certainly a casual glance backward brings instantaneously to mind innumerable discoveries of far-reaching importance and value which have been made since Manchester first entertained the British Association.

The Association met in Manchester in 1861 and in 1887, and the meeting in the latter year still holds the record in point of attendance of members in this country, 3,838 persons being present. Under happier circumstances, the present meeting would probably have been not one whit less successful, judged from the standpoint of numbers; and the Manchester that is accustomed to big things was fully determined, when the invitation to visit the city was extended to the Association two or three years ago, to make the 85th meeting of that august body a record. As it is, the attendance of members is round about 1,200 or 1,300; and although the number is small by comparison with that of previous years, the officials are perfectly satisfied, having regard to all the circumstances.

Prof. A. Schuster, the President, is, of course, no stranger to Manchester. His father was once in business in the city, and he himself was at one time a student, and later an honorary demonstrator at Owen's College—now the Victoria University of Manchester. In 1881 he was appointed to the newly-founded chair of Applied Mathematics at the University, and in 1888 became Professor of Physics and Director of the Physical Laboratory, holding the office until 1907.

The various Sections are meeting in the theatres of the University, in the Dover Street High School close at hand, and at the Municipal School of Technology, which is a good distance away in the centre of the city. The Engineering Section (G) is holding its meetings in the Engineering Department of the University. The programme of papers arranged for submission covers a wide field, but practically the whole of the session on Thursday was to be devoted to Manchester municipal engineering undertakings, in which, of course, the electricity undertaking and the big Barton project hold prominent places.

Of wider interest, public speculation was mainly directed to the discussion on means for the promotion of industrial harmony in Section F (Economic Science) between representative gentlemen—employers, trade unionists, and economists. This subject is one of deep and vital importance to the country, to its commerce and its labour, and the liveliest interest was manifested in the subject, even before the discussion was entered upon. Any suggested means to hasten the time when sudden disturbance and shock to industry through lack of "industrial harmony" shall cease, merits, and will assuredly receive, the closest and most careful consideration.

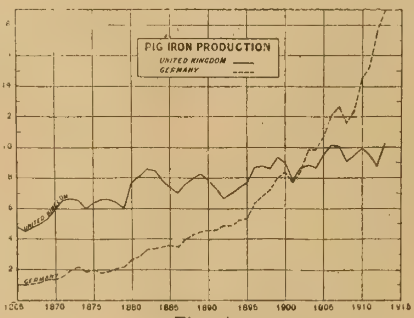


Fig. 1

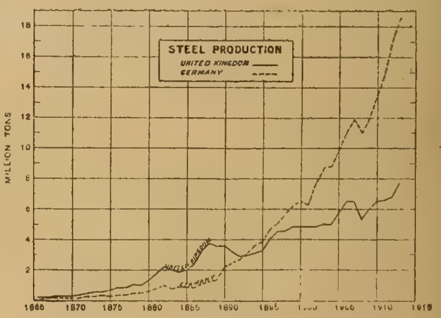


Fig. 3

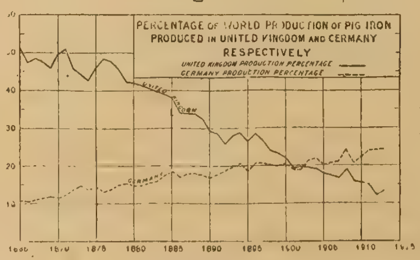


Fig. 2

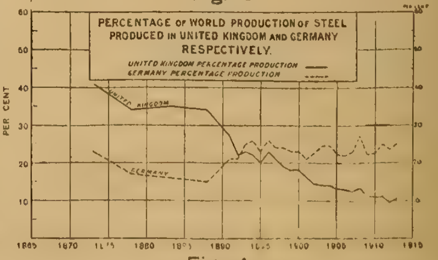


Fig. 4

Presidential Address to the Engineering Section,

by H. S. Hele-Shaw, F.R.S.

(Abstract.)

The time is not an ordinary one, for the war which a year ago cast its shadow over the meeting of the British Association in Australia has, as the months have passed by, gradually unfolded the most terrible page in the history of the world. It is terrible not merely because of the frightful slaughter which has taken place and which will yet take place, owing on one hand to the gigantic armies employed, and on the other to the nature of modern warfare. I do not know which will hereafter stand out in the blackest light—the callous disregard, by our enemy of the recognised laws which have governed warfare amongst civilised countries hitherto, or the fact, of which there is now abundant and overwhelming proof, that this country, while animated only by peaceful intentions, was itself the real object and ultimate aim for the destructive effort of our enemy.

Fortunately we now all know that our determination at any cost to ourselves to stand by our treaty obligation to a weaker country was really a fateful moment in the history of our Empire. Had we then failed, such failure would have spelt our own doom.

We are told by soldiers that practically any applications of science constitute legitimate warfare, and that the only way to escape from destruction ourselves is to employ all the resources of science in our own defence. It is on these grounds that the meeting of the British Association for the Advancement of Science has been held this year, because science is proving such an all-important factor in the present war.

The mere holding of this meeting, however, with a vague sort of idea that science is associated with war, does not meet the real needs of the case. Our failure in this war means the loss of what has been built up in so many centuries, and what we value above all other things, viz., our freedom, and that this loss would be accompanied by atrocities and degradation beyond the most savage happenings of the past. It behoves us all, then, who are members of it to show that the British Association, which has rendered such great services to the country in the past, can bear its share of the burden to-day.

It remains to consider the best way in which such a work can be carried out. I suggest that we continue the three Research Committees already in existence, but do not institute a fresh one, forming instead a special committee, the purpose of which I propose to lay before you. Before doing this, I should like to point out that the very fact that engineering constitutes such an important feature of the war has prevented our having, as often in times past, papers on military and naval subjects, such as warships, armour, projectiles, etc. Hence, the 24 papers before the Section deal with engineering science generally; they are of a high scientific quality, and quite as important in character as those of former years, and in several cases they touch closely on subjects bearing on the war, such as those on wireless telegraphy and traction.

The object of the proposed committee is two-fold. The first of these would be to undertake any work which may be of use in an advisory capacity or by research, or, indeed, in any other way for direct assistance in the war. One step will be to place ourselves at the service of the Ministry of Munitions for such work.

With regard to the second purpose, the matter stands on a rather different footing. We were in many respects quite unprepared for the war on which we have entered, and though this offers one of the most powerful arguments in refutation of the charge that we deliberately entered the war for sinister purposes, it will be very disastrous if we repeat our unpreparedness when the war ceases, and we shall deserve the worst that can happen to us. When peace is concluded, it will only be a prelude to another war, and a war which will recommence with far greater energy on the part of our enemy than before—viz., the war of commerce—and the latter will be almost as serious for us as the more sanguinary one. This will be so even if we are victors, for "after a long war the difficulties of the victors are often greater than those of the conquered. The conquered have their attention directed to the reparation of losses and are inspired by a patriotic desire to submit to losses for the sake of their country. The victors are in the frame of mind which expects everything to be easy."

Remembering how swiftly we relapsed into national ease at the end of the Boer war, it behoves every man who can do so to take his share in making ready for the terrific struggle Germany is certain to put up in the arts and manufactures. We shall better appreciate what this competition will mean if we consider the marvellous progress made by Germany during the last half-century in the arts and manufactures. Although we cannot say that this is absolutely measured by progress in the production of iron and steel, or even say that the corresponding rate of increase in production during that period by this country directly measures our progress relatively to Germany, still it does afford some indication in the case of the engineering industry. The four diagrams, figs. 1, 2, 3, and 4, represent annual production in ordinates and the corresponding years by abscissæ, the production of the United Kingdom being shown throughout in full lines and that of Germany by dotted lines. Taking first fig. 1, we have the actual production of pig iron for the last 50 years, and we can see at a glance the much more rapid rate of comparative production in Germany in recent years. When we come to the percentage relatively to the world's production, we see that while Germany is steadily rising, even in comparison with the whole world output, the production of the United Kingdom is falling at an even more rapid rate than that of Germany is rising; for, whereas 50 years ago it was more than half the production of the whole world, it is now only 13 per cent., whereas Germany's percentage, which 50 years ago was only 10 per cent., has now risen to 25 per cent. of the whole world production.

Figs. 3 and 4 tell the same tale, except that the relative production in steel of this country is now only 10 per cent., Germany keeping for many years the satisfactory figure of a quarter of the whole world's production; and it is, of course, quite familiar matter that, as far as science and discovery go, Germany owes her growth in steel production largely to the discoveries in this country, although in the case of the Bessemer steel process, she evaded the payment of royalties in making use of the invention. We know that the same tale is to be told in many other industries, such, for instance, as the chemical industry, and we are now suffering severely from the want of the very dyes which were invented by one of our own countrymen.

I cannot help recalling the astonishment with which I found in South Africa that, when there was a huge scheme of electrification effected, the enormous amount of material which Germany supplied was for what the public mostly believed to be a purely British enterprise. I also have reason to know that the supply of machinery to New South Wales from Krupp in some cases exceeded by as much as ten times in amount the quantity supplied by British firms. The prices were no higher, in spite of the 5 per cent. advantage to this country. The delivery of the goods was on the one hand sometimes inordinately delayed, though scrupulously punctual in delivery on the other.

Now, when we look closely into the causes of Germany's great advance, we can learn lessons which we have been culpably slow to take to heart. Although there are other causes, first and foremost, and overshadowing all others, is the determined and whole-hearted organisation of German industry. I see it recently stated that the scheme above referred to (the Victoria Falls scheme) was lost to this country because the industrial banks of Germany backed their own manufacturers, and this is no doubt partly true. Germany's power in war is admitted to be her mechanical organisation, and the organisation of every material and engineering force to that end. Just as striking, if not more so, is her organisation for the arts of peace, and I lately heard a very shrewd man of affairs express his amazement at Germany's entrance into war, when by peacefully pursuing the way she was going she would have dominated the world commercially in a few years' time, and, in the words of the speaker, might in many manufactures have made us practically bankrupt. It is undoubtedly in the matter of scientific organisation even more than the organisation of science that Germany has achieved such wonderful results, and it is, therefore, in this direction that we must leave no stone unturned if we wish to have any chance of holding our own in the future.

(To be continued.)

LEGAL.

Manchester Munitions Prosecution.

The Record Electrical Co., Ltd., of Broadheath, near Manchester, summoned at the Manchester Munitions Tribunal, on Wednesday, September 1st, before Mr. P. W. Atkin, Arthur Mantle, of Sale, Cheshire, for leaving work without giving notice, contrary to Sec. 4, Sub-sec. 5, of the Act. The firm's representative said that the company were sub-contractors to other electrical engineering firms, and were indirectly engaged solely on Government war contracts. He admitted, however, that they were not a controlled establishment, but submitted that for all practical purposes the Act applied to their workshops. The complaint against the employé was that on August 27th he suddenly threw up his work without giving notice, his complaint being that the firm refused to pay him the standard rate of 39s. per week, plus war bonus. The reason (continued the firm's spokesman) they declined to do this was because the defendant was only 19 years of age, and he was only entitled to (approximately) 20s. per week. The firm, however, were paying him a good deal more than that, but still he was not satisfied. In the first instance the youth obtained work at their establishment by making a false statement as to his age; he said he was 22, but he was found to be three years younger, by the Union representatives. The action of the defendant had stopped the completion of an important contract for Scotland.

The Chairman said he was afraid the complainants had no jurisdiction, as their place was not a controlled establishment.

The firm's representative replied that a communication had just been received from the Ministry of Munitions ordering them to supply a weekly list of the goods manufactured. It had also been intimated that war badges would be supplied in the course of a few days. To all intents and purposes they were a controlled establishment. He further pointed out that the defendant had not abided by the rules of the Electrical Trades Union, which clearly specified that all complaints should be made through them, and that no stoppage of work should ensue.

Replying to the Chairman, the Defendant said he would not resume work except at the full rates.

The Chairman said that, in view of such a stubborn attitude, the young man would have to "play" for six weeks, and he hoped the firm would not give him a certificate to go elsewhere. Employers in the electrical engineering trades required men of more amenable disposition to work for them.

The case was dismissed on the technical ground that the Court had no jurisdiction.

A Case before the Munitions Tribunal at Blackburn.

At the first sitting of the Munitions Tribunal for Blackburn and District, on September 2nd, Messrs. Dick, Kerr & Co., electrical engineers, Preston, alleged that a workman, Ernest Wilkinson, fitter, of Burnley, had left his employment without permission. Wilkinson said he left Preston because he could not afford to stay there any longer. During the last six weeks he was with the firm he only worked ordinary time. The chairman announced that the case would have to be adjourned, as the firm desired to obtain further information for the Ministry of Munitions. The case was accordingly adjourned.

WAR ITEMS.

Rathenau Optimist and the Turning of the Tables.—We see that Doctor Walther Rathenau has again been delivering an extraordinary speech at an extraordinary meeting of the Allgemeine Electricitäts Gesellschaft. The news comes by telegram *viâ* Amsterdam through the medium of Reuter. Some other remarkable utterances of this gentleman were recorded in the Electrical Review for January 1st, 1915. Really we suppose his remarks would have little concern for us here were it not for the fact that he made them at a meeting of a company which in normal times manufactures chiefly electrical engineering requirements. Now he is, of course, turning out unprecedented quantities of war materials, and is anxious to see the new War Loan of his Hunnish Fatherland a brilliant success. We observe that his company has taken £500,000 of the said loan. That he and his company have had past anxieties regarding raw materials, and that the blockade has really affected his operations, we can well believe, but let his observations in the course of a "highly optimistic speech" speak for themselves:—

"Our anxiety concerning raw materials has completely gone. The blockade no longer affects us. On the contrary, the tables have been completely turned.

"The country which declared a blockade against Germany, hoping to exhaust us industrially and kill us economically, suffers most heavily from its own blockade, while we, in spite of the blockade, are able to continue our immense work, producing unprecedented quantities of war materials.

"We see that Great Britain works hard to raise means for footing bills amounting to thousands of millions, while we who are now used to domestic economy have escaped economic embarrassment, and once more foster the hope that brilliant subscriptions to the new war loan will confirm our independence abroad."

No doubt in due course further references to the speech will come to us through our ordinary channels. Can it be that Walther Rathenau, too, is blinded concerning the small effect of the blockade upon the inhabitants of these islands? The "turning of the tables" will be another interesting operation when the A.E.G., finding its occupation as munition-maker gone, tries to recover its lost export electrical trade. We venture to predict that it will have little assistance from the British Empire, and probably about as much from the Allies when it revives its efforts in that connection. German diplomacy may raise all sorts of confusing issues, but Teutonic traders will not be able to obscure their country's record of systematic barbarism, and they will not be able to wipe out of the recollection of buyers the revelations of trading trickeries that probably nothing but this war would have made before the eyes of the whole world. Let us hear Doctor Walther Rathenau's views on this matter. Even our American friends in their investigations of the South American market have found out the ways of the German banks in disclosing American prices and other secrets for the benefit of German firms. These mean and deceitful practices are referred to on another page of this issue.

Disgruntled Technicists. — The "Higher Technicists" who have been appointed to posts as temporary assistants under the German War Office have expressed some dissatisfaction in the matter of the pay and the uniform accorded to them. The "Higher Technicists" are Herren with college degrees in engineering, chemistry, and so forth. Their services are presumably required in connection with the manufacture of poison gas, baby-slaying explosives, flame-projectors, well-defiling materials, and other contrivances for the propagation of Kultur, and they do not consider that they are either paid or dressed in accordance with their high calling. The Ministry of War has now decided that engineers with university degrees, who are not liable to military service but who are employed by the War Office, are entitled to be treated by the military authorities with the same consideration, and shall wear the same uniform, as qualified civilian medical men in similar employment. But the War Office declines to pay to qualified engineers and architects who are liable to military duty, but who are employed by the Government in their professional capacities, the same salary as is paid to medical men, dentists, and other professional practitioners. The dissatisfied architects and engineers are invited to consider that in being allowed to practice their profession they already enjoy a great advantage over large numbers of educated Germans who are serving as private soldiers. Moreover, while it is comparatively easy for an army to make use of medical men in positions corresponding with their professional dignity, it is not so easy to find similar employment for engineers. —*Ironmonger*.

The Leipzig Fair.—A Reuter dispatch from Amsterdam, quoting the *Vossische Zeitung*, says that at the annual meeting of the Central Committee of Manufacturers concerned in the Leipzig Fair, the President, Councillor Rosenthal, said:—"Attempts by England and France to fight the Leipzig Fair must not be treated lightly. England and France will start their fairs with a State subsidy. Therefore, it is evident that the Leipzig Fair is no longer a matter for Leipzig alone. It is a national question. All interested parties should co-operate with the Empire in maintaining the high standard which the Leipzig Fair has kept up to now."

American Westinghouse Orders.—The *Financier* states that while the American Westinghouse Electric Co.'s biggest war order is for 1,800,000 rifles, its order for shells is an exceedingly important item to the company. The first shell order was for $4,500,000, but the amount has now grown far beyond the expectations of the company when that order was booked. At the rate at which these shells are being handled a profit is estimated of approximately $500,000 a month. "At that rate the present dividend of 4 per cent. on the common stock would be earned about every three months. . . . Westinghouse's rifle manufacturing capacity has been increased to about 6,000 rifles a day by acquisition of the Meriden Arms plant. Apart from the additional capacity this plant gives, is the fact that it offers a supplementary factory on which the company may fall back in case of emergency."

The County Company.—We have already referred to the *Staff War Bulletin* issued by the County of London Electric Supply Co., Ltd., and the splendid way in which the staff and employés are rendering assistance with the Forces. We now learn that the Government have recognised the company as a public service company. In addition to its public utility services, the company is supplying electrical energy for power purposes to a very large number of munition factories and workshops.

The Riots on the Rand.—In connection with the recent anti-German riots on the Rand several firms have commenced actions at law against the fire insurance companies. Amongst others, we note that the A.E.G. Co. are suing the London and Lancashire for £4,000, Alliance Assurance for £3,000, Liverpool and London and Globe for £4,000, Phœnix for £4,000, Roval for £7,000, and Northern for £3,000; also Orenstein, Arthur Koppel & Co. are suing the Union Assurance for £696, the Central for £1,374, the Liverpool and London and Globe for £2,945, and Lloyds for £2,262.

Australia and Enemy Goods.—The *Times* Sydney correspondent states that at the opening of the New South Wales Chamber of Commerce's Exhibition of Manufactures of Enemy Countries and of the Allies, on 1st inst., the Governor, Sir Gerald Strickland, said that though 3 or 4 per cent. more might be paid for articles made by the Allies, it would mean an increase of 30 or 40 per cent, in national security.

BUSINESS NOTES.

Private Arrangements. — William Frederick Lee, electrical engineer, 262, Conway Street, Birkenhead.—The creditors interested herein were called together on August 30th, at the office of Messrs. Moore & Son, solicitors, Birkenhead, when a statement of affairs was presented showing liabilities amounting to £97, and net assets £25, the estate disclosing a deficiency of £72. It was reported that the debtor had been in business for six years, and commenced with a capital of £200, borrowed from his wife. The present position was due to loss on contracts owing to the war, and increase in the price of materials. Debtor was unable to say how much he had drawn out of the business, but thought that it would average between £3 and £4 per week. No accounts had been kept to show how the receipts had been spent. It was decided that the debtor should execute a letter of authority, and that the estate should be realised and the proceeds distributed *pro rata*, the debtor to make a contribution of 5s. a week out of his wages until such time as 5s. in the £ could be procured for the creditors. The following are creditors:—

Drake & Gorham, Ltd., Liverpool	£20
Simplex Conduits, Ltd., Birmingham	11
Bromell Patents Co., Ltd., Liverpool	11
Metallic Seamless Tube Co., Ltd., Birmingham	10
Turner, F. J., Birkenhead	11
Handley, William, Birkenhead	14

Liquidations.—SEEAR, SCOTT & CO., LTD.—This company is winding up voluntarily, with Mr. J. Scott, 17, Lismore Road, Croydon, as liquidator. A meeting of creditors is called for September 15th, at 16-17, Devonshire Square, London.

BRITISH ELECTRIC AUTOMATIC MACHINES, LTD.—A meeting of creditors is called for September 22nd, at 1, Broad Street Place, E.C.

G. STRAUS & CO., LTD., 211, Upper Thames Street, London, E.C., electrical engineers.—Pursuant to Sec. 188 of the Companies' (Consolidation) Act, a meeting of the creditors of the above was called for Monday last, at 13, Gray's Inn Square, W.C. The shareholders of the company had previously passed a resolution for the voluntary liquidation of the concern, and had appointed Mr. W. J. Colquhoun, the secretary, to act as liquidator. The company was registered in October, 1895, with a nominal capital of £2,000, divided into shares of the face value of £1 each. In all 1,880 shares had been issued, of which 1,370 were issued for cash. The remaining 510 were issued for a consideration other than cash, and were allotted to Mr. G. Straus in payment of the assets of the business which he had formerly carried on, and which he transferred to the company. In June, 1900, debentures for £500 were authorised, and in the following year debentures for £150 were issued. The assets of the company are more than sufficient to discharge the liabilities, and the claims of all the English creditors have been paid in full. The calling of a creditors' meeting is merely a formal matter, necessitated by the decision to wind up the company, and the voluntary liquidation will be continued by the liquidator appointed by the shareholders.

Stoker Contracts.—The following is a list of some of the important orders for stokers recently received by the UNDERFEED STOKER CO.:—

Corporation of Sheffield electricity station, Neepsend (this makes a total of 28 stokers sold to the Sheffield Corporation), 16 E; Borough of Wigan electricity station, 8 E; Borough of Wolverhampton electricity station (for burning low grade fuel from gas works), 2 A; Borough of Leigh electricity station, 1 E; Corporation of Bury electricity station, 1 E; National Electric Supply Co., Preston, 6 D; South Lancashire Tramways, 1 E; Royal Aircraft Factory, Farnborough (from the War Office), 12 B 5; Lorient Arsenal, France (this is a French Government Arsenal solely engaged on munition work), 4 A; Delaunay Belleville's Works, France (engaged on French Government war work), 4 A; Midland Railway-Carriage and Wagon Co., 2 E; North-British Rubber Co., 6 B 5; Synthetic Products Co., Ltd., 4 B 5; Société Electro Quimica de Flix, 1 E; Central Catalana de Electricidad, Barcelona (these stokers are supplied to enable them to increase the supply of power for war material), 5 A; Société Havraise d'Energie Electric, Havre, 3 A (this concern is largely engaged on French Government purposes), 8 A.

Annual Outing.—Saturday last was the day chosen for the sixth annual outing of the employés of the BRIMSDOWN LAMP WORKS, LTD. It was spent with much enjoyment amidst the old-world surroundings of Rye House, in Hertfordshire. After luncheon the toast of the King and Royal Family (proposed by Mr. C. Rice, managing director), was responded to with great enthusiasm, amidst the singing of the National Anthem. Mr. H. C. Sharrar then proposed the toast of the Brimsdown Lamp Works, Ltd., and its managing director. Mr. C. Rice, in replying, reminded those present how necessary it was that in these abnormal times they should all work together. Many difficulties had arisen, but, after all, what were difficulties created for but to be overcome? Many who were with them on the occasion of the last outing were now serving in His Majesty's Forces. He hoped, however, that they would return safely and would be able to join them on the occasion of their next outing. After luncheon a cricket match was played, Ladies *v.* Gentlemen, the gentlemen bowling and fielding left-handed and batting with sticks. The rest of the afternoon was spent in divers ways, some of the party boating, others visiting the places of interest in the neighbourhood. After tea, the evening was occupied by a concert and dance which was held in the Retainers' Hall.

"Hands Across the Sea."—An Australian correspondent writing in July says:—"Your paper comes as a link with the old country and my many friends there."

Bankruptcy Proceedings.—G. J. T. J. Parfitt, consulting electrical engineer, Keynsham.—Last day for receipt of proofs for dividend, September 18th. Trustee, C. H. King, 26, Baldwin Street, Bristol.

Arthur Faraday Hawdon, electrical engineer, Yetholme, Elmfield Gardens, Gosforth, Northumberland.—The first meeting of creditors was held last week at the office of the Official Receiver, 30, Mosley Street, Newcastle-on-Tyne. The Official Receiver reported that the receiving order was made on the petition of a creditor, the Act of Bankruptcy being that the debtor had failed to comply with the requirements of a bankruptcy notice. The debtor's statement of affairs showed liabilities ranking at £543, and assets estimated to produce £50. The failure was attributed by the debtor to the liquidation of a company of which he was managing director. The debtor said that he was unable to put forward any offer of a composition and would consent to adjudication. It was, therefore, resolved that the debtor should be adjudicated bankrupt, and that the Official Receiver should remain trustee.

Brazil.—The Rio de Janeiro French Chamber of Commerce has addressed a letter to all Chambers of Commerce in France, stating that it is prepared to act as a bureau of information for French exporting firms in South America The letter points out that the Chamber has had ocular experience of the means whereby German exporters have achieved their great successes in the industrial and commercial field. They are three:—(1) The organisation of their service of information; (2) their banking organisation, permitting of the allowance of long credits; and (3) their incomparable pliability and power of adaptation to the exigencies of their trade. To fill the first-named deficiency in French trading methods, the Chamber offers its services to French exporting firms.—*La Lumière Electrique.*

Catalogues and Lists.—Messrs. Cookson & Co., 25, New Oxford Street, London, W.C.—Revised price leaflet of accessories for the accumulator trade (i.r. corks and collars, glass vents, and hydrometers).

Bastian Electric Heating Syndicate, Ltd., 185, Wardour Street, London, W.—Illustrated catalogue of 32 pages containing particulars and prices of Bastian glowers, metal bus-bars, various types of heaters, ovens, the Pyrostove, electric geyser, flatirons, &c. The prices are now subject to a uniform trade discount instead of the varying rate previously obtaining. The alteration dates from September 14th.

Messrs. Belling & Co, Edmonton, N.—Illustrated folder giving descriptions, illustrations and prices of various patterns of Belling electric fires. The folder is described as a "temporary leaflet" for the 1915-16 season, and it has a space left for the imprint of the contractor or tradesman circulating it.

Messrs. Musgrave & Co., Ltd., St. Ann's Ironworks, Belfast.—Postal card giving prices and other particulars of their slow-combustion stoves and air-warmers for workshop heating.

Trade Announcements.—Messrs. W. & R. Jacobs have removed from King William Street (where they have been established for eight years) to larger premises at 94, Leonard Street, Finsbury, where offices and works are under one roof.

Messrs. Bergtheil & Young, Ltd., have changed the name of the company to Berkeley & Young, Ltd. The company has been in existence in the City of London for 23 years.

Book Notices.—"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIV, No. 8. August, 1915. New York: The Institute. Price $1.

"*Proceedings* of the American Society of Civil Engineers." Vol. XLI. No. 6. August, 1915. The Society. $8 per annum.

"The Wireless Telegraphist's Pocket-Book." By J. A. Fleming. London: The Wireless Press. Price 6s. net.

"The Standard Handbook for Electrical Engineers." London: Hill Publishing Co., Ltd. Price 21s. net.

Patent Application.—Messrs. Heenan & Froude, Ltd., and H. N. Leash have applied for the restoration of Patent No. 16,237 of 1910, and Patent of Addition No. 29,638 of 1910, granted to H. N. Leash for "Improvements in charging doors for furnaces."

Meters Approved.—The Board of Trade has approved of the Murday recording voltmeter, types M.R. 1 and M.R. 2, deposited in August last by Messrs. Evershed & Vignoles, for use in testing stations for testing electrical pressure when supplied on the constant pressure C.C. and A.C. systems respectively.

For Sale.—Messrs. Edwards, Son & Bigwood will sell by auction, on September 21st to 24th, the goodwill, patents, &c., and stock-in-trade of the British Prometheus Co., Ltd., in liquidation, also electrical appliance manufacturers' plant, machinery and tools, including a gas engine and 66-kw., one-phase, A.C. generator, Particulars are given in our advertisement pages,

LIGHTING and POWER NOTES.

Aberdeen.—The accounts of the Corporation electricity department for the year show that the sale of current realised £56,740, as compared with £56,809, and the hire of motors £3,326, as against £2 889. On the expenditure side the generation of electricity cost £16,029, as compared with £17,711 last year; distribution costs were £1,226, as against £874. The revenue and expenditure account amounted to £60,231, a balance of £32,222 having been carried to the net revenue account. The quantity of electricity generated amounted to 12,475,920 B.T. units, this being a record and exceeding last year's quantity by 781,925 units.

Accrington.—In view of the desire for economy the question of discontinuing the electricity showroom has been referred to a sub-Committee.

Amble.—Proposed E.L.—The U.D.C. has instructed the surveyor to prepare estimates for public lighting by electricity. The Council recently asked the Gas Co. to supply by meter, but it refused, and stated that it could only supply gas for public lighting at a lump sum of £200 a year. The Council, considering it was not justified in accepting these terms, has applied to the Broomhill Collieries, Ltd., for a supply of electricity, the Council being empowered to undertake the distribution of current for public and private purposes under Sec. 161 of the Public Health Act, 1875.

Argentina.—The new electric power station at Castelli (Province of Buenos Ayres) was inaugurated recently. The concessionaire is Senor Antinori.

The "Argentine Brighton" is threatened with darkness. In other words, Mar del Plata's electric light supply is likely to be cut off, like that of an ordinary citizen, and for the same usual reason, non-payment. The Municipal Commissioner has applied to the President of the "Club Mar del Plata" for help in this emergency; the amount owing by the community to the electric light company comes to about $124,000 m/n. In reply to an application of the local board for funds with which to purchase coal, instructions have been received for the company to suspend operations. To get over the difficulty the club is invited to assume an obligation of the municipality for the sum of $47,272 m/n, representing electric supply during the months June to December, 1913. Since 1913 the municipality has only paid $23,213 "on account," which amount corresponds to the supplies during January and February, 1914, and $32,868 m/n. during the current year.—*Review of the River Plate.*

Australia.—The South Brisbane City Council has under consideration an application for permission to supply the city with electric light and power.

A scheme has been submitted to the Minister of Public Works for New South Wales for utilising the water supply system of Grafton and South Grafton in connection with a hydro-electric power scheme.

The Cottesloe (W.A.) Council proposes raising a loan of £11,000, a portion of which is to be expended in extending the electric light.—*Tenders.*

Bacup.—Street Lighting.—The Electricity and Tramways Committee has decided to accede to a request of the Lighting Committee that double-time switches should be installed on alternate lamps in Todmorden Road. The electric lighting of Todmorden Road is now practically completed.

Blackpool.—Hospital Supply.—The T.C. has read a letter from Lord Derby relating to the provision of electrical massage treatment at the large Convalescent Hospital at South Shore. He said the necessary appliances would cost about £500, whilst the working expenses would reach from £3,000 to £4,000 a year additional to the amount that the War Office was spending on the hospital. The Council decided to defray the cost of equipment, and to supply electric current for the treatment free of charge.

Bolton.—Coal Siding.—The Electricity Committee has instructed the electrical engineer to arrange with the L. & Y. Railway Co. for the construction of a coal siding from the railway to the new electricity works at Back-o'-th'-Bank.

Bury.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the Corporation of £7,225 for additional equipment at the Chamber Hall electricity generating station.

Canada.—The American Consul at Fort William, Ontario, in a recent report, states:—It is reported that the water power of the Nipigon River, on the north shore of Lake Superior, is one of the largest of the undeveloped accessible water powers in Canada. Of the total descent nearly 175 ft. could probably be utilised. The Hydro-electric Commission of Ontario reports as to the power available at the different localities along the river, as follows:—Cameron Rapids, 19,500 H.P.; Splitrock, 7,500 H.P.; Island Portage, 4,750 H.P.; White Chute, 6,000 H.P.; Victoria Rapids, 5,000 H.P.; Camp Minor Rapids, 3,500 H.P.; Virgin Falls, 12,500 H.P.; Flatrock, 19,000 H.P. The report further states that Lake Nipigon could be converted into an excellent storage basin rendering it possible to increase the rate of flow above the minimum figures given in the report of the commission. Power plants at Cameron Pool and Virgin Falls would be about 85 miles from Port Arthur,

Connah's Quay.—Prov. Order.—The U.D.C. has been granted a prov. order for E.L., but it cannot be proceeded with until after the termination of the war.

Denny.—Proposed Price Increase.—At a recent meeting of the T.C. a letter was submitted from the Scottish Central Electric Power Co., intimating an increase in rates for electrical energy. It was decided to point out that the Council had a contract, under which rates were fixed for a period of 15 years, and that it declined to agree to the increase.

Dewsbury.—Annual Accounts.—Figures relating to the electricity department for the year ending March 31st last show receipts amounting to £14,950, as against £13,875 during the preceding year, whilst the expenditure was £7,439, against £7,077 a year ago. After deducting payments to the depreciation and renewal fund account, &c., there was a balance of £1,819, of which £1,347 is carried forward to next year. The number of units sold during the year was 1,949,026, as against 1,733,137 during the preceding 12 months, including 449,171 for lighting purposes; 887,039 for power and heating; 552,854 for traction (Yorkshire Woollen District); and 59,962 for the National Electric Construction Co. The increase of, roundly, 200,000 units, is accounted for by the enlarged supply of energy to mills, workshops, &c., for power and heating purposes. Although the total units increased by 12·45 per cent., 181 tons of coal less than last year were used, the coal cost per unit being about the lowest in the country for a similar output and a record for the undertaking.

Eccles.—Price Increase.—The Public Lighting and Electricity Committee has resolved to increase the charges for the supply of energy as from October 1st next, by 10 per cent. for private and public lighting, and by 20 per cent. for general power, heating and cooking. The L.G.B. has refused the T.C.'s application for the raising of further loans for extensions to electricity mains, services, &c., for ordinary purposes.

Guildford.—Price Increase.—The local Electricity Supply Co. has intimated that the price of electricity will be increased by 10 per cent. for lighting and by 20 per cent. for heating, cooking and power, as from September 30th next.

Hoylandswaine.—Proposed E.L.—The U.D.C. has deferred consideration of the proposal of the Electrical Distribution of Yorkshire, Ltd., to apply to the B. of T. for a provisional order to provide electric lighting in the Council's district. It was stated that the charges would be on a sliding scale, from 1½d. per unit for street lighting to 5d. per unit for house lighting, with a maximum price of 7d.

India.—Electrical Pumping.—The success which is attending the electrical pumping experiments in the Amritsar district is attracting attention in Simla. The value for irrigation purposes of the water raised by this method affords, it is found, a very fair return upon the cost of installing and working the electrical pumping machinery, and, by the method adopted at Amritsar, not only can waterlogging and consequent malaria be reduced, but also canal irrigation can be extended, inasmuch as the water originally brought to the canals is made to do duty a number of times over, the result being that the amount of water taken from the canals for local irrigation can be reduced, leaving an increased supply of canal water for distribution to areas which could not otherwise have been supplied.—*Indian Engineering.*

Simla Extensions.—Owing to the large number of applications for electricity, the Simla Municipality is now extending the area of supply considerably. The work is well in hand, and bigger transformers are being installed in all the sub-stations in Simla, while at Chabba arrangements are being made for the erection of a new 500-K.V.A. alternator, which is expected to arrive shortly. The scheme includes the fitting up and supplying of energy at one rupee per lamp per month up to a maximum of five lamps, whether the consumer uses it by day or by night, and quite a large number of shopkeepers on The Mall are already availing themselves of it. —*Indian Engineering.*

Killorglin (Co. Kerry).—Mr. Thos. O'Donnell, M.P., is one of the promoters of the Killorglin Electric Light and Power Co., which has been registered with a nominal capital of £1,650 in £1 shares.

Middleton.—Year's Working.—The loss on the electricity undertaking for the past year is £429, which has been transferred to profit and loss account, increasing the debit balance to £2,244.

New Zealand.—The Lyttleton B.C. has approved of the principle of lighting the borough with electricity, and a poll of the ratepayers is to be taken on the proposal to carry out the scheme.

The Dominion Cement Co., of New Zealand, is installing a complete hydro-electric generating plant, with sub-station equipment. The power house at Wairua will contain two water-wheel-driven A.C. generators of 1,250 K.V.A., at 50 cycles, 500 R.P.M., 5,500 volts, and two D.C. generators of 30 KW., at 1,000 R.P.M., 230 volts; the pressure will be stepped up to 22,000 volts for transmission.

The Takapuna B.C. has received an application from the Tramway and Ferry Co. for a concession to supply the borough with electric light and power on terms to be arranged; the recently-appointed Electric Lighting Committee has been instructed to obtain full information, and report to the Council.

Devonport (N.Z.).—The Council has received an offer from the Electricity Supply Corporation (N.Z.), Ltd., to light the streets by electricity. The company would install 167 lamps of 100 C.P., 10 of 300 C.P., six of 1,000 C.P., and three of 2,000 C.P. The charges to the Council for lighting and maintenance would be approximately £813, as against £380 paid at present for gas. A discount of 3¾ per cent. is offered if 8,000 C.P. is taken as a first instalment. The matter has been referred to the Works Committee with instructions to select two areas in which demonstrations could be carried out by the gas and electricity companies over a period of three months. The Council has accepted the Electricity Supply Corporation's offer to supply electric power for operating the Council's stone-crushing plant.—*Tenders.*

Plymouth.—Year's Working.—The annual report of the Electricity and Street Lighting Committee shows that the Prince Rock works made a gross profit of £15,042, as against £15,529 in the previous year, which has been appropriated as follows:—Expenditure on mains, &c., £2,624; dividends and interest, £4,755; income-tax, £1,478; stock and mortgages redemption, £4,090; and repayment of loans, £1,441; leaving a net profit of £981, of which £442 has been placed to reserve fund and £539 applied in aid of the rates. In the preceding year the net profits amounted to £3,028; the reduction is accounted for by the large expenditure on mains out of revenue, the increased price of coal, and the heavier income-tax charges. At the Newport Street works the gross profit for the year has been £10,164, compared with £7,878, which has been appropriated as follows:—Dividends and interest, £4,071; stock and mortgages redemption, £4,766; income-tax, £11; and interest on deposits, £15; making total payments of £8,864, and leaving a net profit of £1,299, which has been transferred to reserve fund. In the preceding year the net profit was £46.

Rochdale.—Following a report by the borough electrical engineer as to the difficulty experienced in keeping men at the electricity works—many employés having left to make munitions—the E.L. Committee has decided to apply to the Minister of Munitions for recognition of the electricity works as being engaged on Government work.

Shipley.—At the last meeting of the U.D.C. attention was directed to a draft agreement submitted by the Bradford Corporation in regard to the supply of electricity to Dumb Mills, Frizinghall. It was pointed out that this agreement was the same as a previous one which the Council refused to sign, and, in view of this fact, the clerk was instructed to prepare a draft agreement for submission to the Corporation embodying the terms desired by the Council. It was stated that the Council would not give way in the slightest degree until it got from the Corporation what it demanded.

South Africa.—Proposed Loan Application.—A ratepayers' meeting was held at Cape Town, on August 18th, for the purpose of obtaining sanction to the loan of £75,000 for the extensions to the electric lighting plant. The following figures were given by the chairman of the Electric Lighting Committee as a justification for the proposed expenditure: number of consumers in 1913, 5,533; 1914, 7,176; seven months of 1915, 7,738, equal to an increase of 40 per cent. over 1913. The increase in 1915 would have been much larger, but for the suspension of the free-wiring facilities. The revenue in 1913 was £101,131, and in 1914, £116,330; the estimated revenue for 1915 was £124,868, which would in all probability be exceeded, as the returns for the period January to July showed an increase of 18 per cent. over the corresponding period of 1914; units sold 1913, 7,469,000; 1914, 9,349,000; for the first seven months of 1915 the units generated showed an increase of 22 per cent. over a similar period of last year. For the relief of rates in 1913 £4,680 was available, and in 1914 £10,471; for 1915 the net profit was estimated at £19,571, which on the basis of returns to date would be materially increased. The maximum load this year was nearly equal to the full capacity of the two 2,000-KW. turbines installed and was steadily going up, and they would also shortly have to meet a new demand for 800 KW. for Government requirements. The only stand-by plant was the old reciprocating plant of about 2,600-KW. capacity. Owing to the increasing demand it was necessary that the plant should be supplemented without delay. The distributing system in many parts of the city was also becoming overloaded and inadequate; it was estimated that the £75,000 would cover capital expenditure for the next two years. The resolution sanctioning the application for a loan was carried.

Pietermaritzburg.—The borough electrical engineer reports that the revenue from private lighting and power shows a substantial increase over that of last year, the number of new connections during the year being up to the average. The new turbine plant which has now been working for some 16 months has enabled the department to deal with a greatly increased demand, while at the same time effecting economies in the generating costs. On June 25th the number of units generated during the 24 hours was 10,400, an increase of 25 per cent. on the corresponding day of last year, when the output was 8,214 units. With the increasing demand the question of additional plant would shortly have to be considered. The steam alternators and stand-by boiler plant had been overhauled. The agreement with the railway department expires at the New Year, and it will be necessary for the Council to consider the conditions of its renewal.—*South African Mining Journal.*

South Wales.—Miners' Lamps.—According to the *Standard*, a portion of the South Wales coalfield has agreed to use electric lamps instead of Davy lamps, in order to minimise the risk; coal cutters who use them are offered 1d. per ton extra.

St. Annes.—Bulk Supply.—The D.C. has signed the agreement to provide Lytham with a bulk supply of electricity, but the L.G.B. has announced that it cannot sanction a loan for the purpose at present.

Stockport.—Plant Extension.—The electrical engineer having reported to the Electricity Committee that it would be some weeks before the new plant on order would be at work, two condensers are to be put down, at an approximate cost of £600, so that the output of the present plant can be increased.

Swansea.—Price Increase.—The borough electrical engineer reports that owing to the war, the extra cost of production for the year ending March next will be £4,420, viz., £2,000 for coal (40 per cent. increase), £752 for men on military service, £468 war bonus to employés, and £1,200 extra cost of material, &c. To meet this extra expenditure he recommends that the hours of maximum demand be increased in the winter quarter from 91 to 137, that the flat rate in connection with the maximum demand system be discontinued, that meter rent ranging from 2s. to 10s. per quarter be charged, that the minimum charge per service be 5s. for each summer quarter and 10s. for each winter quarter, and that the extra cost (£517) of carbons, globes, &c., be charged to public lighting. It was stated that these changes would provide an estimated increased revenue of £3,300, and that it would be the first time that Swansea had charged a meter rent. The report was adopted, and the question of a proposed showroom was referred to a Sub-Committee.

Trowbridge.—Overhead Lines.—Provided that underground cables are laid in the main streets of the town, the U.D.C. has decided to raise no objection to the Electric Supply Co. using overhead lines in the side streets and outlying districts, according to a plan to be prepared by the surveyor.

TRAMWAY and RAILWAY NOTES.

Accrington.—Tramworkers' Wages.—The Corporation has refused a request by the men's Union to pay all men in the tramway department at the rate of time and a half for time worked on Saturdays over and above their ordinary duty.

Burnley.—War Bonus.—An application for a war bonus of 3s. per week for local tramway workers has been referred to the General Purposes Committee of the Corporation; the Tramways Committee has refused an application from the shed labourers.

Continental.—Sicilian Railway Electrification.—A Milan syndicate has submitted to the Italian Government a scheme for the electrification of the light railways on the Island of Sicily, the total length of which is about 625 miles. According to the project, the necessary current would be taken from the generating station of the Societa Elettrica della Sicillie Orientale, and converted from three-phase to single-phase current at 50,000 volts at a large converting station to be established at Nicosia. Fourteen transformer and distributing stations would also be established along the railways, where the voltage would be transformed to a working pressure of 11,000 volts.

Dartford.—The Tramways Committee has reported that the Chief Commissioner of Police has issued summonses against the tramway manager for employing unlicensed conductors. The Chief Commissioner, the report explains, will not issue licences to persons under 21 years of age, and the clerk has been instructed to suggest to Messrs. Balfour, Beatty & Co., Ltd. (the tramway lessees), that unless the Chief Commissioner will relax the rule for the period of the war, they should lay the whole of the facts before the Minister of Munitions, and inform him that it will be impossible for them to provide proper facilities for conveying workmen to local works.

Glasgow.—Electric Vehicles.—The members who attended the Conference of sanitary inspectors in London reported to the T.C. that they had inspected various kinds of vehicles constructed for cleansing work, particularly electric vehicles for refuse collection, and were of opinion that there was a promising future for electric vehicles, particularly for the collection of refuse, &c., and considered that the development of this class of vehicle should be carefully watched.

Road Widening.—The B. of T. has been in communication with the Tramways Committee on the working of the single line of tramway at Spier's Bridge, Thornliebank, and has pointed out that while the Board can accept no responsibility for a line used without its sanction, it does not propose to take any further action in the matter at present, on the understanding that the Corporation will take the earliest opportunity to obtain Parliamentary powers to purchase the land necessary for the widening. The Committee has agreed to recommend the T.C. to include in the prov. order the necessary clauses suggested by the Board.

Bulk Supply.—Owing to the postponement of all extensions of plant and buildings at the electricity department the Tramways Committee, at the request of the Corporation electrical engineer, agreed to assist the electricity department during the coming and succeeding winters by supplying energy from the Pinkston power station to Port Dundas.

London.—L.C.C. Annual Accounts.—The year's working of the London County Council tramway undertaking—to which reference was made in our issue of April 30th last—resulted in a total income of £2,399,847 (£2,389,046 electric); working expenses amounted to £1,700,571 (£1,684,243 electric); and the surplus was £704,803 (electric); after meeting a deficiency of £5,526 on horse traction, a balance (gross profit) of £699,276 remained. As against this, debt charges, income-tax, Parliamentary expenses, &c., less certain deductions, totalled £732,448, leaving a net deficiency for the year of £33,173, which was met out of the general reserve fund.

By electric traction 58,706,161 car-miles were run, the total, including horse cars, being nearly 59 million car-miles; 547,253,332 passengers were carried by electric cars and 550,597,993 passengers in total. This compares with 522,952,600 passengers in the previous year and 512,652,700 in 1912-13. It is interesting to note that 41 per cent. of the total were 1d. fares and 29 per cent. ½d. fares.

The total revenue averaged 9·77d. per car-mile, as against 9·21d. in 1913-14; working expenses totalled 6·89d. (including war service allowances), as against 6·50d. in the previous year, when no such allowances were made, and included 1·02d. per car-mile for power expenses, exclusive of debt charges.

For power purposes, 143,393,600 units were generated at a total cost of ·396d. per unit (including ·31d. working expenses and ·086d. debt charges).

Sub-station and distribution costs, including debt charges, amounted to ·195d. per unit, the energy dealt with including, in addition to the above, nearly 14 million purchased A.C. units (costing ·577d. per unit); there were also purchased 325,396 D.C. units at ·854d. per unit—the total units generated and purchased amounting to 157,680,899.

The units used for traction, including transmission and conversion losses, totalled 152,666,477, at an average cost of ·615d. per unit, the balance being used for car and repair shed and for auxiliary plant. The L.C.C. tramway system extends over practically 150 miles of streets, and includes 5·7 miles horse traction, 121 miles of conduit, and 20·28 miles of overhead trolley electric route; 2·79 miles of overhead route were, in addition, worked by the Metropolitan Electric Tramways, Ltd.; 1,767 cars were in use, including 16 trailer, 3 petrol-electric and 37 horse cars.

During the year one of the reciprocating sets at the Greenwich generating station was replaced by the first new 8,000-kw. turbo-generator, some of the switchgear was reconstructed and additional safety devices were introduced. The work was generally carried out without interference with the supply of power, but unfortunately on December 11th, 1914, a transformer, which exploded, caused a serious fire and consequent interruption of the supply.

The improvement in the price of coal at the commencement of the year was not maintained, owing to the partial closing of the Firth of Forth, the restricted output, and also to the increased rates for freight and insurance. Large quantities of coal had to be purchased at enhanced prices outside the contracts.

The total amount charged against the capital account of the tramway undertaking to March 31st, 1915, in respect of street improvements was £714,351. The charge against revenue account for the year in respect of this capital was £35,940, an increase of approximately £5 000 over the charge of the previous year.

During the period under review sums amounting to £87,828 were paid to the local authorities in respect of rates levied on permanent way, an increase of £1,500 on the year 1913-14; the rates on the power station, car-sheds, &c., were, in addition, £40,207. The various road authorities through whose districts tramways operate have, it is estimated, effected a saving of at least £134,400 during the year by the Council paving and maintaining the tramway area.

In June, 1908, the Council decided that during a period of five years any balance remaining after providing for renewals should be carried to general reserve; this fund amounted to £196,223, and deducting the deficiency for the year, a balance remained of £163,050.

The renewals fund amounted to £543,859; £141,813 was spent during the year, leaving a balance of £402,045.

South Shields.—Year's Working.—For the year ended March 31st last, the Corporation tramways carried 10,479,421 passengers and ran 927,728 car-miles, increases of 474,257 passengers and 29,713 miles, respectively. The total revenue was £39,845, and the gross balance £14,335, leaving after meeting interest and sinking fund charges a net balance of £5,594. Compared with the previous year, the revenue was somewhat higher, but owing to a considerable increase in working expenses, the disposable net balance was about £1,500 less. The working of the Edison battery 'buses resulted in 156,203 passengers being carried and 22,197 car-miles being run, the receipts amounting to 6·55d. per c.m. Over 39,000 units were supplied for the 'bus service; and the total energy used for the cars, workshops, and 'buses, amounted to 1,220,313 units. The net balance on the year's working was appropriated as to £3,194 to reserve and £2,400 in aid of the rates. The total of the reserve fund now amounts to £28,838.

Manchester.—Tramway Accident.—On the night of the 3rd inst. a Corporation car overturned at the junction of Alexandria Road South and Wilbraham Road.

At a Board of Trade inquiry on Wednesday into the accident, evidence was given that the track and the car were in perfect condition, but that the place where the accident occurred was not illuminated as the Tramways Committee would wish; and Mr. McElroy, general manager, said that in his opinion the accident would never have happened if a lamp on the east side had been lit instead of one on the other side. Lieut.-Colonel Von Donop closed the inquiry.

The first women conductors in the city were put to work experimentally on Wednesday.

Mexborough and Swinton.—Railless Traction.—Last week the B of T. inspected the new railless traction routes of the Mexborough and Swinton Tramways Co., and a commencement was made with the carrying of passengers. There are two sections, from the junction of Swinton Road and High Street, Mexborough, to the Manvers Main Colliery, and from the Mexborough Toll Bar to Elm Green, Conisborough.

Reading.—After considering the tramway manager's report as to restricting the expenditure during the war, the Committee has decided to inform the Council that the cost of working the undertaking cannot be reduced if the present car services are maintained.

Rochdale.—Following the breakdown of the arrangement with the contractors for the work of erecting the new car-shed, the Corporation Finance Committee has decided to advance the necessary money to enable the shell of the extensions to be completed and covered in.

Salford.—Annual Accounts.—During the year ended March 31st the Corporation tramways ran 5,828,232 car-miles, some 400,000 miles less, and carried 54,343,908 passengers, or 1,219,362 more than in the previous year. The total income was £262,454, and the gross profit (after deducting working expenses and £6,226 war allowances) amounted to £85,706. The balance of the year's working, after meeting all the usual charges, was £32,264, as against £26,450 the previous year, and was appropriated as to £22,000 to the relief of rates, and £10,264 to the renewals fund. The total number of units used was 9,602,534; average total revenue per car-mile, 10·807d.; average working expenses, including energy cost per car-mile, 7·022d. The balance of the depreciation and renewals fund amounts to £27,573.

Stockport.—The Chairman of the Tramways Committee reported to his Committee that he had been informed that the Electricity Committee had decided to give notice that it might be necessary to curtail the supply of electricity for tramway purposes. He suggested that the Committee should draw the attention of the Electricity Committee to the fact "that the Tramways Committee are not customers but partners in the electricity works, both as a department of the Corporation and as owners of the plant therein in excess of the tramway requirements." The terms of the resolution were plainly put, "so that there may be no misapprehension as to the ownership," the Tramways Committee deciding that it would not, except by consent, accept any cutting down of the tramway service.

Warrington.—Motor-'Bus Service.—The Electricity and Tramways Committee has decided not to accede to requests that motor-'bus services should be inaugurated to Winwick and Thelwall, where military hospitals are situated.

The Corporation motor-'bus drivers are to receive a bonus of 1s. per week when they average six miles to the gallon, and an extra 1s. per week when the average is 6½ miles or over. The idea of the bonuses is to encourage the men to save petrol.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—October 25th. Six electrically-operated wharf capstans, for the Sydney Harbour Trust. Forms of tender from the Engineer-in-Chief, Harbour Trust Offices, Circular Quay.*

October 25th. For the Commonwealth Department of Defence (Navy Office). Supply, delivery and erection of power-station plant and equipment for the Commonwealth Naval Dockyard, Sydney.*

Hawthorn.—November 30th. Refuse destructor plant, for the Hawthorn-Malvern-Camberwell and Kew Destructor Trust. Specification from the Trust Engineer's Office, Town Hall.

Bristol.—September 24th. Unwashed small coal for six or twelve months, for the Corporation electricity works. Mr. H. F. Proctor, Chief Engineer and General Manager, Exchange, Corn Street (returnable deposit of £2 2s.).

Burnley.—September 20th. B. of G. Electrical goods. Tender forms from Mr. J. S. Horn, Clerk.

Castletown-Bere.—The District Council has called for tenders for the public lighting of the town by electricity for a term of 15 years.

Edinburgh.—October 4th. Corporation. Cast-iron intake shaft, pump shaft, &c., for obtaining sea-water for condensing in connection with the new electricity station at West Bank, Portobello. The Engineer, Dewar Place station, Edinburgh.

London.—Bow.—September 21st. Electrical goods for the managers of the Poplar and Stepney Sick Asylum District. Mr. S. G. Wright, Clerk, the Asylum, Devon's Road, Bow, E.

Kensington.—September 23rd. Six months' supply of electric lamps and fittings for the B. of G. of Kensington Parish. Tender forms from Mr. W. R. Stephens, Clerk, Guardians' Offices, Marloes Road, W.

Newport (Mon.).—Converter plant and transformers, for the Corporation. Mr. A. N. Moore, Borough Electrical Engineer, Town Hall.

New Zealand.—Dunedin.—November 3rd. City Council. Supply and delivery of insulated and bare copper wire in quantities for a period of two years. Specifications at Electrical Engineer's office, Market Street, Dunedin.—*New Zealand Shipping and Commerce.*

Reigate.—September 13th. T.C. Twelve months' supply of A.C. induction motor meters. See "Official Notices" September 3rd.

Shanghai.—September 24th. Municipal Council. One turbo-generator, 5,000 KW., and one or two of 10,000 KW., complete with condensing plant, &c. See "Official Notices" August 20th.

September 29th. E.H.T. switchgear, static transformers, and underground cables for 22,000 V., for the Municipal Council. See "Official Notices" August 27th.

Stanley.—General repair and upkeep of the electric bells in Newton Hill and Stanley Council New Schools. Mr. A. Angus, West Riding Education Office, Wakefield.

South Africa.—Johannesburg.—September 25th. For the T.C. Two turbo-alternator sets, condensing plant, switchgear, &c. Specification, &c., on deposit of £2 2s., from Mr. J. H. Dobson, General Manager.*

September 25th. Municipal Council. 1,595 electricity meters and 50 time switches.*

October 9th. Municipal Council. Water-purifying plant with a capacity of 75,000 gallons per 24 hours, for the generating station.*

Swindon.—September 18th. Corporation. Supply of steam coal. See "Official Notices" September 3rd.

Wakefield.—Coal for one year from October 9th, 1915, for Yorkshire (West Riding) Electric Tramways Co., Ltd., Belle Isle. Tenders to H. England, General Manager.

Warrington.—September 22nd. B. of G. Electrical goods ("none of German or Austrian origin") for six months ending March 31st, 1916. Tender forms from Mr. Arthur Bottomley, Clerk, Bewsey Chambers.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The following contracts have been placed:—

Victorian Railways.

Construction of sub-station at North Fitzroy.—Swanson Bros., £15,740.

Carbons.—Item 1, £7 8s per 1,000; item 2, £7 16s. 9d. per 1,000; item 3, £8 9s. 10d. per 1,000; item 4, £9 2s. 10d. per 1,000; item 5, £9 15s. 11d. per 1,000; item 6, £10 9s. per 1,000.—W. McLean & Co.

Two air-compressors, £335 each.—Belliss & Morcom, Ltd.

H.T. two-core concentric cable, per mile: 7/16, £207; 7/14, £261; 19/16, £340. L.T. two-core cable, per mile: 7/16, £147; 19/14, £386. Ditto three-core cable, per mile: 7/14, £261; 19/14, £531.—B.I. & Helsby Cables, Ltd.

Two motor-driven air-compressors with spare parts, for the Jolimont car shop; four ditto, including motors, for the Ballarat and Bendigo workshops, £3,462.—Belliss & Morcom, Ltd.

Hawthorn Tramways Trust.

Construction of the permanent-way for the electric tramway from Melbourne to Burwood, £55,065.—H. Teesdale Smith. The tender of the Trust's engineer to do the work by day labour exceeded the accepted tender by £6,000.

Sydney Harbour Trust.

Electric power wool-bale elevators and conveyors, Wooloomooloo Bay sheds.—Gibson, Battle & Co., Ltd.

Sydney City Council.

Two arcing ground suppressors complete, for 33,000-volt 50-cycle circuits, £1,510.—Aust. General Electric Co.

Bare copper cable: 7/16, 5,000 yd.; 7/14, 800,000 yd.; 19/16, 150,000 yd.; 19/14, 200,000 yd.; £18,050, subject to the metal market, as provided by agreement.—B.I. & Helsby Cables, Ltd.

For the supply of 33,000-volt cables (Specification No. 874) the following tenders were received:—

	Schedule A, with copper sheath.	Schedule B, without copper sheath.
Noyes Bros.	£18,300	£17,050
W. T. Henley's, Ltd.	18,771	16,809
Siemens Bros. & Co.	18,920	17,770
B.I. & Helsby Cables, Ltd.	19,125	17,941
Western Electric Co.	19,291	17,642
British General Electric Co... ..	20,560	—
Aust. General Electric Co.	21,668	18,900
Lawrence & Hanson	25,875	28,625
N. Guthridge, Ltd.	38,259	35,169

The tender of Messrs. Noyes Bros. (Schedule B), at £17,050, was recommended for acceptance.

MELBOURNE CITY COUNCIL.

Cast-iron service and cut-out boxes.—Commonwealth Cast & Malleable Iron Works.
One turbine-driven boiler feed pump, £467.—H. Perks.
Four three-phase transformers, £612.—Johnson & Phillips.
Condenser fuses.—McIlwraith & Co.
Insulators.—Commonwealth Art Pottery & Insulator Co.

COMMONWEALTH P.M.G.'s DEPARTMENT.

Two generators at £343 18s. each, and two transformers, £105 each, for the radio-telegraph stations at Townsville and Woodlark Island.—G. Weymouth & Co. Pty.

VICTORIAN STATE COAL MINE.

H.D. copper wire, 7/18, £17 17s. 6d. per mile.—B.I. & Helsby Cables, Ltd.

—*Tenders*.

Dartford.—In view of the advice of the Board of Trade, the T C. Electricity Committee has decided to store 1,000 tons of coal, and recommends the acceptance of the following tenders :—

J. Waddell & Sons, Ltd.—500 tons Yorkshire Main, 24s. 6d. per ton.
Myers, Rose & Co., Ltd.—500 tons Yorkshire nutty slack, 21s. 9d. per ton; 500 tons Notts Mansfield slack, 20s. 9d. per ton.

The firms will be asked if they are willing to extend the contract for six months.

Glasgow.—The Clyde Navigation Trustees have accepted the offer of Messrs. Johnson & Phillips, Ltd., for the supply of cables for the capstans in connection with the electric crane being erected at Queen's Dock. The Tramways Committee recommends for acceptance the offer of the British Westinghouse Co. for a supply of motor armature coils.

Liverpool.—The T.C. has accepted the tender of Messrs. Spurrier, Glazebrook & Co., Ltd., for lubricating oils for the Electricity Supply Department for a period of seven months.

Middleton.—The Electricity Committee has accepted the tender of Mr. J. Hulbert for six months' supply of coal to the electricity works.

Salford.—The Corporation has sealed an agreement with Mr. Bertram Thomas for the supply of switchgear required for a rotary converter at the works of the Broughton Copper Co.

Stockport.—The following tenders have been accepted by the Electricity Committee :—

Iron stanchion for new boiler installation.—H. Parkes & Nephew, £27.
New I.P. cylinder for No. 4 engine.—Belliss & Morcom, Ltd, £95, less 10 per cent.

The Tramways Committee has accepted the following :—

One ton of mild-steel fishbolts and nuts.—Hadfield's Steel Foundry, Ltd, £21 10s.
20 gallons shellac varnish.—J. C. Arnfield & Co.
Wheels and axles —John Baker & Co. (Rotherham), Ltd.
Gold leaf.—Coe Ribbon Gold Leaf Manufacturing Co.
Turned bolts for axle-caps.—British Thomson-Houston Co., Ltd.

FORTHCOMING EVENTS.

Association of Engineers-in-Charge.—Wednesday, September 15th. At 7.30 p.m. At St. Bride's Institute, E.C. Annual meeting.

Institution of Mining Engineers.—Wednesday, September 15th. At 2.30 p.m. At Hotel Métropole, King Street, Leeds. Annual general meeting.

Institute of Metals.—Friday, September 17th. At 8.30 p.m. At the Chemical Society's rooms, Burlington House, W. Annual general meeting.

NOTES.

Fatalities.—The circumstances surrounding the death of George Fernie, an apprentice electrician, were inquired into by Sheriff Armour Hannay and a jury at Kirkcaldy. Deceased was found dead in the workshop at the power station at Kinglassie Colliery, belonging to the Fife Coal Co. Fernie, who was only 16 years of age, was found lying near where the cables are connected with the switchboard. Artificial respiration was attempted, without success. Deceased's father, a miner, stated that his son was employed at the power station at Kinglassie Colliery. On August 5th he went to work in his usual health. On hearing that his son had been killed witness went to the pit and found the men working the pulmotor in an attempt to bring the lad round, but it was in vain. He noticed only one mark on deceased's body—a thin burnt-like mark on the right thumb. John Gourlie, the colliery electrician, said Fernie was working under him. About 2.30 p.m. on August 5th he told Fernie to prepare for the extension of some lights. To do so he would have to go to the place where he had to extend the lights and repair any that were out. About 4.30 witness passed the turbine engine house, and on looking over to the workshop stair he saw Fernie lying on his back. His face was cold, but the pulmotor was tried. Witness was of opinion that the lad was dead when he first saw him. He had examined all the cables by feeling, and with an instrument, but found no defect. There was no leakage. Deceased was found practically under the medium power switchboard. He had no occasion to go there to carry out witness's instructions. Witness did not think the lad could possibly have been killed by electric shock.

Dr. Adam R. Wight Leslie said he examined the body on the morning after the accident, and along with another doctor had carried out a post-mortem examination. They found all the organs perfectly healthy. There was nothing in the body to show the cause of death, but everything he found was quite compatible with death from an electric shock. From what he found, and learned, he was of opinion that the boy died from electric shock. There was nothing found otherwise to account for death. There was a mark of injury on the left thumb, but no other mark on the body or clothing. In answer to the Sheriff, witness stated that in the case of a person being killed by shock it was not necessary there should be any marks.

Hugh Gordon Fraser, chief electrical engineer of the Fife Coal Co., said he had made a thorough examination of the plant and cables and found them intact. Besides being properly insulated the cables were all thoroughly earthed. It was quite impossible for the lad to have been killed by shock in the place. The jury were absent 15 minutes, and on returning the foreman intimated that they found that the boy, George Fernie, died at the place and time stated, but they could not find evidence as to the cause of death.

Reuter, quoting the Havre correspondent of the *Petit Journal*, states that M. Canonne, inspector of works, and engineer attached to the Ministry of Industry and Works in Belgium, was killed as he was entering Belgium from Holland. M. Canonne had been in France, and was on his way back to take up his official duties again. He accidentally came into contact with a live electric wire, and was killed on the spot.

An inquest was held at Newcastle-on-Tyne on Monday night upon the body of Alfred J. A. M. Henry (56), who was killed at Elswick Works on Saturday, while following his employment as an electrician. The evidence showed that while climbing up some trellis work to an overhead crane deceased caught hold of a "live" wire. He shouted to his mates to switch off the current. He then had one hand on the wire, the other on the crane, and one foot on a shaft. When the current was turned off he relaxed his grip and fell on to a machine, fracturing his skull. A verdict of "Accidental death" was returned.

An inquest was held at Wednesbury, on Friday of last week, relative to the death of William John Maybury (57), of Walsall, who died on the previous day as the result of coming in contact with live electric wires at the works of the Patent Shaft and Axletree Co., Ltd., Wednesbury. Deceased was a crane driver, and was helping to unload axles from a truck. The crane was stopped to allow a locomotive to pass, and a few minutes afterwards Maybury was found lying on the top of a cabin, near to which the crane was being worked. Evidence was given to the effect that a notice was posted in the cabin stating that when the crane was not in use the switch must be pulled out. Deceased, it is supposed, must have gone to do some oiling and, forgetting the switch had been left in, touched the live wires, as his left hand had been burned. The electrical engineer of the works said there was no reason why a screen should not be placed above the cabin as an extra precaution. The jury returned a verdict of "Accidental death."

Foreign Trade.—FIGURES FOR AUGUST.—The following are the electrical and machinery figures given in the official returns for August :—

	Month of August. £	*Inc. or dec.* £	*Eight months, 1915.* £	*Inc. or dec.* £
IMPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	105,303	+ 67,852	658,759	− 322,683
Machinery	793,903	+ 485,604	6,067,803	+ 982,228
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	259,130	+ 113,447	2,008,179	− 196,138
Machinery ...	1,483,934	− 224,139	12,999,904	−11,482,612

Appointments Vacant. — Switchboard attendant (27s. 6d.) for Borough of Lancaster; engineer-in-charge, fitter driver, and pumping station attendant, for a military camp; chargeman for electric generating station; shift engineer (£2 2s.) for Swansea Harbour Trust; assistant mains superintendent (35s.) for Darlington electricity works. Particulars are given in our advertisement pages.

Educational.—In a circular to local education authorities and others, the Board of Education announces that the Regulations and Syllabuses which governed the Examinations in Science and Technology held in 1915 will continue in force for 1916; after 1916 it will no longer hold Lower General Examinations in any subjects of Science and Technology. The Higher General Examinations will for the present be continued.

Workmen's Compensation: Unusual Claim.—A novel claim under the Workmen's Compensation Act is reported to have been lodged with the Oldham Corporation. An employé of the Corporation died recently, and the grounds of the claim which has now been made in respect of his death are that death was caused by the shock received by the deceased through seeing a fellow workmate die while working alongside him in January last.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—

Company Orders.—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week ending September 18th, 1915 :—

Monday.—Drills, 6.30-7.30 ; 7.30-8.30. Section 1, Technical instruction ; Section 3, musketry at range ; Sections 2 and 4, Squad drill or signalling.

Friday.—Section 2, Technical instruction ; Section 4, musketry at range ; Sections 1 and 3, Squad drill or signalling.

Classes for signalling instruction are being formed, and the names of those desiring to take part should be handed to the Section Commanders.

The Corps will still be glad to welcome recruits. Although primarily appealing to members of the Engineering Institutions, others whose tastes lie in the direction of a technical training will find this Corps meet their views.

Applications for membership should be made to the Commandant, Lieut.-Col. C. B. Clay, V.D., Marconi House, Strand, W.C.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, September 9th, 1915 :—

Week-end Parades.—Saturday.—The Battalion will parade at Liverpool Street Station (low level entrance G.E.R.), at 1.50 p.m., and proceed by rail, for entrenching duties.

Sunday, 7 a.m., Réveillé ; 10 a.m., Church Parade ; 10.20 a.m., Battalion Parade (Bridging) ; 10.30 a.m., Sketching Class as usual ; 2·30 a.m., Battalion Parade (Bridging and Bombing).

Duties.—The special duty for which men were asked to volunteer, for Saturday next, the 11th inst., is cancelled.

Musketry.—There will be Firing at both Acton and Bisley Ranges on Saturday next, the 11th inst. Men who have sent in their names will parade at the usual times.

A. G. JOINER, *Major and Adjutant.*

The British Association.—Our special correspondent telegraphs that on Wednesday morning, in Section G, Prof. Hele-Shaw read his presidential address, after which Profs. Asakawa and Petavel read a paper on the thermal efficiency of a gas engine, and Prof. Thornton dealt with the total radiation from a gaseous explosion. In Section A (Mathematical), Prof. Soddy opened a discussion on radioactive elements and the periodic law. A crowded audience attended the discussion on industrial harmony, in Section F (Economics), which was opened by Prof. Kirkaldy ; other speakers were Sir Chas. Macara, Mr. Will Thorne, M.P., Sir Hugh Bell, and Mr. Evans. The discussion was resumed in the afternoon.

London — Birmingham — Liverpool Telephone Cable.—In consequence of the rapid growth of telephone traffic between London, Birmingham and Liverpool, the British Post Office is providing an underground telephone cable connecting the three cities. Stoneware multiway ducts, each way being of $3\frac{3}{8}$-in. internal diameter, have been laid to form the conduits. The cable is made up of copper conductors, paper insulated ; the individual wires are twisted in pairs, and two pairs are then twisted together to form a four-wire core in the style known as "multiple twin," and there are 52 pairs of wires in the cable, distributed as follows :—

Central core	...	2	pairs, each wire	300 lb. per mile.
First layer	...	14	" " "	200 " "
Second layer		12	" " "	150 " "
		24	" " "	100 " "

The whole is enclosed in a lead sheath of an average overall diameter of 2·9 in.

One telephone circuit is obtained on each pair, and one additional circuit per two pairs may be formed by "Superposed" or "Phantom" circuit working.

The cable and loading scheme were designed by the engineers of the Post Office, and the section London to Birmingham, 110½ miles in length, has been manufactured, laid and jointed by the Western Electric Co., Ltd., North Woolwich. It has been carefully balanced during manufacture, and in the jointing processes, so as to make the electrical constants of the circuits such that the minimum of inductive disturbance takes place between one loop and another, whether "physical" or "phantom."

The section Birmingham to Liverpool, 90 miles in length, is being similarly treated by other contractors, namely, the British Insulated and Helsby Cables, Ltd., but is not quite ready for use.

Loading coils have been inserted in each circuit at 2½-mile intervals along the route, the iron cases containing the coils being accommodated in underground brick chambers. All the loading coils are of the Western Electric Co.'s type.

The estimated attenuation constants per mile and those actually obtained after completion of the London—Birmingham length are given below :—

Weight of single wire per mile forming loops.	* Attenuation constant per mile, 800 p.p.s.	
	Estimated.	Observed.
300 lb.	·00480	·00408
200 "	·00684	·00664
150 "	·00875	·00884
100 "	·01161	·01074

(* The logarithmic decrement in the telephonic current strength per mile).

The results on the superposed (phantom) circuits are equally satisfactory and the attenuation constants of such circuits are somewhat less than those of the physical loops from which they are formed.

On Wednesday last, by the courtesy of Sir William Slingo, Engineer-in-Chief of the Post Office, and his staff, we were privileged to take part in a test of the speaking qualities of the new cable, and found that conversation between London and Birmingham direct over any loop in the cable was excellent ; no inductive disturbance from other loops in use could be detected.

Various lengths of loop were formed by doubling to and fro between London and Birmingham, thus :—

(*a*) London to Birmingham and back on two 300-lb. loops, equal to 221 route-miles, or, roughly, equivalent to a London-Liverpool length. The speech was very loud and distinct.

(*b*) The same route length as in (*a*), but using 200-lb. loops. The speech was still very clear.

(*c*) London to Birmingham and back on four 200-lb. loops, equal to 442 route-miles or, roughly, equivalent to a London-Glasgow length. The speech was still very good.

(*d*) The same loops as used in (*c*), but with the addition in series of two 300-lb. loops between London and Birmingham, making in all 663 route miles or, roughly, a London—Aberdeen length. Speech was not at all difficult, and was within what might be regarded as the commercial limit.

(*e*) The same loops as used in (*d*), but further extended by two 200-lb. loops between London and Birmingham, making in all 884 route miles. In this case speech was just possible, but could not be regarded as within the commercial limit.

Similar trials made on the phantom circuits give equally satisfactory results as regards speech transmission, and although during the trials there were 21 trunk circuits working in the cable, there was no observable interference from other physical or phantom circuits.

One novelty in the cable is the provision of the heavy (300-lb.) conductor loaded loops, the heaviest loaded conductors previously laid underground anywhere being slightly under 200 lb. per mile. The excellent results obtained reflect the greatest credit upon the engineering staff of the Post Office and the contractors.

Although equally good, or better, results may be obtained by using lines wholly overhead, it does not yet appear that equally good results can be obtained when the same route lengths are made up partly of overhead and partly of underground wires ; the line must be as far as possible homogeneous.

We believe that the results obtained constitute an absolutely new record in underground cable telephony, and demonstrate the technical possibility of conducting conversation by this means between any two points within the limits of the United Kingdom—although, of course, it is not suggested that it would be commercially practicable to provide for such communication. The close agreement between the calculated and observed characteristics of the line is particularly gratifying, indicating, as it does, that the engineers responsible for the design of the cable had completely mastered the difficult technical problems which surround the use of loaded underground cables for telephonic purposes.

Institution and Lecture Notes.—Institute of Marine Engineers.—The following are the further arrangements of this Institute for the coming session. All of the meetings are on Tuesdays, at 7 p.m. :—

October 5th.—"Engineering Prospects in Russia," by Mr. Jas. Anderson.
November 2nd.—"Development of Mechanical Ventilation, Hygienically, Aboveground, Underground and Underdeck," by Mr. James Keith.
December 7th.—"Stern Shaft Lubrication," by Mr. A. J. Lebeda.
January 11th, 1916.—"Power-driven Tools on Board Ship," by Mr. J. Hamilton Thomson.

Post Office War Bonus.—The war bonus conceded to Post Office workers will be paid from this week. The terms of the concession were :—3s. to men earning 40s. a week and under ; 2s. to men receiving more than 40s., but less than 62s. per week ; and women were awarded half of these amounts in each grade.

The Lighting of Factories and Workshops.—The first report of the Home Office Departmental Committee on lighting in factories and workshops has just been issued, the Committee feeling that although the investigation is incomplete, and cannot be completed under the conditions prevailing at present, it is desirable to make available to the public the work already done, and to formulate certain recommendations regarding suitable standards of illumination. The report contains an immense amount of detailed information, and the subject is discussed at considerable length. The conclusions of the Committee in brief are that statutory standards of "adequate and suitable illumination" should be set up, and the standards suggested are a minimum illumination on a horizontal plane at the floor level of 0·25 foot-candle in workrooms, 0·4 foot-candle in foundries, 0·1 foot-candle in passages, and 0·05 foot-candle in open spaces out of doors. These recommendations are subject to certain qualifications and exemptions, and are, of course, only provisional ; they will serve, however, to indicate approximately the standards that will eventually be adopted, and will thus be of assistance to works managers, who will also find the mass of data contained in the voluminous appendices of the greatest value. In later issues we shall review this very important document at greater length than is possible at the moment.

Radium Spring Discoveries.—The *Financier* reports that the strongest radium mineral spring in the world has been discovered at Oberschlema, Saxony, and that bath-houses are to be erected there for treatment of the wounded. Simultaneously with this report, news arrives that the company owning the radium baths at Joachimsthal, in Bohemia, is bankrupt.

It is reported that in Colorado mineral springs have been discovered containing radium in such large quantities that a gramme of the metal will in future cost only £7,200 instead of £32,000.

Machinery Maintenance in China.—The Acting British Consul at Wuhu reporting on the foreign machinery used in that city, remarks that the Chinese seem to expect that their machinery will run at full load during an indefinite number of years without other care than occasional oiling, and that the economy of a maintenance and refit charge does not apparently appeal to the Chinese mind. The policy of getting quick and large returns without making allowances for the inevitably following exhaustion is unfair to manufacturers, for machinery is unjustly blamed when the fault really resides in the Chinese lack of business method. He, therefore, suggests that it would pay U.K. manufacturers to allow long credits with a proviso that the supplier of the machinery should have the right to send a competent engineer to inspect it every two or three years. The purchaser would have to pay for the services of the expert, but that could be arranged for in the contract price. In this way British machinery would have a better chance of showing its worth.—*Board of Trade Journal.*

Copper.—European visible supplies, as shown by Messrs. H. R. Merton & Co.'s statistical circular, were 999 tons less at the end of August than at the end of July last. English supplies, however, were only 31 tons less, and French 20 tons higher. In detailed supplies, European arrivals from North America were low at 16,070 tons, while Spain and Portugal supplied England and France with a quantity of 126 tons less than the pre-war average. "Other countries" sent England and France a quantity 10 per cent. higher than in pre-war times. Chile shipments were rather below pre-war average, Australian above. Total supplies, though higher than last month, are considerably below last March, April or May (months when the "blockade" might be expected to be vigorous) while deliveries, higher than the last two months, reflect the general activity.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. C. E. Crocker, manager and attorney for the Kalgoorlie, West Australia, Power and Lighting Corporation, has been appointed manager of the Perth (West Australia) City Council's electricity, lighting and gas departments.—*Tenders.*

General.—The following announcement appeared in the *London Gazette* on September 3rd :—

War Office.—Regular Forces: General Staff. General Staff Officer—2nd Grade—Major Walter A. J. O'Meara, C.M.G., Reserve of Officers. Dated August 19th, 1915.

Private Jas. Chandler, of the 2nd Sportsman's Battalion, who was on the staff of Siemens Dynamo Works, Ltd., at Stafford, has been gazetted Lieutenant in the battalion.

On September 1st the marriage took place at St. Barnabas Church, York, of Sapper F. E. Powell, of the Royal Engineers, who was on the electrical staff of the North-Eastern Railway Co., and Miss Annie Croft, of York. The bridegroom is leaving for the Front.

We are informed that Mr. W. J. Polyblank is not now connected with the Magneta Time Co., Ltd.

The marriage took place, at the Parish Church, Gillingham (Kent), on August 28th, of Mr. Henry Knight, eldest son of Mr. C. Knight, to Miss Hilda Emma Marriott, daughter of Mr. Chas. Wm. Marriott, of the electrical staff of H.M. Dockyard, Chatham.

The employés of Messrs. J. H. Tucker & Co., of Hay Mills, Birmingham, gathered together on Friday, the 3rd inst., to bid "Good-bye" and "Good luck" to Mr. J. B. Tucker, the son of the founder and present head of the firm, who has been granted a commission in the Royal Engineers, and who was leaving the next day to join his regiment. The meeting was held in the works during the tea interval, and was of a most cordial character—a tribute to the personal popularity of Mr. J. B. Tucker, and to the happy relations existing between the firm and the employés generally. From those representatives of the firm who were unavoidably prevented from being present, Mr. Tucker received during the meeting telegrams of congratulations and good wishes. Mr. R. H. Lamb, who has been with the firm some 15 years, presided, and said that they could not let Mr. J. B. Tucker go without some mark of their appreciation and esteem. A Committee had been hastily formed, and it was decided that, in addition to "Good wishes," Mr. Tucker should carry with him something that would be a constant reminder of those whom he was leaving. Mr. Bisby, who has been with the firm 20 years, on behalf of the employés in the works, then presented Mr. Tucker with a Webley and Scott service revolver. Miss Jeffries, who has been in the service of the firm some 14 years, on behalf of the office staff, presented a silver cigarette case, suitably inscribed, and Mr. Willmott, the oldest official of the company, having been with them upwards of 19 years, on behalf of the officials, asked Mr. Tucker's acceptance of a sword, sword knot and scabbard, suitably engraved as a record of the occasion. In acknowledging the gifts and the very warm welcome which greeted him as he rose, Mr. Tucker said that he always seemed to be receiving similar marks of their goodwill. He could only express his appreciation of their kindness and good wishes, and thank them very much. In response to calls for a speech from the head of the firm, Mr. J. H. Tucker, after referring to the fact that "It was really not his show that afternoon at all," joined with the meeting in wishing his son every success and a speedy and safe return. He referred in terms of appreciation to the men who had already gone from the works and were now serving their country, also to those in the works, who, though not in the same way, were equally serving their country and doing their duty. Whilst they honoured his son that afternoon none of the others were forgotten. Hearty cheers for the firm, for Mr. J. B. Tucker, and the singing of "For he's a jolly good fellow," brought the proceedings to a close.

Mr. William H. Taylor, A.M.I.E.E., electrical superintendent of tramways at Perth, has been appointed arbitrator to grant an award for the use of electricity in the Collie Coalmines.

The following members of the staff of the Cape Town city electrical department have enlisted in the South African Overseas contingent :—Messrs. Wallace and Smith, draughtsmen ; Messrs. Nixon and Roper, installation inspectors ; Messrs. Purcell and Mostert, meter readers ; Messrs. Driver, Van Niekerk, and Strusk, mains department ; Mr. Knox, clerk ; Mr. Desmond, battery attendant ; and Mr. Smith, fireman. This is a very good percentage out of a total of 32 white members of the staff.

Roll of Honour.—Private John Radcliffe, of the Royal Munster Regiment, who was on the Rochdale Corporation electricity staff, has been wounded in the foot at the Dardanelles, and is in hospital at Liverpool. He enlisted a year ago, and proceeded to the Dardanelles in July.

Corporal Wm. Henry Hedgcock, who was on the staff of the Isle of Thanet Tramway and E.L. Co., Ltd., has died of wounds received in action in the Dardanelles. Deceased, who lived at Ramsgate, was an old Army man, and was 48 years of age. He rejoined the Forces early in September, 1914, and attached to the Military Mounted Police was drafted to the Mediterranean in June. He died on August 20th.

Corporal J. Lomas, a Territorial employed at the Blackburn electricity works, has lost his life in the Dardanelles. He was going to the assistance of a comrade when shot down by a sniper.

Mr. John Scurr Leese, of the 6th Manchesters, formerly employed by the British Westinghouse Co., is reported missing at the Dardanelles.

Private J. J. O'Connor, of Ashton, formerly an electrician employed at the Delta Works, Guide Bridge, has been killed in action. He was 19 years of age, and was serving at the Dardanelles with the 1/9th Battalion Manchester Regiment.

Private R. B. Brown, of the 10th Rifle Brigade, an employé in the offices of the Peel-Conner Telephone Works, Salford, was killed by a sniper in France last week.

Private Robert Owen, of the 11th King's (Liverpool) Regiment, formerly employed at the Chloride Electrical Works, Clifton, near Manchester, has died from wounds received in the fighting in France. He was 20 years old.

Corporal John Barnes, of the 11th Auckland (N.Z) Mounted Rifles, formerly employed in the Middleton Corporation tramway department, has been killed in the fighting on the Gallipoli Peninsula. He was 34 years of age.

Private Albert Michael Mills, of the 5th Queen's Surrey Regiment, who was on the staff of the Guildford Electricity Supply Co., has died from fever in the Military Hospital, at Fyzabad, India.

Lieut. L. L. Rees Mogg, of the Royal Engineers, who was with Messrs. Willans & Robinson, Ltd., Rugby, has been killed in action.

Obituary.—Mr. F. H. W. Higgins.—On Saturday last there were laid to rest at Abney Park Cemetery the remains of Mr. Frederick Herbert William Higgins, M.I.E.E., chief engineer to the Exchange Telegraph Co., Ltd., who passed away at his residence at Stamford Hill, on September 1st, at the age of 66 years. Mr. Higgins commenced his career in the Post Office Telegraph Department, and after passing through the junior ranks was made Superintendent of Telegraphs in the island of Mauritius. After being there some years he returned home and entered the service of the Exchange Telegraph Co. in the year 1873, devoting his inventive genius henceforth to the development of type-printing telegraphs in the various forms now familiar to the public as "Tape" instruments. In this he was particularly successful, as besides perfecting various forms of "relays" he very largely increased the speed of the instruments. The original form of tape machine which was brought over from America was known by the name of its inventor, Mr. T. A. Edison, and when first worked in this country printed at the rate of six words per minute only, but thanks to Mr. Higgins's skill various important alterations and improvements were from time to time effected, resulting in the present form of apparatus, which prints, in tape form, at a speed of from 35 to 45 words per minute, according to the individual skill of the operator, and, in addition, he invented an instrument printing on a broad band of paper, known as a column printer, now largely in use in the principal clubs and hotels in London and the chief Provincial towns. Mr. Higgins was also the patentee of numerous inventions in electric fire alarms, and the author of many papers read before the Institution of Electrical Engineers, of which he was a Member. He leaves a widow and family. Several of his sons are now serving the country.

We are indebted to a correspondent for the following references to Mr. Higgins's life and work :—"The late Mr. F. H. W. Higgins entered the service of the Electric and International Telegraph Co.

in the 'sixties'; before he was 20 years old he had devised a non-inductive shunt for increasing the speed on repeater circuits. He was then transferred to the late Mr. R. S. Culley's laboratory, where he commenced an investigation into the establishment of current in a submarine cable. The application of the results of this investigation effected an increase of speed in the Dutch cables of such a magnitude, that a contemplated new cable was afterwards considered as unnecessary. Soon after this Mr. Higgins became superintendent of telegraphs to Mauritius, where he applied himself with great energy to the manifold duties which then devolved upon the telegraph engineer—including the blasting of a channel into the principal harbour of the Seychelles Islands, and the construction of a massive time ball at Mauritius. After three years in the island, Mr. Higgins returned to England, and in 1872 applied himself to the study of the distributive printing telegraph, which he made the work of his lifetime, and which he developed to a great degree of efficiency. The Exchange Telegraph Co. were then using the Edison printer; Mr. Higgins developed this instrument and greatly increased its speed, and later devised a new system of transmission, which enabled him to still further improve the apparatus. The necessity for an apparatus which printed on a broad band, instead of the familiar tape, caused Mr. Higgins to devise his column printer, an instrument now familiar in every large club and hotel. Mr. Higgins was responsible for many other inventions, among which may be mentioned his annunciator, which announces to the Members of the House of Commons the various happenings in the Chamber; also his fire-alarm system."

The death is notified of Mr. Geo. T. Evans, of Langland, Margam, electrician to the Margam Estate.

Mr. J. W. Nicholson, for 20 years engaged in the Leeds tramway department, and who was for the past six years hon. secretary of the Leeds Municipal Officers' Guild, died last week, at the early age of 48 years.

Will.—The late Prof. W. Grylls Adams, F.R.S., left £13,200 gross, and £5,000 net personalty.

NEW COMPANIES REGISTERED.

Smith, Lemon and Stewart, Ltd. (141,411).—This company was registered on August 27th, with a capital of £2,000 in £1 shares, to carry on the business of consulting engineers, manufacturers and commission agents as formerly carried on by T. E. Smith, C. W. Lemon, and T. W. Stewart, as "Smith, Lemon & Stewart," and to carry on the same and the business of manufacturers of and dealers in tarpaulins and other waterproof materials and coverings, metals, and all classes of machinery and tools, and things operated by electricity, steam, internal combustion, water or compressed air, ships' fittings, outfits, paints, varnishes, greases, oils, colliery and ships' stores, boiler insulating materials, telegraph, telephone and other electrical equipment, etc., used in engineering or shipbuilding yards and collieries. The subscribers (with one share each) are: T. E. Smith, County Chambers, Newcastle-on-Tyne, consulting engineer; C. W. Lemon, County Chambers, Newcastle-on-Tyne, consulting engineer; T. W. Stewart, County Chambers, Newcastle-on-Tyne, consulting engineer. Private company. The number of directors is not to be less than two or more than five; the first are T. E. Smith, C. W. Lemon, and T. W. Stewart (all permanent, subject to holding 250 ordinary shares). Qualification of other directors, 100 ordinary shares. Solicitor: E. L. Bates, 20, Collingwood Street, Newcastle-on-Tyne. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

Westwood Electrical Co., Ltd. (141,383).—This company was registered on August 25th, with a capital of £4,000 in £1 shares, to carry on the business of manufacturers of and dealers in electrical and general fittings and accessory parts thereof, electrical and general engineers, etc. The subscribers (with one share each) are: F. Westwood, 37, Lawdon Road, Birmingham, director; E. M. Westwood, 14, Park Road, Sparkhill, Birmingham, director. Private company. The number of directors is not to be less than two or more than five; the first are F. Westwood and E. M. Westwood. Qualification, 500 shares. Solicitor: T. J. Richards, 126, Colmore Row, Birmingham. Registered Office: Lawdon Road, Bordesley, Birmingham.

Seear, Scott and Co., Ltd. (141,463).—This company was registered on September 1st, with a capital of £3,000 in £1 shares (2,250 7 per cent. pref. and 750 ord.), to take over the business of manufacturing electrical and general engineers now or lately carried on by Seear, Scott and Co., Ltd. (old company), to carry on the business of mechanical, electrical, telegraphic and general engineers, manufacturers and builders, model and tool makers, founders, metal workers, cart, coach, carriage and van builders, manufacturers of and dealers in machinery, vehicles, boats, submersible and flying machines, and mechanical implements, etc., and to adopt an agreement with J. Scott. The subscribers (with one share each) are: J. Scott, 17, Lismore Road, Croydon, engineer; E. C. Seear, 16-17, Devonshire Square, E.C., electrical engineer; R. H. Yuile, 24, Moreton Road, Croydon, draughtsman. Private company. The number of directors is not to be less than two or more than five; the first are J. Scott (chairman), E. C. Seear, and R. H. Yuile. Qualification £50. Remuneration as fixed by the company. Secretary: E. C. Seear. Registered office: 51a, St. Peter's Street, South Croydon.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electro-Flex Steel Co., Ltd.—Issue, on August 20th, 1915, of £5,100 debentures, part of a series of which particulars have already been filed.

Pritchett and Gold and Electrical Power Storage Co., Ltd.—Particulars of £30,000 debentures, created August 12th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £10,000. Property charged: The company's property, present and future, including uncalled capital, and premises at Dagenham, Essex, with fixed machinery, etc. No trustees.

Carville Site and Power Co., Ltd.—Issue, on August 28th, 1915, of £10,000 debentures, part of a series of which particulars have already been filed.

Defries and Goldman, Ltd.—Particulars of £600 "B" debentures, created August 21st, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £300. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Evered and Co., Ltd. (20,158).—Capital, £200,000 in £1 shares. Return dated May 12th, 1915. All shares taken up. £1 per share called up on 35,040 and 14s. per share on 63,800; £79,700 paid; £91,044 considered as paid, being £1 per share on 67,440 and 14s. per share on 33,720 shares. Mortgages and charges: £20,600.

Electric and General Investment Co., Ltd. (31,506).—Capital, £201,500 in 20,000 ord. and 19,900 pref. shares of £5 each and 40,000 defd. shares of £1 each. Return dated August 10th, 1915. All shares taken up. £1 per share called up on the ord., 1s. per share on the defd., and £5 per share on the pref.; £121,500 paid. Mortgages and charges: £27,813 10s.

Electricity Supply Co. for Spain, Ltd. (29,103).—Capital, £105,000 in 20,000 pref. shares of £5 each and 19,900 ord. and 100 founders' shares of 5s. each. Return dated December 31st, 1914 (filed April 8th, 1915). 17,330 pref., 19,900 ord., and 100 founders' shares taken up. 5s. per share called up on 19,900 ord.; £4,975 paid; £86,675 considered as paid, being 5s per share on 100 founders' and £5 per share on 17,330 pref. Mortgages and charges: £133,800.

Electromotors, Ltd. (60,826).—Capital, £50,000 in £1 shares. Return dated May 31st, 1915. 42,370 shares taken up; £42,370 paid. Mortgages and charges: Nil.

Europe and Azores Telegraph Co., Ltd. (39,452).—Capital, £200,000 in £10 shares. Return dated July 7th, 1915. All shares taken up. £144,320 paid; £55,680 considered as paid. Mortgages and charges: Nil.

Consolidated Electrical Co., Ltd., (77,054).—Capital, £125,000 in £1 shares (15,000 six per cent. pref.). Return dated July 20th, 1915. All shares taken up. £1 per share called up on 15,000 pref. and 757 ord., and 5s. per share on 109,243 ord; £43,067 15s. paid; £81,932 5s. considered as paid, being 15s. per share on 109,243 ord. Mortgages and charges: Nil.

Chiswick Electricity Supply Corporation, Ltd. (38,854).—Capital, £100,000 in £1 shares. Return dated June 2nd, 1915. 62,800 shares taken up. £62,800 paid. Mortgages and charges: £80,000.

CITY NOTES.

German Electrical Companies.

The A.G. Kortings Elektrizitats Werke, of Berlin, has declared a dividend of 4 per cent. for 1914-15, as compared with 6 per cent. in the previous year.

The Ges. fur Elektrotechnische Unternehmungen, of Munich, reports that the increased receipts from supply, installations, and contracts in the first half of 1914-15 were more than extinguished in the second half of the year. It is proposed to pay 4 per cent. on the preference capital, as in 1913-14, but no distribution is again made on the ordinary shares.

The Internationale Stickstoff A.G., of Wiesbaden, records a further loss in 1914, whereby the debit balance has risen to £46,000 on a share capital of £103,000. The report states that improvements have been made at the Patsch nitrogen works, and the factory at Innsbruck is in a state of progressive development, whilst the large State works near Halle, which is to operate on the Pauling process, will presumably be brought into use in the near future.

The A.E.G. Unternehmungen A.G., of Frankfort-on-Main, which was formed in 1911 by the A.E.G. and the Carlswerk (Felten & Guilleaume) as an investment and site company, reports profits from dividends, interest and rent amounting to £35,500 in 1914-15, as contrasted with £36,600 in the preceding year, and net profits of £32,000 and £31,900 in the two years respectively. A dividend at the rate of 6 per cent. has been declared, being the same as in 1913-14. The company holds £200,000 in shares in the Carlswerk and shares in the Meissner Tramway, whilst the Frankfort works, formerly owned by the Carlswerk, are leased to the A.E.G.

The report of the *Wolfram Lampen A.G., of Augsburg,* for 1914-15 states that the turnover experienced a considerable reduction through the war, and as no compensation could be obtained by the manufacture of war material, working had first to be restricted and then totally suspended for a short time. The inland sales departments were at first at a standstill, although a general improvement took place subsequently, but no connection was being maintained with the sales organisations in hostile countries. As gross profits, the accounts show the sum of £75,000, as against £116,000 in 1913-14, general expenses and depreciation bringing the net profits down to £824, as compared with £2,000 in the previous year. A dividend of 6 per cent. was paid on the preference capital for 1913-14, but for the past year no distribution is being made on both preference and ordinary shares. It is, further, mentioned that the patent action in regard to drawn wolfram wire is pending in the final court.

The Compagnie Electro-Mécanique, of Le Bourget, near Paris, in which the Swiss firm of Brown-Boveri is interested, reports that the satisfactory demand for steam turbines and electrical plant which was experienced in the first seven months of 1914 ceased after the outbreak of the war, so that the working results were affected unfavourably. Early in 1914 the share capital was increased from £200,000 to £400,000, but the augmentation, under the circumstances prevailing, was unable to be utilised to the desired extent in promoting the receipts. The gross profits are returned at £69,000, as compared with £99,000 in 1913, and the net profits at £25,000 and £61,000 in the two years respectively. These are, however, not strictly net profits, as they make no provision for depreciation. The amount set aside for depreciation practically absorbs the net profits, and compares with £41,000 in 1913, so that no dividend is payable, whereas a rate of 8 per cent. was paid in each of the previous three years.

The Compagnie Métropolitain, of Paris, reports that the occurrence of war exercised decisive effects on the development of the railway, as the working of various lines had to be suspended immediately after the French mobilisation, and the receipts consequently declined. Whilst the receipts on August 2nd amounted to £6,204, or an increase of 43 per cent. as contrasted with the same day of 1913, eight days later they had fallen to £1,918, and reached the lowest level on August 15th at £1,545, this amount showing a decrease of 58 per cent. as compared with the equivalent day in the preceding year. With the resumption of working, however, a gradual advance in the receipts took place, and from a total of £75,000 in the month of September the receipts rose to £140,000 in December, but this amount was less by £67,000 than in the same month in 1913. The total revenue from the sale of tickets reached £1,855,000 in 1914, as against £2,179,000 in 1913, whilst the working expenses were £847,000 and £966,000 in the two years respectively. After deducting the shares of the City of Paris in the gross receipts, the net profits are recorded at £445,000, as contrasted with £553,000 in the previous year. It is intended to pay a dividend of 11s. 2½d. per £10 share, this comparing with 17s. 2½d. in 1913. The directors state that from the working results in the new financial year the crisis may be considered as almost entirely overcome. The company derives advantage at present from the absence of motor omnibuses, but the hope is expressed that traffic later on will increase so largely as to extinguish the losses hitherto incurred.

The Compagnie Francaise Thomson-Houston, which was in close relations with the A.E.G. prior to the war, reports that although deprived of 60 per cent. of the *personnel* through the mobilisation, it was possible for the company to maintain working, notwithstanding the moratorium, the deficiency in traffic conditions, and the difficulties experienced in obtaining raw materials. Only one shop was excluded, namely, that at Lesquin, which lies in the area occupied by the enemy. Immediately on the outbreak of hostilities the company placed its industrial organisation at the disposal of the Army and Navy, and, at the same time, it was still able to meet the requirements of current business. The company neither availed itself of the facilities afforded by the moratorium in relation to the creditors nor in regard to the shareholders. The net profits at £127,000 were less by £53,000 than in 1913, and the dividend is 5 per cent. on share capital of £2,400,000, as contrasted with 7 per cent. in the previous year, the amount carried forward being £7,000. As to the relations formerly existing with the A.E.G., the directors state that the agreements were concluded to avert the invasion of German production, which had made itself perceptible in all branches of industrial, commercial and financial activity. In regard to the future, the French company's programme lay completely in the determination that all relations between the French and Germans were impossible. The dissolution of these relations would result in difficult problems; they would be all the easier the more complete the victory of France became, and they could, therefore, look forward to them without anxiety. It is added that as a consequence of existing conditions, the dissolution and liquidation were already being observed of the Société Francaise of the A.E.G., which was brought into existence by the French Thomson-Houston Co.

Aberdeen Suburban Tramways Co., Ltd.

At the half-yearly meeting, Mr. James Mearns, the Chairman, said that notwithstanding the shrinkage in revenue, which was entirely due to temporary causes, the directors had come to the conclusion that the time had arrived for an increased dividend. For many years back the directors' policy had been to restrict the dividend in order that they might build up a strong renewal and depreciation fund. This fund, with the amount which the directors proposed to add this half-year, now amounted to half the capital of the company, and, in view of the condition of the undertaking generally, the directors were satisfied that they would not require to write off in future years so much as had been written off in the past, and they hoped to be able to maintain, if not to increase, the dividend that they now proposed to pay (5 per cent.). In regard to the negotiations for the purchase of the company's undertaking, which were initiated by the Town Council, no substantial progress had been made. In place of the late Mr. Jackson, the directors appointed Mr. James Sellar, who, for a time, managed the Singapore Tramways, as one of the directors. After references to the satisfactory financial position, the report was adopted.

United Electric Car Co., Ltd., Preston. — The directors' report for the year ended June 30th, 1915, states that the works have been efficiently maintained as regards buildings and machinery, the cost of which has been charged against revenue. After charging £5,332 for depreciation (including £4,500 added to reserve), the profit for the year is £8,553, plus £2,154 brought forward, making £10,707, less the preference dividend for the six months ending December 31st, 1914, £3,000, leaving an available balance of £7,707. The directors recommend the payment of the preference dividend, less income-tax, for the half-year ending June 30th, 1915, £3,000, carrying forward £4,707.

Dumbarton Tramways Co., Ltd.—The accounts for the year ended July 31st show that the profit for the year, including the balance brought forward, after providing for interest on debenture stock, amounted to £10,790. A dividend of 1½ per cent. on the ordinary shares is proposed.

Clyde Valley Electrical Power Co.—The profit for the past half-year, including £11,535 brought forward, amounts to £54,095. After adjusting interest and transferring £18,709 to contingency fund for depreciation, &c., the directors recommend that £4,276 be transferred to reserve fund, £10,000 applied in writing down cost of legal charges, the dividend paid on the preference shares to October 31st, 1915, and £12,430 carried forward.

British Electric Transformer Co., Ltd.—An interim dividend at the rate of 6 per cent. per annum, less income-tax, on the ordinary shares is announced for the past year.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—Interim dividend for the quarter to June 30th of 2s. 6d. per share, free of tax.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers, during the five weeks ended July 30th, 1915, amounted to 2,474,568, compared with 1,851,329 units in the corresponding five weeks of 1914.

Liverpool District Lighting Co., Ltd.—Interim dividend 4 per cent. per annum, less tax, for the half-year to June 30th.

STOCKS AND SHARES.

Tuesday Evening.

There is a general firmness about the markets of the Stock Exchange as a whole which is satisfactory enough to those who watch this barometer of the national pulse. Prices are well held in most departments. The Home Railway stocks, which for a long time have been stagnant and depressed, are in somewhat better fettle. The illumination list is very quiet, both electric lighting shares and gas stocks hardly moving. Telegraphs are disposed to improve again.

What the Stock Exchange wants more than anything else, to influence its securities, is definite news. The daily *communiqués* from the various fronts contain nothing of sufficient importance to affect markets one way or the other. The Russian retreat is not regarded as being serious enough to justify any financial alarm; it certainly has brought very little stock to market, and this week the tendency has been to put prices up to what they stood at before the fall of Warsaw, and subsequent developments on this line. The news for which everyone is waiting with intense eagerness is that concerning the passage of the Dardanelles.

The gyrations in the American rate of exchange have helped Stock Exchange business to some extent, in that they had the effect of forcing up the prices of various American securities until these prices attained levels quite out of proportion to those of British issues. This we have pointed out once or twice previously, and the result has been to bring in sellers of American railroad and industrial bonds, with the natural consequence that the inflated prices gave way. American Marconis, for instance, from 22s. slid back to 15s. 6d. New York Telephone bonds there was a rush to sell at par, and the price has reacted to 97¾. The same conditions prevailed in other American issues, it being felt that the drop in the sterling exchange could be only a temporary affair in the nature of things, and that its rectification would be followed by the restoring of prices to more normal standards.

Meanwhile, the German Chancellor talks with amusing bombast of the new loan which he is issuing in Berlin. How serious the financial situation in Germany must be getting may be read between some of the lines of his speech, in which, as security for the loan, he held out the compensation that Germany would claim, if—he had the grace to say "if"—victory was granted to them. "Those who provoked war, and not we, deserve to drag through the centuries to come the leaden weight of those milliards. No doubt," he explained, "the fearful financial exhaustion of our opponents will make this somewhat difficult of attainment; but we shall do all that is possible to obtain it." He alluded, significantly enough, to the hint thrown out by the German Government to the bourses that there is a better field than speculation in securities for the employment of liquid assets. "All available gold," he declared, "belongs to the country to-day."

At the end of last week, there was a little news in from Mexico which read more encouragingly. Prices in the railway markets made a start towards improvement, but this was not maintained. The information was of a character too nebulous for people to take much notice of it without further confirmation, and this is still awaited. Therefore, the Mexican group remains weak.

Brazilian Tractions have gone back ½ to 47, the market being somewhat under the influence of sales by those who bought perhaps more than they ought to have done two or three months ago. The Rio rate of exchange, moreover, offers no attraction to speculatively-invest—it is a moot point whether a hyphen word splits an infinitive or not—in Brazilian things of any sort, and so the market is disposed to rest. Rio Tramway 1st mortgage bonds, with a coupon due on the 1st of next month, have been picked up at 71. Anglo-Argentine Tramways debenture issues advanced in sympathy with the stocks of the Argentine railway market.

There is nothing doing in British Columbia descriptions, the only bargain recorded this month up to the present being one at 28½ in the preferred ordinary stock. Odd lots of British Electric Tractions have been done within the past week at 70 in the 6 per cent. preference, 41 in the non-cumulative preference, and 11¾ in the preferred ordinary. A small amount of London United Tramways 1st debenture stock was sold a few days ago at 42½.

Home Rails, as already mentioned, are inclined to be a little better, and the tendency has begun to penetrate the electric railway issues. Underground Electric income bonds, at 70¾ ex dividend, are somewhat better: the shares are steady at their previous levels. Central London ordinary is a dullish spot at 71. The non-assented last changed hands, in May, at 40, but no transactions have taken place this year in the preferred or deferred stock of the non-assented varieties. There is a little doing in Metropolitan Surplus Lands on the basis of 48, and the Ordinary is ½ up. East London consolidated stock is being dealt in at 2⅞, which, by the way, is about half the price at which the stock stood when war broke out.

The Telegraph market is the firmest of them all. Eastern Extensions, Eastern ordinary, Globe ordinary and Western Telegraphs have all improved, and the recent blocks of deceased-account stock appears to have been absorbed. The tone is accordingly much harder, and sellers are able to get better terms. Marconi shares are 1/16 down, as are Americans, which dropped sharply to 15s. 6d. in consequence of a rise in the New York exchange. This latter factor had the effect of reducing New York Telephone bonds from 100 to 97¾; even this lower price looks more than sufficiently high, when compared with quotations for many domestic stocks.

British Insulated were taken the other day at 10 11/16, but the handful of shares by no means exhausted the various sellers that there are in the market. The Manufacturing group on the whole is steady, but Henleys 4½ per cent. preference at 4½ have moved back to the 5 per cent. level, at which it is not unreasonable to suppose the shares ought to stand in days when British Government stock returns 4½ per cent. Except for this, there are no changes worth mentioning. The rubber market remains very firm. Notwithstanding the realisations of a few "dead" accounts, prices keep up well, although there is no startling movement from day to day. In the armament group, Vickers are moving quietly upwards; while as regards copper shares, the recent improvement has been stayed in consequence of a check to the rise in the price of the raw product.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Blackpool-Fleetw'd	Aug. 28	8,510	+1,888	34	26,351	— 2,639	8	..
Bristol	" 27	44,837	+6,443	34	325,739	+27,595	30·5	..
Chatham and Dist.	..	..	..	..	..	..	..	..
Cork	" 26	2,205	+ 61	34	17,035	— 241	54·25	..
Dublin	" 27	26,814	+ 983	34	208,466	+ 6,262	9·89	..
Hastings	" 28	6,622	+1,018	..	..	— 942	19·3	..
Lancashire United	" 25	7,806	+ 884	42	58,810	+ 2,848	42	..
Llandudno-Col. Bay	" 27	2,871	+ 392	39	12,929	+ 740	6·5	..
Tyneside	" 25	2,828	+ 163	8	5,459	+ 390	11	..
Anglo-Argentine ..	" 26	202,078	+1,425	34	1,783,692	—185,814	..	..
Auckland	July 30	20,408	— 374	30	22,153	— 1,158	25·42	1·06
Calcutta	Aug. 28	17,860	— 134	..	..	— 6,618	..	..
Kalgoorlie, W.A. ..	May	8,269	..	21	18,472	..	..	..
Madras	Aug. 31	4,283	+ 385	31	32,594	+ 218	..	..
Montevideo ..	Aug.	26,493	+ 418	44	278,846	—31,892	..	..
Dublin-Lucan Rly.	Aug. 27	714	+ 5	8	1,390	— 81	7	..

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend, 1914.	Price Sept. 7, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	7½	—	£6 18 4
do. 7 per cent. Pref.	7	7¼	—	4 16 7
Charing Cross Ordinary	5	3¾	—	6 13 4
do. do. do. 4½ Pref. ..	4½	3¾	—	6 0 0
do. do. City Pref.	4½	3¾	—	6 0 0
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4⅜	—	5 14 3
do. 4½ Deb.	4½	88	—	4 17 10
City of London	9	12¼	—	7 7 0
do. do. 6 per cent. Pref. ..	6	10¾	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10½	—	6 13 4
do. do. 6 per cent. Pref. ..	6	10½	—	5 14 3
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6¼	—	7 4 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref. ..	6	4¾	—	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	3½	2½	—	7 0 0
do. 4½ per cent. Pref. ..	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6¾	—	7 8 2
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6¾	—	6 18 [illegible]
do. 4½ Pref.	4½	4¼	—	5 9 0

Telegraphs and Telephones.

	Dividend, 1914.	Price Sept. 7, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	98	—	6 2 6
do. Def.	1½	21¼	—	7 1 2
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8¼	—	6 1 3
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11¾	+ ¼	*6 17 0
do. 4 Deb.	4	79	—	5 2 1
Eastern Tel. Ord...	7	116	—	*6 16 0
do. 3½ Pref.	3½	70	—	5 0 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	9¾	+ ¼	*7 0 8
do. Pref.	6	10	—	6 0 0
Gt. Northern Tel.	22	35	—	6 5 9
Indo-European	10	50	—	6 10 0
Marconi	10	1 29/32	— 1/16	5 5 3
New York Tel. 4½..	4½	97¾	—	4 11 10
Oriental Telephone Ord.	10	1 15/16	— 1/16	5 3 1
do. Pref.	6	1⅛	—	5 6 8
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5½	— 1/16	*8 6 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	11¾	—	*6 17 0
do. 4 Deb.	4	81	—	4 16 5

Home Rails.

	Dividend, 1914.	Price Sept. 7, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented ..	4	71	—1	5 12 1
Metropolitan	1¼	24	+ ½	5 4 2
do. District	Nil	14¼	—	Nil
Underground Electric Ordinary ..	Nil	1½	—	Nil
do. do. "A"	Nil	5/9	—	Nil
do. do. Income ..	6	70¾	+ ½	*9 14 0

Foreign Trams, &c.

	Dividend, 1914.	Price Sept. 7, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Arg. Trams, First Pref. ..	5½	3⅞	—	7 1 11
do. 2nd Pref.	5½	3½	—	7 17 2
do. 4 Deb.	4	72½	+1½	5 12 7
do. 4½ Deb.	4½	72	—	6 5 0
do. 5 Deb.	5	74	+2	6 15 2
Brazil Tractions	3½	47	— ½	7 9 0
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds ..	—	40	—	Nil
do. 6 per cent. Bonds ..	—	35	—	Nil
Mexican Light Common	Nil	25	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	40	—	—
Adelaide Sup. 6 per cent. Pref. ..	6	5	—	6 0 0
do. 5 Deb.	5	98	—	5 2 0

Manufacturing Companies.

	Dividend, 1914.	Price Sept. 7, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	2 3/16	—	6 8 5
British Aluminium Ord.	5	1 1/16	—	4 14
do. Pref.	6	18/3	—	6 9
British Insulated Ord.	15	10⅝	—	7 1 2
do. Pref.	6	5⅞	—	5 2 2
British Westinghouse Pref.	7½	32/6	—	9 7 6
do. 4 Deb...	4	68	—	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref...	5	4½	—	5 11 8
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	8¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	58	—	6 18 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/-	—	7 7 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	14	—	*8 8 8
do. 4½ Pref.	4½	4½	— ¼	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	8¾	—	5 14 3
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

Canadian General Electric Co., Ltd.—A quarterly dividend of 1¾ per cent. for the three months ending September 30th is announced, being at the rate of 7 per cent. per annum on the common stock; also a half-yearly dividend of 3½ per cent. for the six months ending September 30th, being at the rate of 7 per cent. per annum on the preference stock.

THE TREND OF ELECTRICAL DEVELOPMENT.

(Concluded from page 293.)

Mr. Paul M. Lincoln, continuing his presidential address to the American Institute of Electrical Engineers, says that one of the most pressing of our existing limitations to a reduction in cost of electrical apparatus is that fixed by temperature rise. The output of a piece of electrical apparatus increases with the temperature rise, and the temperature rise in turn is dictated by the point of balance between the rate at which heat is put in and that at which it is taken out. The rate at which heat is put in depends largely upon physical characteristics which are already being crowded to the limit by our modern designs. The rate at which heat is dissipated depends upon the efficiency of the ventilation methods used, and in this particular there is a considerable opportunity for improvement. The methods and devices for taking heat out of machines are just as important, when considering the temperature rise, as the prevention of heat from entering. The additional costs of applying the more efficient methods of dissipating heat will go far toward multiplying their tendency toward a reduction of cost.

However, there is one line of development that does promise some reduction in cost, and that is the tendency toward higher operating temperatures. In the past, the maximum operating temperature has been fixed by the disintegrating point of fibrous insulation, and this point has placed a very definite and logical limit to temperature rises in such machines. However, when types of insulation are used which do not have this definite temperature of disintegration, this reason for such a temperature limit disappears. Just how far we can go without exceeding the safe limits is as yet problematical; however, a limit to an indefinite extension in this direction is set by the temperature coefficient of copper conductors, the property that causes the resistance to rise with increasing temperature, thereby causing still higher losses, and in turn still higher temperatures. If we go high enough, we reach a point of unstable equilibrium in this temperature rise curve, where the apparatus will literally and automatically "burn out." This point is, of course, far above anything that is projected at the present time.

In the matter of power production, therefore, although we have steadily improved in the past, both as to costs and as to performance, and although we may expect to continue this steady improvement in the future, we can see ahead of us a definite limit beyond which it will be impossible to improve the methods of power production now in use. So long as we continue to get our power from falling streams and burning coal, we need not expect to see the same radical improvements in the future as have distinguished the past. The revolutionary improvements in power production methods of the future must come in a fundamental change of method rather than in the continued improvement of existing methods.

In the matter of utilisation of power a few comparisons with the past may not be amiss. The progress of the future will undoubtedly come from improvements in methods of application, and in this direction the field is inexhaustible. For instance, the problem of applying electrically the large amounts of power which are demanded by our modern railroad trains has not yet received a solution which is satisfactory to all concerned. The devising of methods for the application of electricity to our modern industries constitutes the occupation of no small part of our fraternity; it is along this line that we may expect much of what the future may have to offer us of a revolutionary character.

After the telegraph, in point of time, the electric light was the first practical application of electricity.

Most of our modern development in electrical engineering has taken its initiative from the supply of electric lighting to our communities. Kennelly in his 1898 address said, "The price of a 16-c.p. incandescent lamp 16 years ago was about $1.00. Now it is about 18 cents. The best lamps at that time, under laboratory conditions, gave about 0·28 mean horizontal British candle-power per watt, and under commercial conditions about 0·20. The highest pressure for which they could then be obtained was about 110 volts. At the present time lamps are obtainable giving normally 0·4 mean horizontal British candles per watt, while under commercial conditions the average lamp normally develops about 0·25 candle per watt. They can also be obtained (at 0·25 candle per watt) for pressures up to 240 volts, and are frequently installed on 220-volt mains."

The introduction of the metal-filament lamp has enabled us to-day to record a much greater rate of improvement in efficiency than Kennelly did. He reported an improvement of about 50 per cent. in efficiency in the 16 years previous to 1898. In the 17 years since Kennelly wrote, we have improved our maximum efficiency about 1,000 per cent., an advance which is truly marvellous. But here is a field where we have a long way to go yet without reaching a possible limit. It is true that the melting point of the now available materials seems to place the limit of lamp efficiency at a point not much higher than that which we have at present. However, when we come to compare the efficiencies of even our best lamps with that attained by the fire-fly it is evident that we still have a long way to go before we have reached perfection.

In the matter of power transmission, progress during the past few years has been remarkable. In 1898 the record reads: "The electric transmission of the power of falling water is a branch of engineering that has come into service since 1884, and is making rapid strides, owing to the recent successful employment of high voltages and multi-phase alternating currents. It has been estimated that about 150,000 kw. of this class of machinery is installed in the North American continent, commercially transmitting power to various distances up to 85 miles, at various pressures up to 40,000 volts." Since Kennelly wrote, 17 years ago, the maximum transmission voltages have gone up about three and three-quarter times; the maximum then was 40,000, and now is 150,000 volts. The maximum distance of transmission has gone up about three and a half times, 245 miles as against 85, and the installed capacity of water power plants on the North American continent about nine times, 1,350,000 instead of 150,000 kw. Kennelly also mentions in his record that "insulation testing sets have been made for producing alternating pressures up to 160,000 volts effective." In this respect we can go at least 10 times better than he reported, 1,000,000 volts from transformers having been made available on more than one occasion, and in some cases the voltage available from transformers has been pushed even higher. This matter of power transmission has advanced with probably greater rapidity than in any other branch, but we are approaching some fairly well defined limits in these matters. For instance, in the question of increasing transmission voltages we are close to the corona limit. There are, of course, methods of increasing the voltage range somewhat before corona is produced, such as increasing conductor diameter, but it can be readily seen that the limits of such remedies will be reached long before transmission voltages have increased by the same ratio as they have in the past 17 years.

Another limit that we are approaching in the matter of power transmission is the economic one. There obviously is a limit to the investment that can be made in transmission lines, and still be able to supply power with the same economy as it can be generated upon the ground. This consideration, coupled with the rapid advance in methods of generating power from steam, has placed an economic limit to the transmission of water power, so that we cannot expect any such advances in the future as the past 10 or 15 years have given us.

Transmission by high-voltage direct currents has received some attention of recent years. While there is no question but that the problems of pure transmission are much simplified by the use of direct currents, the accompanying problems of the generation and utilisation are so much intensified that nothing is to be gained in this manner. Probably no material advance will be made in direct-current transmission unless some means, as yet undeveloped, is found by which its generation and utilisation are made easier and safer than is possible at present.

Electricity is no longer the infant that it was formerly pictured, and cannot be expected to continue the rate o growth of the infant. It is attaining the vigour and strength of manhood. It is contrary to natural law that either a child or an industry can have rapidity of growth and at the same time strength and stability of character. Unquestionably the rapidity of our development is not so great now as it was when Kennelly spoke in 1898, and in this respect we are but following a natural law. At the same time, our vocation is acquiring a stability and performance that are absolutely incompatible with the rate of growth that characterised our earlier years.

AN ELECTRIC FERRY.

The small country town of Strausberg, situated some 25 miles east of Berlin, with about 9,000 inhabitants, has several features of interest to electrical engineers.

The 40,000-volt transmission lines of the Märkische Electricitätswerke (an "overland" system) pass within a mile of the town, and serve it through sub-stations and a low-tension overhead distribution network belonging to the municipality. There is one sub-station close to the main 40,000-volt line, where the pressure is transformed down to 5,000 volts for the surrounding rural supply, and in the town there is another sub-station connected by underground cables with the first, which transforms from 5,000 volts down to distribution pressures. This sub-station also contains a small A.C.-D.C. converting plant. Both belong to the Town Council. A noteworthy point is the absence of a gas supply.

The characteristically quaint cobbled streets and plastered houses contrast strangely with centre-hung flame-arc lamps and an unusually obtrusive distribution network. The old and partly ruined tower, shown in fig. 1, is used as a centre for the latter, and, though this may verge upon vandalism, it must be admitted that the belfry constitutes an excellent protection and support for the numerous wires.

The township is situated on the side of a lake two miles long at a point where the width is only about 170 yd., but from which the road distance round either end is nearly 3 miles. For many years, therefore, the municipal ferries have had to cater for a considerable traffic. Originally there was a hand-propelled chain ferry, and later, a similar craft driven by an oil-engine.

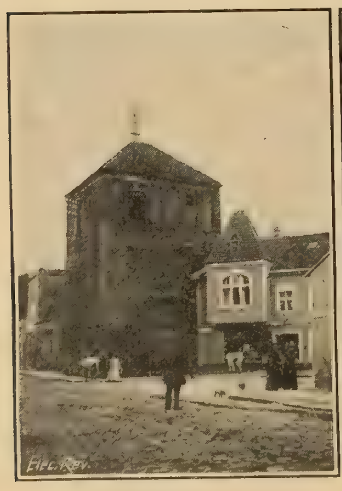
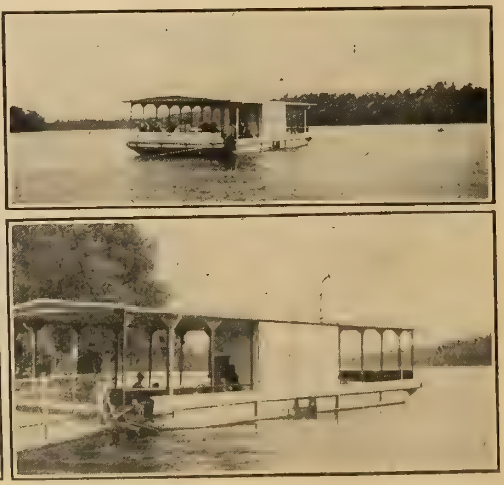


Fig. 1.



Figs. 2 and 3.

In 1913, however, there was installed a ferry propelled by an electric motor through the agency of an overhead trolley wire.

The boat itself is a flat raft, 45 ft. long by 20 ft. beam, with a deck-house on one side and a roof; as may be gathered from figs. 2 and 3, no attempt has been made to adopt such "lines" as would tend to minimise the water resistance, but lee-boards have been fitted in order to reduce side-drifting.

The motor, control-gear, gearing, &c., are mounted in the deck-house.

Resting upon the bed of the lake, and kept taut by a winch at one end, is a stranded galvanised steel rope $\frac{5}{8}$ in. in diameter, which passes round a 3-ft. hauling drum on the boat, and incidentally serves as the return conductor for the current. The motor drives this drum through two belts and a countershaft, which thus form double-reduction gearing.

The electrical equipment was supplied by the Sachsenwerk Co., of Dresden, and consists of a $7\frac{1}{2}$-B.H.P. 220-volt protected type series-wound direct-current motor, a drum type reversing controller with metallic resistances, a D.P. switch and fuses, an ammeter, and five metallic-filament lamps. The positive conductor is an ordinary trolley wire of hard-drawn copper 9 mm. in diameter, stretched between two 30-ft. lattice masts, one on each side of the lake, and insulated from them by strain insulators. In spite of the long span and the necessity for limiting the sag, the masts are of comparatively light construction. They are set in concrete blocks and have each only a single wire stay.

During the winter it was found necessary to insert a stout spiral steel spring and an adjusting device in one end of the wire, in order to enable the sag, due to temperature variations, &c., to be taken up more satisfactorily.

Along the trolley wire there runs a collector consisting of a single light over-running wheel attached to the raft by a flexible single-core insulated copper cable.

The cable passes through a vertical bell-mouthed tube in the roof of the deck-house. The slack varies considerably, not only on account of the sag in the trolley wire, but also due to the drift of the raft when exposed to a side wind; the same difficulties had therefore to be met as in those systems of railless traction which employ over-running collectors.

At first a spring drum was relied upon to wind in the slack cable, but this required occasional assistance from the ferryman before it would consent to perform its pseudo-automatic function.

An improvement was effected by the substitution of hanging weights and pulleys suspended from loops in the cable. These are arranged on the side of the deck-house. About $3\frac{1}{2}$ minutes are occupied in crossing the lake, and at busy times the ferry plies almost continuously. The operating results have given distinct satisfaction.

As with all rope ferries, the management is simple; the attendant has only to operate the controller and to collect the toll, as the raft pulls itself automatically up to the landing stage and into the required position.

There would, however, appear to be a case for the provision of fore and aft rudders to enable the leeway due to a side wind to be counteracted, so that the boat would always travel under the trolley wire.

It happens that this lake is not connected with the main waterways of Prussia, and therefore no hindrance to navigation is involved by the overhead and submerged wires. Otherwise special precautions would be necessary, and this is a consideration which would, no doubt, limit the sphere of application of the system elsewhere. On the other hand, it may be pointed out that the considerable width of this lake is a factor which renders the trolley system less readily applicable in this case than in many others.

There is one other ferry of generally similar construction, and this is in the Province of Brunswick.

Several obvious advantages may be claimed for the trolley ferry. The power required is a minimum, because the motor hauls upon a fixed point, and there is no slip, or eddies, as with a propeller or paddle-wheel.

Cheap power is used; the weight, losses and maintenance of a battery and the frequent repairs and adjustments of an internal-combustion engine or steam engine are all avoided, whilst a large power house can employ the most economical prime movers. Stand-by losses, such as occur with an oil engine when running between journeys, are absent. The ferry is always available for immediate use. The simplicity of the equipment reduces the attention required to a minimum. Electric lighting is available. Smoke, noise, and smell are entirely absent.

In conclusion, it may be suggested that, although the necessary electric supply is not so generally available, there are many cases even in England where a similar system might advantageously be adopted.

THE DOUBLE AUDION RECEIVER FOR CONTINUOUS WAVES.

The audion as well as any other detector can be used with the heterodyne receiver if local high-frequency current for "beat" forming be generated by an auxiliary high-frequency alternator or Poulsen arc. De Forest's "ultraudion," being capable of producing continuous oscillations of great purity though small energy, should be suitable for use as a local high-frequency generator in any heterodyne receiver set for continuous waves, the ultraudion oscillation circuit being coupled loosely to the aerial and the beat frequency equalling the difference between the frequencies of the received continuous wave and the ultraudion circuit. Using with such an outfit, an ordinary audion as receiver, two-fold amplification of signal strength is obtained :—(*a*) Due to the heterodyne principle itself.[*] (*b*) Due to the audion being worked at a point where the incoming signal releases a store of energy from the local high-potential battery. An interesting method of using two audions in cascade as an amplifying beats-receiver for continuous waves, so as to secure both of the above and possibly one other amplification, is described in a recent issue of the *Electrical World*, by A. H. Taylor, who cites a number of observations made at Grand Forks (N.D.), showing that the double connection is well worth while.

As receiver for regular spark stations the author uses the apparatus shown in fig. 1. The transformer secondary leading to the second audion is closed through a very small stopping capacity, and is itself the secondary of a ½-in. spark coil used as auto-transformer. When receiving signals from a spark station, the high-frequency oscillations received in the first audion are converted to a series of unidirectional impulses. If the stopping condenser in the second audion circuit be large, these impulses pass through it bunched in the form of low-frequency groups corresponding to the spark pitch of the sending station, but if the second stopping capacity be very small only high-frequency pulses will pass through.

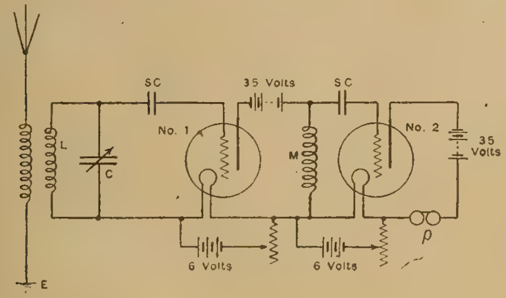


Fig. 1.

In the first case the second audion will amplify the low-frequency groups by energy from its high-voltage battery, and in the second case it will amplify individual high-frequency pulses and deliver them to its telephone circuit smoothed out by telephone inductance in low-frequency groups. The transformer M completes the circuit of the No. 1 audion high-pressure battery, but offers sufficient impedance to prevent short-circuit of the low-frequency groups or high-frequency pulses. To prevent amalgamation of current from the first audion into low-frequency pulses, the stopping condenser of the second audion must be of very small capacity (*ca.* 0·0005 mfd.). With ordinary spark station reception both audions are adjusted to maximum sensibility, preferably by varying the audion heating current.

With this arrangement, continuous oscillation signals are not received as tones in the telephone unless there is simultaneously impressed on the circuit a local high-frequency current. It is possible to find an adjustment of the audions such that local high-frequency current is produced within them, thus dispensing with the external generator generally employed for heterodyne reception. In order that a rectifying detector may produce high-frequency oscillations from direct current, on the Poulsen arc principle, R^2 must be less than 4 L/C, and, in general, the audion does not act as an oscillator owing to its high resistance. By burning the audion filament at abnormally high brilliancy, on the verge of the blue glow point, the tube resistance is much reduced and local high-frequency oscillations may be produced, their presence being made evident by a hissing noise in the telephone.

Working on this principle, the inductance L, fig. 1, must be large and the capacity C small, the product (L C) corresponding to the wave length received. The audion must be worked at higher temperature than corresponds to normal maximum-sensibility adjustment, and only bulbs showing the hissing effect should be used. The adjustment of the second audion is found to be the more important. The best conditions for each bulb must be found experimentally, but fortunately they are very constant. The high-pressure battery voltage should be rather less than gives best results in ordinary spark-signal reception, adjustment from the latter to beat-tone reception being made by changing the filament temperatures. It is very important that there be no "dead" high-resistance cells in the flashlight batteries making up the high potential source, because, particularly in the first audion circuit, the damping effect of such a high-resistance cell would be very serious. Best results are obtained with an adjustment generally near to that producing the "siren" effect, which must strictly be avoided in beat-tone reception.

The above-described cascade connection of audions permits signal and compensating waves to be separated very easily, signals being received with great purity and distinctness, using a very loose coupling. The pitch of the beat signal note is entirely under the operator's control, and is best kept fairly low for stations of long wave-length. At a wave-length of 7,500 m. (40 kilocycles), the beat pitches produced by 1, 2 and 5 per cent. deviation from perfect tuning are 400, 800 and 2,000 per second; at 1 to 3 per cent. asynchrony, there is negligible loss by de-tuning, but the loss is decided at 5 per cent. out of tune. Signal and compensating waves which cannot be separated by tikker give two different beats with the heterodyne receiver, and, if necessary, one beat can be tuned out completely. Most satisfactory results are obtained when receiving waves between 5,000 m. and 10,000 m.; shorter waves can be received, but the capacity required to fulfil the condition R^2 less than 4 L/C becomes so small, that the limiting value of the stopping condenser is reached, and movements of the hand affect the receiving capacity enough to upset adjustment. Experiments still in progress seem to show, however, that waves as short as 300 m. can be received with an audion adjustment corresponding to local generation of oscillations.

"Beats-ultraudion" reception of signals from spark stations is at least ten times as sensitive as ordinary double-audion reception without the oscillating adjustment, but the loss of musical quality in the note is a serious handicap, and one which seems inevitable, since the continuous local oscillation combines with a damped oscillation having group frequency as emitted by the spark station. Tremendous gain in intensity is secured, but the net readability of signals through X's is not greatly increased, owing to the loss of their musical quality. On the other hand, "beats-ultraudion" reception of continuous waves is extremely efficient, because full amplification is retained and the beat-pitch, which is under the operator's immediate control, is of perfect musical quality.

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[*] Denoting the received current by i_1 and the local high-frequency current by i_2, the increment of energy due to the incoming signal = $(i_1 + i_2)^2 - i_2^2 = 2\, i_1 i_2$ if i_2 be large as compared with i_1.

THE SELLING SIDE OF ELECTRICITY SUPPLY.—IV.

A feature of several new blocks of flats recently erected in London has been the elimination of fire-places in certain of the rooms, principally bedrooms. The owners have, doubtless, been influenced in arriving at such an important omission by several considerations. Economy of space would be one of these, while the clean sweep and larger effect of the unbroken walls adds considerably to the attractiveness of the rooms, and leaves the occupants more choice in the placing of furniture. The saving in labour and materials in connection with fire-places, mantelpieces, tiling for hearths, and chimney pots is considerable, even after the cost of wiring for electric heaters is deducted. After all, fires in bedrooms are the exception rather than the rule, and the ventilating value of a chimney is trifling when a fire is not on. For this purpose the open window is far more healthy. The provision of a fire-place may be really looked upon as a precaution against sickness, when it may be required to maintain an even temperature. In this respect a coal fire is very inefficient, the difficulty of regulating the heat, the risk of its going out, and the noise of tending it being drawbacks. There is also the risk of its smoking, a down draught being particularly dangerous in such a common complaint as bronchitis, or, in fact, any ailment connected with the respiratory organs. This risk is, by the way, equally present with a gas fire, perhaps in larger degree owing to the fumes being invisible.

It would be labouring the point to enumerate further the advantages that are to be gained by cutting out fire-places where possible, they are well known to all commercial electrical men; our aim in introducing the subject is that wider publicity may be given to the matter, and the arguments in its favour well pressed home to architects and builders. Such buildings offer another field in which electrical methods stand alone, and gas, oil, &c., are outsiders. There is, of course, no reason why the innovation should not be extended to houses. Dwellings without fire-places are, of course, no novelty in other climates more favoured than ours, and the writer was much interested in a conversation once held with an Australian architect. In that sunny land it appeared he had designed many houses, in which the only provision for damp and cheerless days was a lamp radiator.

Where such opportunities as these are offered there is a fine chance for the new business department to co-operate with the landlord and fit up one of the flats or houses as a show place. In return for some free current for showing prospective tenants over after dark, and to demonstrate the efficiency of the electric heaters, there should not be much difficulty in introducing a very complete equipment, including electric cookers, irons, vacuum cleaners, &c. There is some scope here for the display of good taste in fixing up fittings. As the wall paper, &c., will be left for the tenant to choose, some regard must be had for giving a warm effect. Therefore, in the dining-room a nice rise and fall pendant of the corona type, with a cardinal red shade, should be introduced. Experience has shown that this is the most popular colour, and many fittings manufacturers only stock this shade, moss green, and old gold for this class of fixture. In the drawing-room a semi-indirect fitting might well be placed, one of those pink alabaster bowls giving a charming effect, with the delicate tracing of the veinings showing up when lighted. In the sitting-room or library this type might also be introduced. For the best bedrooms suitable two-light slide fittings with pink silk shades are probably the best. The thing should be done thoroughly, with lanterns in the porch, perhaps another inverted fitting in the hall, and some of the scientific residence shades, of which there are now many types upon the market, on the single-drop pendants.

Of course, fittings appropriate to the class and style of the residence must be selected. A safe rule would be to avoid anything very ornate. Oxidised silver, copper, and the dull finishes are popular, and should be certainly used in the dining-room, and also in rooms such as bedrooms where the points are close to the windows. Portable lamps must not be forgotten, and a floor standard in the drawing-room; it is rather a pity to see these big standards dropping out of favour, they add largely to the furnished effect of a room. The exhibition would not be complete without an electric fan in the kitchen, a hot-plate coffee percolator, and a kettle in the dining-room; in short, some of the numerous electric appliances should be introduced wherever possible. The radiators should be of more than sufficient capacity for the rooms, in order to impress their heating power upon the visitor. The hall must not be overlooked; a good radiator here will make the whole place attractive and comfortable.

All these fittings should be clearly priced, and in the case of heaters and appliances the energy consumption at full and other degrees mentioned. The ticketing can be thoroughly carried out with advantage; for instance, where two or more point switch control is provided, the functions of the switches should be explained on show-cards, simple directions for use placed by the cooker, and so on.

A percentage might be added for fixing, as in the case of the particular show job being taken over it would not be always possible to get anything to cover this item.

All this may seem a lot of trouble to take, but such an exhibition is extremely valuable from an advertising standpoint, and reaches those people with whom one is most anxious to get into touch. There are, of course, a few difficulties in carrying out such a scheme. One is the protection of the property displayed; usually, however, there is an agent of the landlord at hand or a clerk of works, and the actual risk is small. It may be found necessary to supply a few small tables for the standards and appliances, and a good supply of publicity matter should be kept on them as well. There is some satisfaction in remembering that our gas opponents are handicapped in giving such displays, as the effect on the ceilings if the model flat was long in letting would begin to be apparent. It would perhaps be advisable to install a time switch to prevent possible wastage.

THE ELECTRICAL EQUIPMENT OF THE ARGENTINE BATTLESHIP "MORENO."

By H. A. HORNOR.

(*Abstract of paper read before the* American Institute of Electrical Engineers.)

The *Moreno* is one of the two super-dreadnoughts building in the United States for the Argentine Republic. The general characteristics of the vessel are as follows:—

Length overall, 594 ft.; displacement, 27,566 tons; draught, 27 ft. 9 in.; width, 98 ft.; main battery, twelve 12-in. breech-loading rifles mounted in six turrets; torpedo defence battery, sixteen 4-in. and twelve 6-in. breech-loading rifles.

Power for all purposes is supplied by four 375-KW. turbo-generators of the horizontal type. Two of these machines are located forward and two aft on the lower platform deck below armour. Adjacent to each dynamo room is a distribution room in which is located a main distribution switchboard for the control of the two units and the supply circuits. On the gun deck is a third dynamo room containing two Diesel oil-engine-driven generators of 75 KW. capacity for harbour use when fires are drawn.

The 375-KW., 230-volt, 1,500-R.P.M. turbo-generators (fig. 5) are of standard marine design, capable of operating at a steam pressure of 220 lb. per sq. in., condensing at a normal vacuum of 28 in., and also non-condensing with 5 lb. back pressure. The turbine is of the well-known Curtis horizontal, two-stage type, fitted with automatic valve gear, inertia governor, and an emergency valve for automatically closing when the speed exceeds 10 per cent. above normal. Forced lubrication is provided for the main bearings, and the oil is cooled by water circulation. The generator is a compound wound, direct-current, commutating-pole type, mounted on the same bed-plate and directly coupled to the turbine. The magnet frame is circular in form and divided horizontally. The generator is capable of standing 33⅓ per cent. overload for two hours and 50 per cent. overload for five minutes.

The Diesel oil-engine-driven sets are rated at 75 KW., 375 R.P.M., 230 volts. The generator is directly connected to the oil engine, but not mounted on the same bedplate. The generators are designed in a similar manner to the main generators.

Current is carried to all the various systems on a two-wire metallic system, by means of rubber-covered, lead-sheathed, steel-armoured cables, clipped singly, or in groups, to the ship's structure or clipped to special sheet steel pans supported from beam to beam or fastened to the plating. Water-tight fittings are provided wherever the cables terminate and when passing through water-tight bulkheads. Twin conductors are employed from 3,256 cir. mils up to 30,856 cir. mils, and beyond this single conductors up to 373,737 cir. mils. All the conductors in this installation are stranded, lead-covered, steel-armoured, with the exception of the flexible leads in the turret trunks and special brass-covered wire and three-conductor rubber-insulated "Kuhlo" wires, used for branch leads in the officers' quarters and staterooms.

Besides the two main distribution switchboards, fig. 4, adjacent to the two dynamo rooms, there are two auxiliary distribution boards located one forward and one aft; a control board for the oil engine generators; and a combined distribution and control board for the searchlight balancer sets. These boards are all interconnected so that the supply will always be available. The interconnecting circuit breakers are fitted with interlocking devices and reverse-power relays, so that by no possibility will the generators in one room be thrown in parallel with those in another room. The distribution switchboards are designed with separate bus-bars for positive lighting and positive power and a common negative. It is possible, therefore, to divide the load in various ways between the different dynamo rooms. To facilitate this, voltmeters and ammeters are connected in the local and remote circuits, and a diagram of the bus-bar connections is painted in grooves on the front face of the oil-finished slate panels.

Fig. 1.—The Argentine Battleship *Moreno*.

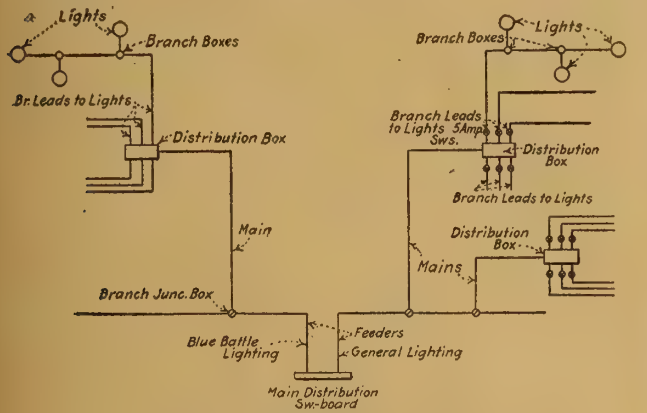


Fig. 2.—Distribution Diagram.

The vessel is provided with, approximately, 3,000 lighting fixtures. The design is similar to the usual water-tight vapour-proof globe type used in marine work. The screw-base lamp socket is, however, made solid instead of a spring, a composition-insulated base provided instead of porcelain, and the globe is flanged and held in place by the guard instead of being screwed into the base. In the magazines and shell rooms, specially guarded fixtures containing two lamp sockets are installed. The lamps in these fixtures are connected to different circuits so that the failure of light in these compartments may be averted. Both carbon and tungsten incandescent lamps are furnished; the former in sizes of 35 watts and 60 watts, clear; the latter in sizes of 32 watts, clear, frosted, and tubular. A special fixture containing a 250-watt tungsten lamp and provided with a reflector is arranged for portable connection in the engine, boiler, and dynamo compartments. The same type of fixture is also employed for coaling booms, propeller booms, and gangway lighting.

Life tests of the 220-volt tungsten incandescent lamps showed as high as 98 to 101 per cent. of the initial C.P. after 1,162 to 972 hours' burning. The spherical reduction factor for the tubular lamp was 0.96, and for the pear-shaped bulb (s-19) was 0.914

The 38 lighting feeders are divided into three circuits; one for general illumination under cruising conditions, one for white battle purposes, and one for blue battle purposes. In this latter circuit the globes are of a deep blue colour, making the light invisible at a short distance. The distribution of the small lighting units has been made with due regard for cross circuits, so that no general spaces of the vessel may be put in darkness by the blowing of a fuse or any other failure of an individual circuit. The distribution of these lights was based on the number of candle-power per cubic foot of space to be lighted; thus in the admiral's quarters a maximum of 0.08 C.P. per cubic foot was required, and in the store-rooms a minimum of 0.01 C.P. per cubic foot. Each officer's stateroom of ordinary size is provided with one fixed light, one portable light, and an outlet for a 12-in. portable electric fan.

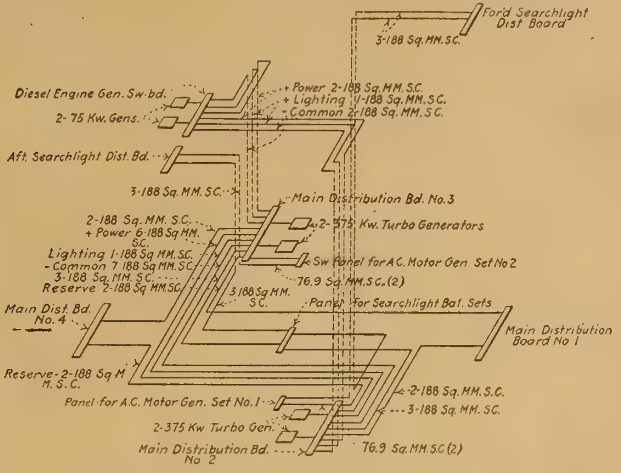

Ford Searchlight Dist Board
3-188 Sq. MM. SC.
Diesel Engine Gen. Sw-bd.
2-75 Kw. Gens.
+ Power 2-188 Sq. MM. SC.
+ Lighting 1-188 Sq. MM. SC.
- Common 2-188 Sq. MM. SC.
Aft. Searchlight Dist. Bd.
3-188 Sq. MM. SC.
Main Distribution Bd. No. 3
2-188 Sq. MM. S.C.
+ Power 6-188 Sq MM. SC.
2-375 Kw. Turbo Generators
Lighting 1-188 Sq MM. SC.
- Common 7 188 Sq MM. SC.
Sw Panel for A.C. Motor Gen Set No 2
3-188 Sq. MM. SC.
76.9 Sq. MM. SC. (2)
Reserve 2-188 Sq MM. SC.
3 188 Sq MM. SC.
Panel for Searchlight Bat. Sets
Main Dist. Bd. No. 4
Main Distribution Board No 1
Reserve-2-188 Sq MM. S.C.
2-188 Sq. MM. S.C.
Panel for A.C. Motor Gen. Set No. 1
3-188 Sq. MM. SC.
2-375 Kw Turbo Gen.
Main Distribution Bd. No 2
76.9 Sq. MM. SC (2)

Fig. 3.—Diagram of Power Distribution.

As shown in the diagram (fig. 2), the feeders are led from the main distribution switchboard to approximately their centre of distribution. Mains are then branched from the feeder, and terminate in fused distributing panels of water-tight construction. From these panels branches are led off to the individual lights. Not more than four lights (one ampere) are allowed to depend upon the same fuse. The branch leads are all of 1.6 mm. (3,250 cir. mils) twin conductor.

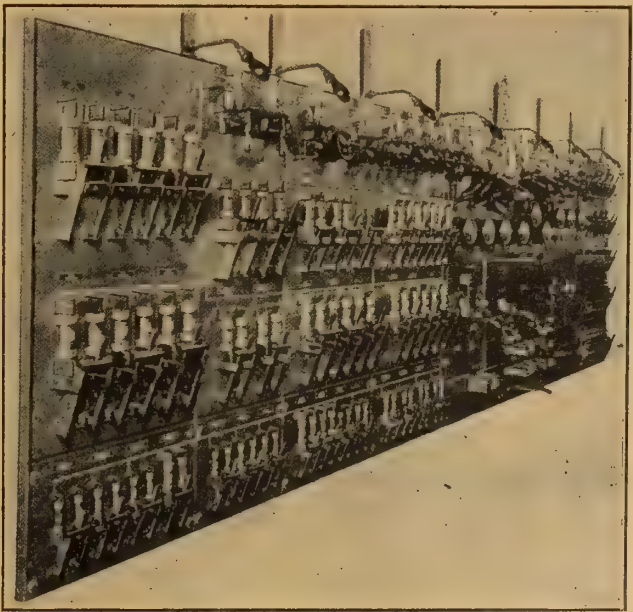


Fig. 4.—Main Distribution Switchboard.

For night battle purposes the vessel is equipped with 12 motor-operated, remote-electrically-controlled 110 cm. searchlights (fig. 8) and one portable signalling projector of 35 cm. As these projectors operate more satisfactorily when supplied with 110 volts, it was considered advisable to transform the 220-volt supply circuit through special balancer sets. Two such machines are installed in the vicinity of the oil engine dynamo room, wherein is located the control switchboard for them and the distribution board for the searchlight feeders. Each balancer set is rated at 70 kw., 1,000 r.p.m., 110 to 220 volts, the full load current on the neutral being 637 amps. They are compound wound, the coils being connected to act accumulatively on the generator and differentially on the motor. The series and shunt coils in one frame are connected across the armature of the other frame for the purpose of producing constant voltage at each end. The sets will maintain a difference of potential not in excess of seven volts under any conditions of load with an impressed e.m.f. of 220 volts.

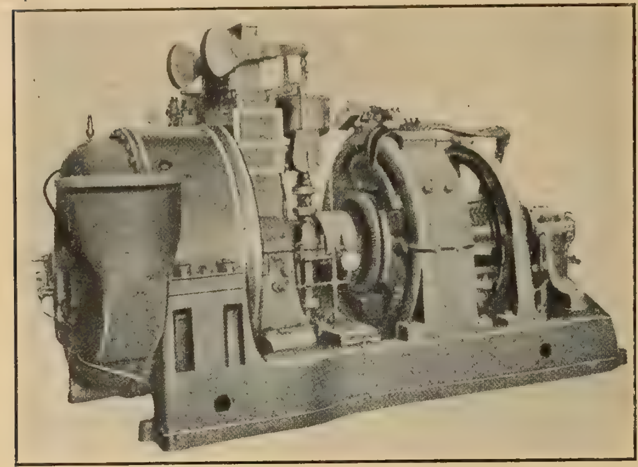


Fig. 5.—375-kw. Turbo Generator Set.

Fig. 6 is a wiring diagram of the searchlights when the carbons are apart, fig. 7 the same with the carbons together; considerable time is saved by the employment of a shunt motor for automatically adjusting the carbons in preference to a compound wound motor. The twelve 110-cm. searchlights are similar in every respect, except that one projector is equipped with a remote-electrically-controlled signalling shutter. The lamp mechanism consists of a small electric motor which functions through gearing and so moves the carbons. The field and armature of the motor are controlled by a differential relay and two auxiliary relays, which cause the armature either to stop or rotate to right or left. The first takes place with current and voltage normal, the second when the amperage is too high and the voltage too low, and the third when the last condition is reversed. Besides the regular field winding there is an additional winding on the motor field to carry the full lamp current. This produces a strong field when the voltage across the arc falls below normal and furnishes a dynamic braking effect for retarding the movement of the motor armature. For signalling purposes the searchlights are equipped with iris shutters similar to camera shutters. These are all manually operated except one, in which latter case a Venetian blind shutter, remotely controlled, is also provided. The optical arrangements are such as to provide rapid means for changing over from a dispersed to a closed beam of light. This is accomplished by means of a double disperser, consisting of two parallel systems of plano-convex cylindrical lenses, which may at will be drawn together or separated. A sighting telescope attached to the side of the drum; a complete lamp telegraph indicating the positions of the searchlight at the controller; and a set of electrical instruments, consisting of a voltmeter and ammeter, are furnished with each searchlight. A complete horizontal cycle of the searchlight may be accomplished either in 28 seconds or, approximately, 15 minutes, by means of the electric remote control. This control may be detached and the mechanism operated locally by hand.

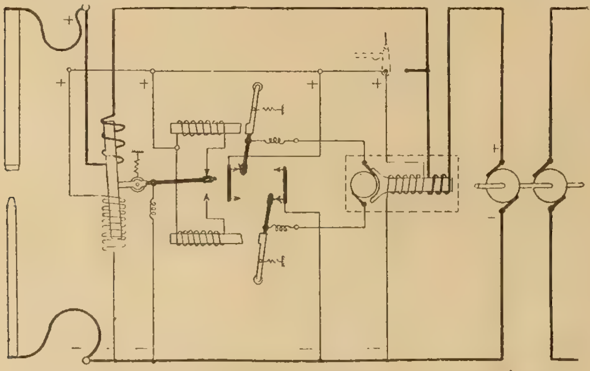


Fig. 6.—Searchlight Connections; Carbons Apart.

The following list shows the extensive applications of electric power and gives the rated load for each equipment. These numerous equipments have their special uses and are brought into action in general upon different occasions. Such systems as the ventilation system, sanitary pumps, etc., are continuously in service; but, on the other hand, the deck machinery, such as boat booms, deck winches, coaling winches, etc., are only used when in port coaling, handling small boats, etc. In like manner, the turret machinery is only used under battle conditions or for practice drills.

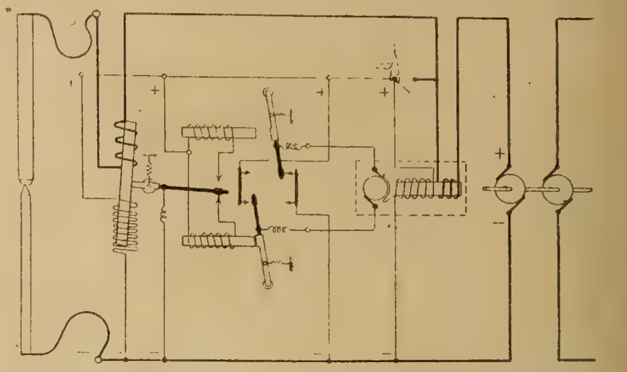


Fig. 7.—Searchlight Connections; Carbons Touching.

No.	Equipment.	Rated H.P.	Total H.P.
2	Boat boom hoisting	50	100
2	Boat boom topping	30	60
4	Deck winches ..	35	140
16	Ammunition hoists	3	48
6	Ammunition hoists	5	30
12	Forced-draught blowers	35	420
1	Anchor windlass ..	100	100
1	Capstan	100	100
2	Coaling winches ..	150	300
1	Steering gear ..	150	150
3	Bilge pumps.. ..	70	210
14	Bilge pumps.. ..	35	490
2	Searchlight balancer sets	93	186
1	Fire pump	60	60
2	Fresh-water pumps	6	12
2	Sanitary pumps ..	35	70
1	Drainage pump ..	3	3
2	Thermo tank pumps	35	70
3	Turbine lifting gear	30	90
1	Laundry	6	6
1	Printing press ..	0·25	0·25
3	Speed signal balls ..	0·5	1·5
1	Cake mixer	1	1
1	Dough mixer ..	2·5	2·5
1	Diesel engine oil pump	1·75	1·75
1	Diesel engine cooling water pump ..	2·7	2·7
12	Turret turning ..	25	300
12	Gun elevating ..	15	180
13	Turret hoists ..	7·5	97·5
5	Turret hoists ..	12	60
1	Dryer room	1	1
1	Röntgen ray equipment	5	5
1	Vacuum cleaner ..	0·33	0·33
1	Electro-mechanical hammer	5	5
2	Torpedo air-compressors	90	180
5	Refrigerator pumps	19·5	97·5
5	Brine pumps ..	3·5	17·5
2	Ozoniser motor-generators ..	1·3	2·6
2	Ozoniser pumps ..	0·5	1
9	Elevators	4	36
1	Wireless motor-generator	18	18
2	Alternating current motor-generators	37	74
1	Dish washer ..	1	1
1	Meat slicer	0·5	0·5
1	Meat chopper ..	1	1
1	Potato peeler ..	1	1
1	Ice-cream freezer ..	1	1
1	Egg beater	2	2
1	Extension lathe ..	3	3
1	Tool-room lathe, 14 in.	0·75	0·75
1	24 in. shaper . ..	8	8
1	30 in. radial drill ..	2·5	2·5
1	16-in. sensitive drill	0·75	0·75
1	14-in. tool-room lathe	0·75	0·75
1	Grindstone	1	1
1	46 in. boring mill ..	8	8
1	Cutter and grinder..	1	1
1	Tool-room lathe, 14 in.	0·75	0·75
1	Sensitive drill, 16 in.	0·75	0·75
1	Lathe for armourer's workshop	0·75	0·75
1	Shaper for armourer's workshop	2	2
1	Sensitive drill for armourer's workshop	0·75	0·75
1	Forge blower ..	0·75	0·75
1	Foundry blower ..	5	5
1	Athletic horse ..	2	2
1	Moving-picture machine	17·6	17·6
9	600-cb. ft. ventilation fans	4	36
9	1,600 cb. ft. ventilation fans	1	9
1	1,600-cb. ft. ventilation fan	2	2
6	2,500 cb. ft. ventilation fans	1·5	9
24	2,500-cb. ft. ventilation fans	2·75	66
3	2,500-cb. ft. ventilation fans	3·5	10·5
4	5,000-cb. ft. ventilation fans	3·25	13
6	5,000-cb. ft. ventilation fans	6	36
2	5,000-cb. ft. ventilation fans	6·75	13·5
7	6,000-cb. ft. ventilation fans	3·75	26·25
5	6,000-cb. ft. ventilation fans	7	35
2	8,000-cb. ft. ventilation fans	5	10
6	8,000-cb. ft. ventilation fans	9	54
2	10,000-cb. ft. ventilation fans	6·25	12·5
3	12,000-cb. ft. ventilation fans	7·5	22·5
2	15,000-cb. ft. ventilation fans	10	20

As shown in the cable scheme for power distribution (fig. 3), the feeders from the main distribution switchboards in some cases lead direct to motor starting panels, in others they branch into mains, and in others lead to special distribution panels. The latter is so in the case of the 4 in. and 6 in. ammunition hoists, the searchlights and the 12 in. turrets. The turret distribution panel is located on the revolving part of the turret and is encased in a water-tight steel box.

As shown in the illustration (fig. 10), a variety of motor types are used, viz.: Open, semi-enclosed, fully-enclosed, and enclosed ventilated. Small motors, up to 10 h.p., are regulated by simple starting and field control panels; above 10 h.p. drum controllers are employed. On very large equipments for special services requiring from 50 to 150 h.p., contactor control with dynamic braking is provided.

The electrical steering gear equipment is designed as an auxiliary to the steam steering engine, operates through the same telemotor gear on a "follow-up" system, and furnishes only sufficient power to carry the rudder from hard-over to hard-over in 40 seconds, which is half the time requirement of the steam gear. The motor is of the commutating-pole open type, compound-wound, rated at 150 H.P., 400 to 600 R.P.M., 220 volts. The controlling appliances comprise a master controller and limit switch mounted in one case, a contactor panel, and the necessary field and armature rheostats operated by the same. In the master controller are two cylinders provided with rings; these make electrical contact with plungers; one of these cylinders is for the controller, the other for the limit switch. Both cylinders turn freely on their supporting shafts. The controller cylinder operates through a connecting rod from the operating shaft of the steering gear. The limit switch cylinder operates through a sprocket chain from the main steering gear shaft. The differential gear, or "follow-up" device, is located between the two cylinders, and is designed to turn the controller cylinder off by motion of the main shaft of the steering gear which turns the limit switch. The latter strengthens the field of the motor when the rudder is displaced more than 10 deg. from the midship position. The mechanical connections are such that the motor will stop when the rudder has reached the angle for which the steering wheel has been turned. The motor field cannot be weakened until all of the accelerating contactors have closed, after which the controller will maintain full field until it has been turned through an angle corresponding to 3 deg. movement of the rudder from starting position, and intermediate field from 3 deg. to 5 deg., after which the motor will run at weak field until the rudder has reached 10 deg. from the midship position. Mounted upon the contactor panel are 10 armature contactors, two field contactors, one disk brake contactor, two counter E.M.F. contactors, an overload relay, a double-pole, fused, control switch, and a single-pole testing switch. The overload relay controls four of the five accelerating circuits; when it operates, resistance is introduced into the armature circuit, and the field rheostat short-circuited so that the motor is protected against continued overload without being actually stopped. In this manner accidental loss of control of the rudder cannot occur. The limit switch is arranged to stop the motor at the 35-deg. position of the rudder. Dynamic braking is provided in connection with the electro-mechanical disk brake in order to provide prompt stopping. The rudder can be turned at slow speed throughout its travel, provided the steering wheel is turned slowly, thereby permitting the motor to turn the controller cylinder backward as fast as it is turned forward by the steering wheel. This may be accomplished while the controller cylinder moves back and forth between limits corresponding to 2.25 degrees motion of the rudder, as the motor will start with a motion of cylinder equivalent to 0.75 deg. movement of the rudder and the field will be weakened with 3-deg. similar motion.

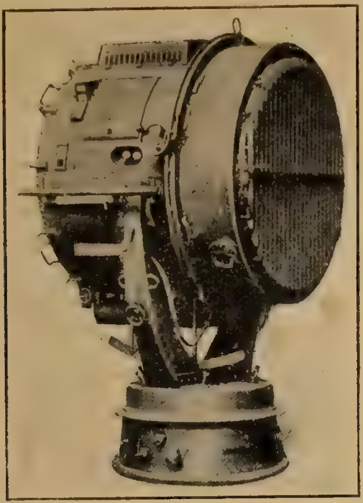


Fig. 8.—Electrically Controlled Searchlight.

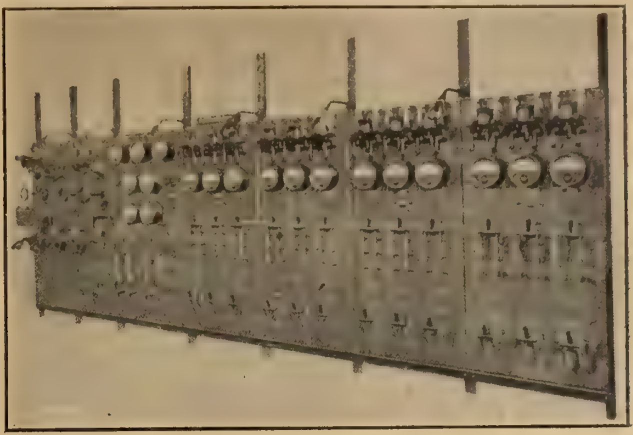
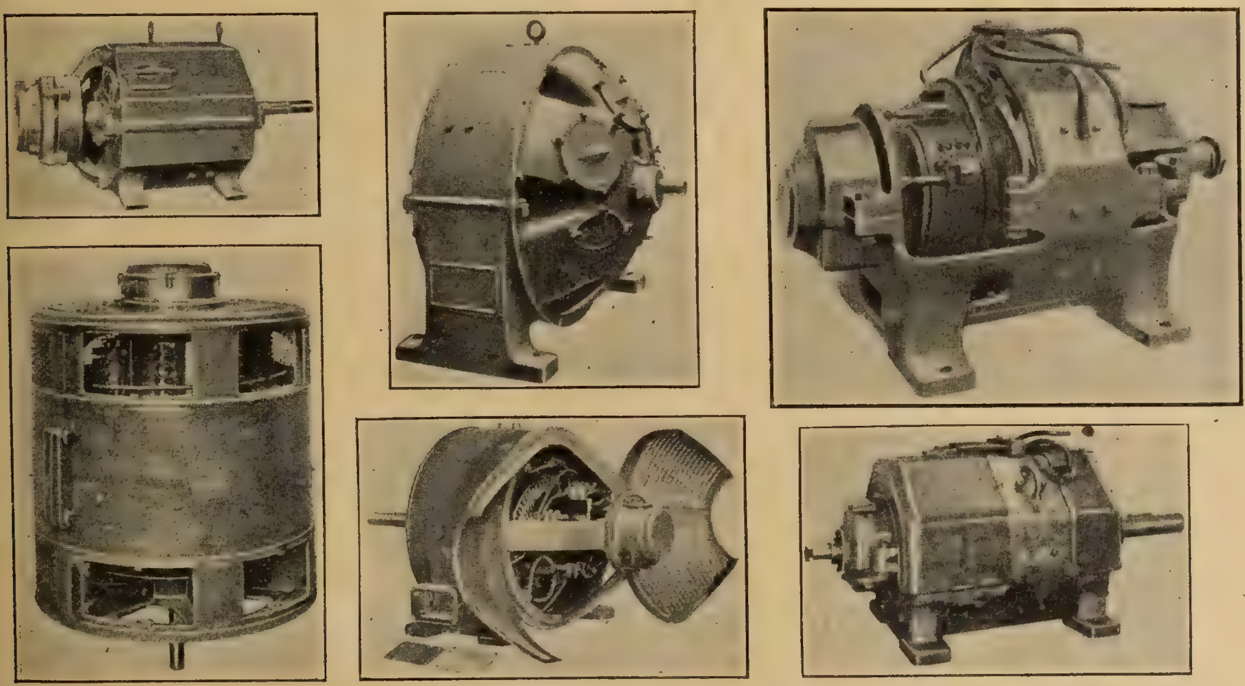


Fig. 9.—Sealchlight Distribution Switchboard.



Boat boom motor.

Forced-draught fan motor.

Coaling winch motor.

Bilge-pump motor.

Hull ventilation fan motor.

Anchor windlass motor.

Fig. 10.—Types of Motor employed on the Battleship *Moreno*.

The turret turning and gun elevating gear are operated by constant-speed motors, and speed variations are accomplished by mechanical means. Ventilation blowers in the turrets are similar to the regular hull ventilation fans, except for increased pressure. The independent hoists complete the electric power equipment of the turrets. The main ammunition hoists are operated by hydraulic power and the electric hoists are provided as an auxiliary. Two upper hoists are fitted in each of the six turrets. These are operated by 7.5-H.P. motors. One lower hoist is fitted in each turret, of which one is operated by a 7.5-H.P. motor and the other by 12-H.P. motors. As these equipments are generally similar in their operation only the 12-H.P. lower hoist will be described.

The apparatus consists of a contactor panel upon which are mounted the accelerating contactors, overload relay, current-limit relay, and voltage relay; the master controller located at the bottom of the hoist; the emergency controller located at the top of the hoist; the limit switch and rheostats. By means of automatic interlocks on the contactors the connections are regulated between the master controller, limit switch and emergency or upper controller; so that upon turning the master controller to the "on" position the disk brake releases and the motor starts. When the hoist, therefore, reaches its limit in either direction dynamic braking is introduced and the motor stops. When the operator at the top of the hoists desires to stop the hoist he turns the emergency controller to the "off" position, the contactors operate automatically and stop the motor. If the limit switch is now left in an intermediate position the motor will automatically start when the emergency controller is turned to the "on" position. If the limit switch has been turned to the "off" position by the hoist then the motor will not start until the master, or lower, controller is turned to the first controller notch. In case of overload, the overload relay through the interlocks will open the contactors automatically and stop the motor. The hoist cannot be started again until the operator returns the master controller to the "off" position, which permits the plunger of the overload relay to drop. It is necessary to unlock the reversing cylinder of the master controller mechanically in order to use the hoist for lowering. The connections for this operation are so arranged that the accelerating contactors and current-limit relays are inoperative, and suitable resistance is introduced in parallel with the armature and a large current capacity resistance connected in series with the armature and starting resistance, by reason of which the hoist will lower slowly. Other functions lowering are similar to those of hoisting.

The electrical anchor windlass acts only as an auxiliary to the steam windlass, and is designed to function at half the normal load of the steam gear. The outfit comprises a 100-H.P., 475-R.P.M., compound-wound, commutating-field motor of the open type, and is equipped with a disk brake; two watertight, drum-type, reversing master controllers, one mounted in the windlass room and one mounted on the weather deck; a contactor panel containing the accelerating contactors, a step-back relay, overload relay, a double-pole, single-throw disconnecting switch with field discharge clips, a small single-throw testing switch, and a low-voltage relay. The control is semi-automatic, *i.e.*, the first three speeds are controlled by the master controller, but beyond that the current-limit relays on the contactors will prevent them from closing until the current in each preceding one has been reduced to a predetermined amount, regardless of the position of the controller cylinder. The set-back relay will open the contactors in case the load should be increased beyond that for which the set-back relay has been set, and it will introduce all of the starting rheostat except two sections, thereby reducing the current to about 25 per cent. overload on the motor. The overload relay will be set considerably higher than the set-back relay, thus protecting the motor in case of excessive overloads. The overload relay is reset by bringing the controller to the "off" position. The armature and commutating field coils are permanently connected and, consequently, are reversed together. The low-voltage relay prevents the equipment from starting automatically after failure of current, requiring the controller to be brought back to the "off" position, whereupon the circuit will be re-established.

The Rontgen ray outfit is arranged for supply from a 220-volt D.C. circuit, and is located in the operating room adjacent to the sick bay.

A portable moving picture machine is an unusual feature; the apparatus is supplied by a 220-volt circuit, and the films are rotated by an adjustable speed 220-volt D.C. motor.

(*To be concluded.*)

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

12,103. "Method for localization of faults on electric cable networks." F. E. Frampton. August 23rd.

12,119. "Sparking plugs for internal-combustion engines." A. Watkins. August 23rd.

12,120. "Connectors for electrical conductors." A. Watkins. August 23rd.

12,133. "Electrical instruments." S. F. Palmer & Ferranti, Ltd. August 23rd (Complete.)

12,143. "Electrical switchgear." E. A. Graham. August 23rd. (Complete.)

12,150. "Connector for the adjacent portions of two or more wires, cables, or the like." A. H. Fargo. August 23rd. (Complete.)

12,151. "Connector or coupling for the adjacent end portions of two or more wires, cables, or other members." A. H. Fargo. August 23rd. (Complete.)

12,184. "Vapour electric devices." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.) August 24th.

12,193. "Insulators for electrical resistances and conductors." A. E. Woodhouse. August 24th.

12,201. "Electric alarm or calling devices used in telegraph receiving apparatus, and more particularly in wireless receiving apparatus." A. H. Morse & Indo-European Telegraph Co., Ltd. August 24th.

12,232. "Electric switches." B. L. Hutchison & A. Hutchison. August 25th.

12,240. "Sparking plugs and the manufacture of same." T. Crosbee and Sons, Ltd., & W. J. Spicer. August 25th.

12,246. "Systems of electrical distribution." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.). August 25th. (Addition to 4,133/14.)

12,252. "Electrolytic processes and apparatus." F. W. Gauntlett. August 25th.

12,253. "Secondary galvanic batteries." O. Oldham. August 25th.

12,256. "Thermic telephones and like instruments." R. Aernout, Baron van Lynden, & Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Mastschappij. August 25th.

12,267. "Controller and circuit making and breaking device having a closed field." L. Renault. August 25th. (Addition to 24,121/14. Convention date, August 26th, 1914, France.) (Complete.)

12,276. "Attachment of insulator-carrying arms to telegraph and like poles." Bullers, Ltd., & H. C. R. Dagnall. August 26th.

12,282. "Appliance for cataphoresis and anaphoresis by fixed electrode." J. T. Jameson. August 26th.

12,299. "Electric cable couplers." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.) August 26th.

12,301. "Electro-magnetic clutches." G. Gabet. August 26th. (Convention date, August 27th, 1914, France.) (Complete.)

12,309. "Electric switch apparatus." F. A. Rose. August 26th.

12,314. "Electrical instruments." S. F. Palmer, J. Denham & Ferranti, Ltd August 26th.

12,318. "Electric heating and cooking apparatus." C. G. Nobbs & W. W. Nobbs. August 26th.

12,340. "Electrical control systems." British Westinghouse Electric and Manufacturing Co., Ltd. August 27th. (Convention date, September 25th, 1914, U.S.) (Complete.)

12,343. "Apparatus and method for electric telegraphy." A. A. Govan. August 27th.

12,351. "Automatic electrical signalling on railways." W. A. Minchin. August 27th.

12,361. "Systems of electric ship propulsion." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.) August 27th.

12,379. "Electrically-operated mercury switches." G. Wilkinson. August 28th.

12,402. "Electric motor controllers." Electric & Ordnance Accessories Co., Ltd., & N. G. Langrish. August 28th.

12,404. "Telephone systems." E. V. Datzevitch. August 28th. (Complete.)

PUBLISHED SPECIFICATIONS.

1914.

4,526. Telephones particularly for use in Collieries and the like. A. Dootson. February 21st. (August 21st, 1914.)

11,629. Electrically-controlled Point-operating Mechanism for Railways and the like. R. V. Collins. May 11th. (Convention date not granted.)

11,630. Electric Railway and like systems. R. V. Collins. May 11th. (Convention date not granted.)

13,699. Apparatus for Electro-plating Wire and the like. V. F. Feeny. (Fabrik Elektrischer Zünder.) June 5th.

16,316. Telephone Installations in which the Subscribers' Lines are grouped according to the frequency of the calls. Siemens & Halske Akt. Ges. July 8th. (September 25th, 1913. Addition to 28,751/12.)

16,661. Means for pulling off Electrical Overhead Conductors or Contact Wires. Siemens Schuckertwerke Ges. July 13th. (July 12th, 1913. Addition to 30,045/13.)

16,860. Protective Arrangements for Electric Installations. Siemens Schuckertwerke Ges. July 15th. (July 15th, 1913.)

17,379. Automatic Protective Devices or Cut-outs for Electric Circuits. Siemens Schuckertwerke Ges. July 22nd. (July 23rd, 1913.)

17,548. Arrangements for Regulating the Working of Electric Hauling or Winding Machinery. Siemens Schuckertwerke Ges. July 24th. (July 26th, 1913.)

17,602. Controlling Devices especially applicable for use with Electrically-operated Printing and Stamping Machines. M. Rockstroh. July 24th (Addition to 4,678/10.)

17,755. Writing or Copying Telegraphs. Telepantograph Ges. July 27th. (July 28th, 1913.)

17,763. Electrolytic Production of Alkali Metals. T. F. Johnson (Badische Anilin and Soda Fabrik). July 27th.

18,261. Motor-starting Rheostat. G. M. Johns. August 7th.

18,442. Electro-magnetic Unlocking and Unscrewing Apparatus for Miners' Lamps. O. Oldham. August 8th. (Addition to 2,249/14.)

18,504. Electric Igniting Apparatus for Gas Burners. C. C. Carpenter. August 10th.

18,509. Electric Switches. B. P. Swyers. August 10th.

19,506. Electric Condensers. W. H. Wilson. September 7th. (Cognate application, 3,660/15.)

19,729. Electric Incandescent Lamps. Deutsche Gasgluhlicht Akt. Ges. (Auerges). September 12th. (September 13th, 1913.)

20,374. Electric Discharging Tubes. B. Donath. September 30th. (October 10th, 1913.)

20,556. Switch for Testing Telegraph Lines. E. D. Gledall. October 5th.

21,650. Composite Conductor Cables and method of making same. E. C. R. Marks (Aluminium Co. of America). October 28th.

22,113. Overhead Conductor Arrangements for use at Cross-overs or Switches on Electric Railways or the like. C. B. Burdon (Siemens Schuckertwerke Ges.). November 6th.

23,170. Electric Sound for Detecting Presence of Metallic Bodies in Living Animal Tissues. D. Findlay. November 27th.

23,272. Electric Switches. J. H. Tucker & J. A. Crabtree. November 30th.

23,486. Electric Insulators. C. B. Burdon (Siemens Schuckertwerke Ges.). December 3rd.

1915.

611. Electrical Telegraph or Telephone Vibrators or Buzzers. A. H. Nicholson. January 14th.

2,370. Fusible Electric Cut-outs. J. Kluijtmans. February 15th.

2,482. Systems of Electric Distribution and Control. R. E. Hellmund. February 16th. (February 19th, 1914.)

3,007. Protrudable Receiver for Subaqueous Signalling. Signal Ges. February 24th. (February 25th, 1914. Addition to 16,298/13.)

3,985. Synchronising System, particularly applicable to Multiplex Telegraphy. P. M. Rainey. March 13th. (March 26th, 1914.)

7,964. Electrical Cooking Apparatus. Deutsche Gasgluhlicht Akt. Ges. (Auerges). May 28th. (December 12th, 1914.)

8,672. Alternating-current Motors of the Commutator Type. British Westinghouse Electric & Manufacturing Co. (Westinghouse Electric & Manufacturing Co.). June 11th.

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Vol. LXXVII.] CONTENTS: September 17, 1915. [No. 1,973.

Page
The War and Russian Electricity Supply 353
The Wire-Drawing Industries 354
Rubber 355
Co-operation between Engineers and Contractors 355
Lighting of Factories 355
A Simple Sterilising Equipment (*illus.*) 356
Lighting in Factories and Workshops 356
The British Association.—II. 358
  Economics and the War 359
  Industrial Harmony 360
  Presidential Address to the Engineering Section, by H. S. Hele-Shaw (*illus.*) (*concluded*) 361
  Thermal Efficiency of a Gas Engine 365
  A Gas-Producer for Steam Boilers 365
Correspondence—
  The A E G. Meeting 365
  Electric Power in India 365
  Lighting Developments 366
  Increased Charges and Special Contracts 366
  Church Lighting 366
  Wrinkles on the Operation of Alternators 366
War Items 366
Business Notes 367
Notes 372
City Notes 374
Stocks and Shares 376
Market Quotations 376
Electric Vehicles in Laundry Service (*illus.*) 377
Field Telephones, by C. R. Darling (*illus.*) 377
The Electrical Equipment of the Argentine Battleship *Moreno*, by H. A. Hornor (*illus.*) (*concluded*) 380
Trade Statistics of India 381
New Electrical Devices, Fittings and Plant (*illus.*) 382
Our Legal Query Column 383
Foreign and Colonial Tariffs on Electrical Goods 383
New Patents Applied for, 1915 384
Abstracts of Published Specifications 384
Contractors' Column ... ... Advertisement page xx

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THE WAR AND RUSSIAN ELECTRICITY SUPPLY.

THE taxation of electricity is by no means a new project in Russia; indeed, it was first proposed at a time when the total consumption of electrical energy was so small that the tax simply languished for lack of victims. Considerably later, after the war with Japan, the proposal was revived, for by that time the Russian electrical industry had become too extensive to escape this unwelcome attention. Statistics showed the total output of Russian central stations to be 500,000,000 KW.-hours in 1905 and, though this estimate was probably much exaggerated, it encouraged the Minister of Finance to introduce in 1906-7 proposals for the taxation of electrical energy. These proposals were held to be equitable, seeing that users of petroleum (very extensively used for lighting purposes in Russia) had to pay a tax of about 5½d. per gallon. Without going into the ethics of taxing any artificial lighting medium, whatever its nature, or the detrimental effect of such a tax on public and private electric lighting, it is obviously a very serious matter to tax electricity for motive power, and, largely due to the energy with which the Société Impériale Technique demonstrated the disastrous influence of such a tax on Russian industry, the Government relinquished its proposals to tax power current but retained for a time a tax of 1d. a unit on lighting current. Subsequently this tax also was abandoned, but now, under the stress of circumstances, which compel advantage to be taken of every resource of the country, taxation of electrical energy seems inevitable.

So long ago as last February, the Electrotechnical Committee of the Société Impériale Technique conferred with representatives of the electrical and other industries of Russia, concerning the problems raised in the electrical field by the war, and particularly concerning this question of taxation. Investigation was made of the quantity of electrical energy produced. According to *Le Génie Civil*, it was found that the annual receipts of 102 stations consulted amounted to £2,500,000. The four large stations of Baku, Lodz, Moscow and Petrograd contributed £1,400,000 to this total, and their output alone amounted, in 1913, to more than four times the 1905 total for all Russia. This is shown by the subjoined figures in which line (A) refers to all Russian stations in 1905, and line (B) refers to the output of Baku, Lodz, Moscow and Petrograd stations in 1913.

Kilowatt-Hours for :—

	Lighting.				
	Private.	Public.	Power.	Tramways.	Total.
(A)...	40,023,700	9,676,800	25,581,000	19.726,500	95,007,000
(B)...	75,151,000	6,906,500	207,083,000	89,695,800	378,836,500

With the exception of the largest cities, electric lighting is little developed in Russia, being sparingly used in large towns and very rarely in villages. The incidence of taxation on electricity would, therefore, be chiefly on energy used for power and traction.

Two immediate effects of a tax on current for lighting would be reduction in the amount of lighting, and the adoption of high-efficiency lamps. Both of these developments would be very injurious to Russian central stations (though the latter would prove beneficial in the long run), and would probably reduce the yield of the tax far below official expectations. The public lighting tariff in Moscow was about 3d. a unit in 1905, but it had fallen to 1⅛d. in 1913, with supplementary supply at ½d. to ¾d. a unit. It would therefore be necessary to reduce public lighting by 50 per cent. or more to keep within the expenditure allocated to this service, supposing a tax of 1d. a unit to be imposed. Though precise data are not available on this point, there are in use in Russia many old and inefficient lamps which would surely be replaced at the earliest opportunity by tungsten and half-watt lamps under the spur of a tax on lighting current. Of course, it can only be a matter of a year or two at most before Russian central stations have to face this problem in any case, but no doubt a lighting tax would hasten the crisis and make it much more acute. By using the latest lamps the consumer could still effect economy, the tax notwithstanding, so that the immediate burden of taxation would virtually be thrown on the lighting revenue of the central station.

The system of taxation applied to petroleum cannot be applied directly to electricity. The cases are fundamentally distinct. Oil can be stored, transported, and used at any time and place. Its producers have no concern as to when and where it will be used; the cost of production is independent of the duration of consumption, and what costs so much a gallon to produce may fairly be taxed by the gallon. With minor reservations, however, electrical energy must be produced as it is consumed, and costs depend essentially on the rate of consumption at a given moment within the restricted area supplied by the generating station. Much capital is locked up in equipment which is idle, but still a source of expense, during the greater part of each day, and on top of these (normal) unfavourable conditions there are the scarcity of liquid capital and the dearness of credit to make the present position of Russian central stations particularly unenviable.

Taking all these facts into consideration, the Société Impériale Technique has urged the Government to consider that the total possible revenue from taxation of lighting current is relatively unimportant, but that if its imposition be regarded essential:—(1) Its amount should in no case exceed 10 per cent. of the normal price of energy; (2) discrimination should be made between different classes of lighting; (3) all possible steps should be taken to avert decrease in present consumption, and as little check as possible should be placed on development. In the last-named connection reduced taxation is considered essential in small communities where electrical energy is still little employed, but where its healthy development is of national importance.

The Société, therefore, proposes the following interesting scheme: In capital cities, assuming average prices of 1¼d., 2½d. and 5d. per unit for lighting street, works and other buildings respectively, the tax to be 10 per cent., *i.e.*, 0·125d., 0·25d., and 0·5d. per unit respectively. In smaller communities, to allow for the fact that generating costs are inversely proportional to population, whilst the "solvency" of consumers is directly proportional thereto, the tax should be adjusted in accordance with population, and should be:—

8 % on the price of energy in towns with	...	Over 100,000	inhabitants.
6 % " " "	...	Between 40 and 100,000	"
5 % " " "	...	" 25 " 40,000	"
4 % " " "	...	Less than 25,000	"

These proposals, which do at least make as reasonable as possible a scheme of taxation for which little can justly be claimed, seem likely to yield quite as much revenue, while causing far less dangerous disturbance to industry than the Government's proposal to levy a 30 per cent. tax on all electrical consumption. Such an impost would certainly be disastrous, and would have far-reaching effects, not only on Russian electrical development itself, but also on the many British interests associated with the latter.

Apart from the fact that taxation on any means of lighting is inherently objectionable, whilst that on energy for industrial purposes is obviously yet more short-sighted, there are plenty of minor matters for contention. Presumably, meters will have to be installed on all consumers' premises, even where private generation is practised, and it is said that the authorities have no great faith in meters, though their distrust is, of course, unfounded, for the ½ per cent. or so error in a good modern meter involves only about ⅛d. in the £ on the energy bill, and the advantage may lie with, as often as against, the State. Then, again, there is a strong body of feeling against taxing any current used to safeguard industrial security, to improve workmen's dwellings, or in philanthropic institutions or hospitals—and these very commendable reservations naturally pare down the possible revenue very considerably. It seems hardly possible that more than £300,000 or £400,000 a year could be levied on the basis of a pre-war consumption, and under existing circumstances, and allowing for exemptions and the throttling effect of the tax itself, probably the returns would be much smaller. Surely any attempt to tax electricity is thoroughly bad business—the possible returns are so small and the undoubted objections so great.

On top of the difficulties with which they are threatened by taxation, Russian central stations have had to contend with great shortage in fuel supply. For many months it has been impracticable to deliver English coal as usual to Petrograd, Moscow and other centres, and the shortage of railways and rolling stock, aggravated by extreme military congestion, has made it most difficult to distribute coal from native mines, particularly from the Donetz district. The central stations of Petrograd, which generally use Cardiff coal and were kept supplied for a time, contemplate a return to naphtha firing. The latter was first adopted in 1901-2, when liquid fuel cost only 36s. a ton, but it was later abandoned owing to abnormal rises in the petroleum market. Though the crisis is said to be so acute that it may be necessary to suspend the working of the electric tramways, there is good reason to suppose that these conditions are quite temporary. The opening of the Dardanelles, which we all hope to see accomplished in the near future, would at once ease the situation and immeasurably improve the industrial position of Russia. Were reversion to be made to oil firing in Petrograd and other stations, it does not seem likely that existing transport difficulties would be overcome or that the use of liquid fuel could be continued once the present crisis had passed. The more serious problem, and the one which will have enduring influence on Russian station development and so on the whole course of industrial expansion, is that of taxing electrical energy. Bearing all facts in mind, it is hard to believe that the game could possibly be worth the candle, but if the tax is to be imposed let us hope—if only for selfish reasons—that it will be on a conservative basis and be removed at the earliest opportunity.

The Wire-Drawing Industries.

The pressure which has existed in the wire-drawing industries during the past 12 months has not eased perceptibly during the present month. The Government demands continue to tax heavily the resources of the works throughout the country, while a fairly large proportion of the private consumers' requirements are being supplied by American wire-drawing manufacturers direct, and in some cases indirectly through British agencies.

There is little doubt that the American wire-drawing firms are benefiting considerably from the stoppage of German supplies into this country, and the extra demands consequent upon the requirements for war purposes. Provided that no artificial restrictions are experienced in the copper market in the near future, a continuance of such satisfactory results may be reasonably looked for in America for some time to come.

As a result of the more efficient system under which recruiting is being conducted at the present time, intending recruits who are skilled in any branch of munition work are not accepted for service at the Front so readily as in the past, but are persuaded, usually without the necessity of authoritative pressure, to return to their duties in the workshop. This improvement in the recruiting system should soon produce a decidedly beneficial effect in the wire-drawing works, where so much disorganisation has been caused by enlistments in the Army and Navy.

Rubber.

A faint but welcome glimmer of hope has set in in the rubber market, where indications of a reviving demand have stayed the drooping tendency of prices. The market has been quite firm on the whole, and the variations in value have been of little moment. Dealings in both spot and forward positions have shown more animation and the demand for America has been a prominent feature. The August statistics show an increase in the warehouse stocks of plantation rubber of over 1,200 tons, totalling 6,985 tons, as compared with 5,744 tons in August of last year, while the arrivals during the month were 4,903 tons against deliveries of 4,614 tons. The rubber yield of the Amazon Basin showed a diminution during the year ended June 30th, 1915, as compared with the previous year, the total entries being 35,305 tons, against 39,115 tons in 1913-14, a decrease of 9·7 per cent., which was almost entirely accounted for by the very market diminution of the output of caucho from all sources, the production of this grade alone falling short of that of the preceding crop to the extent of 3,821 tons. The Amazon crop for 1915-16 is estimated at fully 37,000 tons, or about 5 per cent. in excess of that of the crop year just ended, this figure allowing for an increase of, approximately, 10 per cent. of up-river and 5 per cent. of islands, and a further increase of 15 per cent. in caucho. An important element in the production of rubber in the present crop year is a considerable increase of skilled labour available in the Amazon Basin and the development of the cultivation of food-stuffs in the rubber district, and the more economical methods of business in the local markets all justify hopes of a considerable improvement in the exports of plantation rubber. The exports of rubber from the Federated Malay States during August amounted to 3,796 tons, as compared with 3,687 tons in July last, and 1,850 tons in the corresponding month of last year. The following table shows the export month by month for three years :—

	1913.	1914.	1915.
	Tons.	Tons.	Tons.
January	2,131	2,542	3,473
February	1,757	2,364	3,411
March	1,737	2,418	3,418
April	1,626	2,151	2,777
May	1,225	2,069	2,708
June	2,005	2,306	3,403
July	1,781	2,971	3,687
August...	2,363	1,850	3,796
Total	14,625	18,671	26,673

Co-operation between Engineers and Contractors.

Two papers dealing with co-operation between central stations, contractors, and dealers in electrical supplies have been read recently before the California Association of Electrical Contractors and Dealers, respectively by Mr. S. V. Walton, manager of the commercial department of the Pacific Gas and Electric Co., and Mr. W. L. Goodwin, vice-president and general sales manager for the Pacific States Electric Co.

Mr. Walton prefaces his remarks with the truism that "Co-operation in order to amount to anything must directly benefit the co-operators, and before one would-be co-operator can benefit another he must know him and know something about his problems."

Some of the attempts which have been made in the past to arrive at some working co-operative system have failed, possibly because of a lack of confidence between the parties, and Mr. Walton points out that it is essential to success that "there shall be a fairly good understanding of each other's problems, a feeling of confidence on the part of each that the other intends to play the game fairly with all the cards on the table, and that there should be mutual desire to work harmoniously together, each respecting the interests of the other. Only in this way can the interests of both parties be best served, and the industry as a whole benefited." He observes that from the by-laws of the California Association it is evident that the Association believes in such a policy. One of the by-laws reads as follows :—

> It is fully recognised that the economic and proper channel of distribution of electrical supplies is through the electrical supply jobber to the dealer and contractor, who in turn serves the consumer. The dealer and contractor is the natural channel for distributing various electrical devices to the consuming public.

The recognition of the principle embodied in these by-laws is a cause for which the British Electrical Contractors' Association has struggled for many years, and it has succeeded to some extent in securing the co-operation of electrical manufacturers.

The contractors have not, however, been quite so fortunate in dealing with the supply authorities, and, to judge from the papers read before the California Association, the American contractors have been equally unsuccessful, as will be seen from the following quotations from Mr. Goodwin's paper :—

> We have had very little encouragement from the central stations generally, and, to my mind, the central station is the one branch of the industry which controls the entire situation. . . . In many sections of the country the central station management assume the attitude that they alone are concerned in the success of the industry . . . and, as the result, a most demoralised position presents itself in such localities. . . . The policy on the part of the central station has been such as would offer no encouragement to either contractor or dealer. The insane desire to increase their load has been at the cost of almost every other branch of the industry. Unless the central station management recognises that the business of the contractor and dealer is just as legitimate as his own, and that they should both work together for each other's interest, antagonism on the part of each is bound to result.

We think that the above quotations, which represent the attitude of many of the American supply authorities, very nearly represent the attitude of a section of the supply industry in this country also.

There is, however, another side to the question, namely, that central station managers are not going to sit quietly in their offices waiting for the load to build up, if the contractors are not playing their part in getting all the custom that it is possible to obtain. It should be quite possible for the two sections of the industry to co-operate to their mutual benefit, but this cannot be done without first establishing mutual confidence.

Lighting of Factories.

The Departmental Committee appointed by the Home Office to investigate this question has been a long time at work, having been constituted more than 2½ years ago; but it must be admitted that the subject was one of extreme difficulty and complexity, and we are not disposed to reproach the Committee on the score of undue delay. On the contrary, we think it has followed a wise course in publishing the results which have already been obtained, without waiting for the completion of the inquiry, which may not be reached for years to come, in view of the conditions that now prevail.

There can be few questions that present a wider range of variable quantities to be taken into consideration than that with which the Committee was concerned, and the endeavour to arrive at definite concrete conclusions must at times have proved almost disheartening. Every workshop presents a set of conditions nowhere else precisely paralleled; natural illumination varies from morning to evening, and sometimes from minute to minute, over an extraordinarily wide range, and is subject to a variety of modifying circumstances, while to the vagaries of artificial lighting there is absolutely no limit; fortunately, the wonderful power of accommodation of the human eye enables it to adapt itself so as to neutralise these variations to a very great extent, and the Committee concluded that in the meantime it might confine its work to the definition of the lower limit of illumination beyond which the eye could not be expected to fulfil its functions satisfactorily. We are pleased to note that the average practice is already far in advance of the statutory minima suggested by the Committee, and the latter will, therefore, affect only the bad cases.

The importance of good lighting has been abundantly emphasised in our pages, on the score not only of prevention of accident, but also of economy and efficiency, and we commend the report to our readers as being worthy of the closest study; the appendices contain a mass of information, much of which is entirely new, and which ought to be in the hands of every engineer and contractor concerned with electric lighting.

A SIMPLE STERILISING EQUIPMENT.

The sterilising power of ultra-violet rays has been long established, and the only novelty in the equipment sketched in the accompanying figures lies in the simplicity and effectiveness of the means by which water is made to flow in a very thin sheet across a zone of intense ultra-violet radiation immediately before it is drawn off for use. The arrangement is due to Mons. Billon-Daguerre, and was described a short time ago before the Académie des Sciences. The simplicity and effectiveness of the apparatus are such that it should be very useful for military purposes, the sterilising tank being mounted on a motor-car, the engine of which drives a dynamo feeding the lamp whilst sterilisation is in progress. Besides this important special application, the equipment is applicable to any other case where pure water is required.

Instead of drawing water off indiscriminately from a tank full of more or less completely sterilised liquid, a Tee-shaped outlet pipe P, fig. 1, is used. This is of pure transparent quartz, and has a horizontal window or slot W, so that liquid drawn off at O has to pass in a thin sheet over the surface of a mercury vapour lamp L, and is thus subjected to maximum ultra-violet action. To deal with large quantities of water, say, 1,000 to 2,500 gallons per hour, the intake of the outlet piece is provided with a slot on each side, and two quartz-mercury lamps are used as shown to the right of fig. 1. These lamps may consume about 4 amperes and be used in series on a 100-110-volt circuit (the actual lamp P.D. being about 43 volts each). The gross energy consumption thus works out at about 0·2 KW.-hour per 1,000 gallons sterilised, and the cost of treatment is negligibly small.

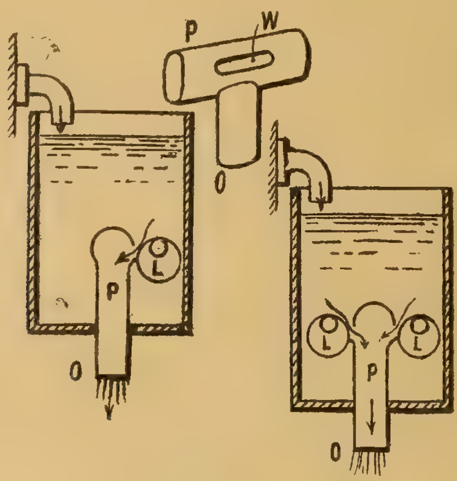

Fig. 1.—Details of Sterilizer.

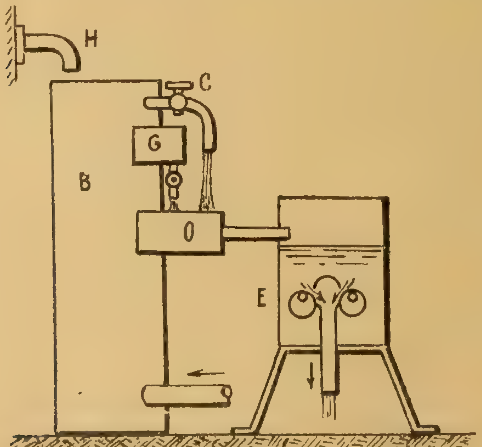

Fig. 2.—Method of Testing the Apparatus.

Severe tests have been carried out on this apparatus, taking water from the Seine below Paris, passing it up through a sand filter in a tank B, fig. 2, and mixing it in a tank O, with a culture from an auxiliary tank G containing bacillus coli, cholera vibrio, tuberculosis germs and various ferments. This frightful mixture left the tank E perfectly sterilised at the rate of 2,200 gallons per hour with a power consumption of 440 watts. After 3,000 hours' continuous operation there was no appreciable reduction in the germicidal efficiency of the lamps, and no calcareous or other deposits had formed on either the lamps or the outlet pipe (no doubt owing to the scouring effect of the rapid water flow). The economy of the process and the simplicity of the equipment are remarkable.

LIGHTING IN FACTORIES AND WORKSHOPS.

The Committee appointed by the Home Office in 1913, to inquire into the conditions necessary for the adequate and suitable lighting (natural and artificial) of factories and workshops, reports* that it has held 38 meetings and examined 50 witnesses, besides obtaining great assistance from Trade Associations representing both employers and operatives, and from H.M. Inspectors of Factories. The inquiry was limited in the first instance to the textile, engineering, and clothing trades, and several tours through industrial parts of the country were undertaken during the winter of 1913-14, 86 works being inspected. Before these visits took place, measurements of illumination were made in many of the workshops, the tests aggregating about 4,000 in number, and relating to 163 rooms in 57 factories; the data thus obtained, together with particulars as to the dimensions of the rooms, sizes of windows, and the number and nature of the light sources installed, have been published in full separately,† together with the notes made by the Committee, and a summary of the results is appended to the report.

A series of experiments was also made in a room set apart for the purpose at the National Physical Laboratory, in which the nature of the lighting and the degree of illumination could be varied at will; details of these experiments are given in an appendix.

As a preliminary step, the Committee draws attention to the important distinction between *illumination* and *surface brightness*, pointing out that the former is measured by the amount of light received on the surface of an object, while the latter is measured by the amount of light returned from the surface, and is always less than the former (unless the body is itself luminous). The difference may be very great, as in the case of a black floor or foundry sand, which returns very little of the incident light. The Committee considers that the only rational criterion of the adequacy of lighting is the actual illumination at the place where work is being carried out, or the floors of passages, &c., and states that the practice of taking as a criterion the candle-power per square foot of floor area is not correct; nevertheless, as will be seen later, this is the method which it adopts in its present recommendations.

The Committee summarises the factors in good lighting as follows:—

(*a*) Adequacy.

(*b*) A reasonable degree of constancy and uniformity of illumination over the necessary area of work.

(*c*) The placing or shading of sources so that the light from them does not fall directly on the eye of an operative when engaged in his work, or when looking horizontally across the workroom.

(*d*) The placing of lights so as to avoid the casting of extraneous shadows on the work.

While all these factors are of great importance, and should receive special attention in the design of lighting installations, the Committee confines its attention in the present report almost entirely to the adequacy of the illumination.

There are at present no general provisions in the Factory Acts of the United Kingdom with regard to lighting, although heating and ventilation have been dealt with; on the other hand, the codes of all the chief European countries, the United States, and India contain such regulations, which are summarised in an appendix to the report.

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* First Report of the Departmental Committee on Lighting in Factories and Workshops, Vol. I, (cd. 8,000) of Session 1915.

† Results of Observations of Illumination in Factories (Stationery Office Publication).

The present lighting of factories is next discussed under the heads of natural and artificial lighting. In the case of the former, roof lighting is obviously the best, and it is stated that the illumination thus obtained with a good system is very uniform, and may be from 2 to 10 per cent. of the outdoor illumination. In many cases, however, lateral illumination only can be provided, and in the case of wide rooms may be inadequate in places, while it is far from uniform. Unsatisfactory illumination is also met with in the case of old and unsuitable buildings which have been converted into workshops, and where the light is obstructed by external or internal means; whitewashing the walls of adjoining buildings or the adoption of special reflectors, &c., to some extent rectifies the trouble, and in some cases much can be done to improve the lighting by taking care that articles are not stored near the windows. Dirty windows, walls, and ceilings are frequently met with, and these causes of inadequacy of illumination can generally be remedied at a minimum of expense.

Where daylight is insufficient, it may be supplemented by artificial light, but there is a consensus of opinion amongst the witnesses, with which the Committee concurs, that conditions entailing the continuous use of artificial light are unnatural and entail greater strain on the workers. There are many devices by which additional daylight can be secured, and in overshadowed rooms the fullest use ought to be made of these. There are no easy means of solving the question what is the minimum amount of daylight in which operatives should be allowed to work continuously; the ordinary conventions, in terms of the ratio of window area to floor space, fail to take all the conditions into account, and a standard in terms of foot-candles would be unsuitable.

With regard to artificial lighting, the chief causes of unsatisfactory illumination include the provision of too few or too weak light sources, the use of antiquated systems of lighting (which are also extremely uneconomical), inadequate supply of gas or electricity at times of maximum consumption, neglect of upkeep, obstruction (as, for instance, where the sources are situated over travelling cranes, which, however, in some cases carry lamps travelling with them), and shadows cast by the source being improperly situated.

The effects of unsatisfactory illumination in causing accidents, and injury to eyesight and health, have been investigated, and it has been found that the percentage of accidents due to persons falling is higher in winter than in summer; in addition, the proportion of accidents is far higher with artificial than with natural lighting. Little evidence of injury to eyesight or health has been obtained. The lack of good lighting, however, is responsible for the accumulation of dirt and the encouragement of idling, and the effect of improved lighting on the quantity and quality of the work, as well as the earning power of the workers, has been shown to be very marked.

Reviewing the evidence, the Committee finds that there is a general agreement as to the economic and hygienic advantages of adequate and suitable illumination, and points to the great improvement in industrial lighting which has taken place in recent years in support of this opinion; in the designing of modern factories good lighting is now regarded as one of the most important factors contributing to industrial efficiency.

The visits paid to factories have enabled the Committee to realise the contrast between the depressing effect of dark surroundings and the cheerfulness of a brightly illuminated workroom, and the vast difference in the working lives of the operatives that must result from continual employment under the respective conditions. The necessity of prescribing adequate lighting in factories and workshops has long been recognised abroad, and the Committee feels that while it is difficult to define standards, it is justified in recommending that a requirement in general terms be applied to all factories and workshops. Standards can be laid down only when the special conditions of each industry have been inquired into, and therefore if standards are to be established, the Secretary of State should have power to prescribe them by order.

The Committee therefore recommends that:—

1. There should be a statutory provision:—

(*a*) Requiring adequate and suitable lighting in general terms in every part of a factory or workshop, and

(*b*) Giving power to the Secretary of State to make orders defining adequate and suitable illumination for factories and workshops or for any parts thereof or for any processes carried on therein.

It is necessary to indicate more precisely what is conveyed by the term "adequate lighting." Broadly, the illumination may be said to be adequate and suitable provided that:—

(i) It is sufficient for the proper carrying out of the work both as regards quality and output, and

(ii) There are no lighting conditions prejudicial to the health, comfort and safety of workers.

In order to satisfy these requirements, the illumination should comply with the requirements tabulated on the previous page. Special emphasis is placed upon the avoidance of "glare," of excessive contrast, and flickering lights.

The next question is the desirability of specifying the amount of illumination implied in the terms "adequate and suitable." Owing to the great progress that has recently been made in the appliances for measuring illumination, it is now practicable to specify numerical values in a manner that would hardly have been possible some years ago.

It is therefore proposed to specify the minimum intensity of illumination desirable, from the standpoint of general convenience and safety, in parts of the workshops where work is normally carried on, and in yards, passages and open spaces along which people are ordinarily liable to pass.

Though the intensity of the light at the working plane is the most important factor of adequacy and suitability, it is by no means the only one to be considered; each trade, or even each process, must be considered on its merits, and this has not yet been done. The Committee therefore deals only with the more general illumination of the factory or workshops as a whole, under three heads:—

(*a*) The illumination of workrooms or parts of workrooms where work is in progress, that is, of the *working area* of the factory.

(*b*) The illumination of passages, stairways, &c., and places in factory premises over which persons are liable to pass, but which are not parts of *working areas*; and

(*c*) The illumination of open yards and approaches.

The following four recommendations are made under these heads:—

2. Over the "working areas" of workrooms the illumination measured on a horizontal plane at floor level shall not be less than 0·25 foot-candle, without prejudice to the illumination required for the work itself.

3. In all parts of foundries in which work is carried on or over which any person is ordinarily liable to pass, the illumination measured on a horizontal plane at floor level shall not be less than 0·4 foot-candle.

4. In all parts of factories and workshops (not included under recommendation 2) over which persons employed are liable to pass the illumination measured on a horizontal plane at floor level shall not be less than 0·1 foot-candle.

5. In all open places in which persons are employed during the period between one hour after sunset and one hour before sunrise, and in any dangerous parts of the regular road or way over a yard or other space forming the approach to any place of work, the illumination on a horizontal plane at ground level shall not be less than 0·05 foot-candle.

These values are suggested without prejudice to the special illumination required for the carrying out of the work, which naturally varies greatly according to the nature of the operations.

In order to meet exceptional circumstances in which the standards proposed in Recommendations 2-5 might cause hardship, in Recommendation (6), provision is made for exemption of individual cases, and of factories to which the above requirements could not be applied, and the case of shipbuilding yards is to receive separate consideration. Finally, in Recommendation (7), suggestions are made for the periodical cleaning of windows. In conclusion, the Committee points out that the minimum values prescribed are considerably lower than those proposed by many witnesses and are also lower than those found to exist in the majority of factories visited. In many cases manufacturers would naturally prefer to provide a substantially higher value than that indicated. The intention has been to propose values which can be adopted as a practical legal minimum without causing hardship, and would serve the purpose of raising the level of illumination in those factories which are behind modern practice, in regard to methods of illumination. In view of the diversity which always exists whatever the system of lighting, any minimum value will usually connote a very much higher maximum and average, and with a given minimum the efficiency of the illumination depends to a large extent on this diversity. In the great majority of factories the standards of general lighting suggested would be inadequate for the actual machines and work-benches, and local lighting in addition is generally essential.

The Committee did not feel justified in drawing any distinction between direct, indirect and semi-indirect lighting, nor between systems which differ in the colour composition of the light. Similarly the standards are intended to apply equally to natural and artificial lighting; that is to say, when the natural illumination falls below the prescribed limits, it must be supplemented or replaced by artificial illumination.

The data given in the appendices will be of service to those engaged in designing new factories and in examining the adequacy of lighting in existing buildings. At present there are few collated data of this character available, and the desire not to withhold them longer from publication is a further reason for the submission of a preliminary report at this stage.

Adequate artificial lighting is an important matter in the utilisation of factories for night work, and a close connection appears to exist between the lighting conditions and the quality and output of work. The information contained in the report should, therefore, be of special interest at the present moment, when many factories are working overtime, and preparations are being made for the period of the year when artificial lighting is mainly required.

The appendices, which constitute the bulk of the volume, contain a great store of information, most of which is of a character hitherto unobtainable. Amongst the "processes requiring exceptionally good light" on account of fineness of the work, are included letterpress printing, machine and fitting-shop processes, and the manufacture of scientific apparatus and glow lamps; and for the avoidance of accidents, power-press processes and iron foundries. Processes involving exceptional exposure to glare include electric welding (causing "welders' rash," an affection similar to "snow blindness"), electric glow lamp sealing and testing, carbide of calcium furnaces, the generation of electricity and testing of electrical apparatus, and various processes in which the position of the light source is unfavourable. Workshops in which the lighting is often inadequate include smiths' shops in engineering works, foundries, metal stamping works, and sawmills. A variety of special means of lighting employed in particular processes, such as white reflecting surfaces, white tissue paper to diffuse the light, &c., is tabulated.

The experiments made at the National Physical Laboratory led to some very interesting results; workpeople—mainly seamstresses—were employed under a variety of conditions, and the degree and kind of illumination which they found satisfactory were ascertained. For work on white stuff, $1\frac{1}{4}$ ft.-candles was sufficient, but for purple 2 ft.-candles was necessary, and when working on black materials not less than 4 ft.-candles sufficed, while five to six was necessary for comfort. These figures were obtained with direct lighting; tests were also made with indirect lighting, and in every case it was found that an increase of 40 per cent. or more in the illumination was required to give the same degree of comfort in working. Further experiments on this point showed that the visibility of fine detail depended upon the variation of the surface brightness over the raised portions of the pattern due to changes in the angle which such surfaces made with the direction of the incident light, and upon the shadows cast on the background by the raised portions of the pattern. Both of these effects depend upon whether the light comes from a single direction or from a number of widely different directions. In the case of direct lighting, while the coefficient of reflection of the surfaces tested varied from 80 to $3\frac{1}{2}$ per cent., the surface brightness which gave a standard degree of visibility of detail remained almost constant between the limits 0·027 and 0·033 ft.-candle, the average being about 0·030. When experiments were made on samples of calico, dyed from very light to very dark blue, it was found that the illumination had to be increased from 1·4 to 12 ft.-candles, while the surface brightness ranged only between 0·62 and 0·9 ft.-candle, with an average of 0·73, in the case of one observer, the values being somewhat lower in the case of another.

The Committee concluded that for equal visibility there must be constant surface brightness; the visibility of detail depends upon the unidirectional character of the light; and work such as sewing on the darkest materials requires not more than 5 to 6 ft.-candles (direct lighting).

A long appendix is devoted to the summary of data obtained from observations of daylight and artificial illumination in factories. The floor illumination by artificial light was found to range about equally above and below 0·4 ft.-candles in foundries, 0·6 in engineering shops, 0·4 in weaving sheds, and 0·6 in spinning mills. The illumination on the work in engineering shops was very variable, but tended towards middle values of 1·6 ft.-candles for machine work, 1·85 ft.-candles for bench work, and 1·0 ft.-candle for heavy work.

THE BRITISH ASSOCIATION—II.

The British Association meeting in Manchester, the opening stages of which were reported in our last issue, continued until Saturday last. The meeting was shorter than usual on account of the war, and, as was only to be expected at a time like this, the titanic conflict now waging in Europe affected the proceedings in quite a number of ways. The attendance of members was down substantially, although it was greater than appeared likely at one time. Many persons known by name and by repute were absent, some being engaged on war work of various sorts either in this country, in Flanders, or at Gallipoli. References to the effect of the war on the Association's activities were frequent, both in the addresses of the presidents of Sections and in the papers and discussions; there were no social functions; and, lastly, one noted here and there that a khaki-clad officer would hurry into a Section, have his say, and hasten away to important work vastly different to that in progress in the Manchester University.

The address of Dr. H. S. Hele-Shaw, the president of Section G (Engineering), an abstract of which is given in our columns, was delivered in characteristically breezy fashion, and the author broke away from time to time to stress important points. In one place, for example, he remarked with some force that he did not believe that things would go back after the war, as had been stated at the Trade Union Congress then sitting. "Let us go back with what is good," said the President. "Why should we turn women out after the war when they are showing themselves splendidly capable of taking their part in many industries? We shall want all we can get." The applause that met the statement was indicative of the agreement of the listeners.

In calling on Professors Asakawa and Petavel to give their paper on "Investigations of the Thermal Efficiency of a Gas Engine," the President made a self-congratulatory reference to the fact that he had finished his address very punctually—on the stroke of noon, when the first paper was timed to be given. The observation caused amusement, but no discomfiture to Dr. Hele-Shaw—not even when he was informed that the clock was really forty minutes late! The clock, by the way, did not show its face at subsequent sessions. A kindly janitor had pasted a sheet of paper over it.

After Professors Asakawa and Petavel's paper, a Report on Gaseous Explosions was read, and was followed by Professor Thornton's paper on the "Total Radiation from a Gaseous Explosion."

In the afternoon the members of the Section visited the premises of the Manchester Steam Users' Association, where Mr. C. E. Stromeyer, chief engineer to the Association, showed a machine for determining fatigue limits calorimetrically. The stresses are produced by revolving masses.

In Section F (Economic Science and Statistics) the whole day was devoted to a discussion on means for the promotion of industrial harmony. There was a large attendance, and speakers followed each other with great rapidity, and with much eagerness to help forward the consideration of this extremely important subject.

The proceedings of Section B (Chemistry) were chiefly interesting for the presidential address of Professor W. A. Bone, F.R.S., who dealt with the important subject of fuel economy. Dr. H. J. Sand gave an experimental demonstration of a new cadmium vapour electric arc lamp.

Thursday was almost entirely a "Manchester Day" in Section G, a number of important Manchester municipal undertakings being described.

Mr. S. L. Pearce, the city electrical engineer, spoke on the Electricity Undertaking and the projected Barton Station. The information he gave was on the same lines as that given recently in a special article on the Barton scheme which appeared in the Electrical Review. Not the least interesting point mentioned was that the Ship Canal Company had withheld their sanction to use water from the Canal for condensing purposes, and that the new station would use the sewage and sub-soil water—in the form of a purified effluent—which passed down the main outfall sewers to the Corporation's sewage works at Davyhulme, situated about 1,400 yd. from the Barton site. It was found that the use of this water would really be most helpful to the sewage department.

The work of the mechanical engineering department of the Municipal School of Technology was outlined by Professor A. B. Field; and Mr. J. B. Newbigging, the city gas engineer, delivered a paper on the recent work of his department.

The Section concluded the day's sitting with a paper by Mr. E. C. Mills on a unit gas producer for steam boilers.

Papers on smoke and its prevention—nine in number—were given in Section B. Mr. E. D. Simon outlined the lines of research in smoke abatement, and spoke of the work of the Manchester Air Pollution Advisory Board, which aims at securing the purification of the atmosphere by research and propaganda, as opposed to the older method of prosecution, and has an annual grant from the Corporation of £450. He said the estimated damage done by smoke in Manchester and Salford was nearly a million sterling per annum. Some reduction of factory smoke had been effected, and domestic smoke provided the main field for work at present. The last paper of the series was entitled "Electrical Precipitation of Smoke," but the proceedings had been long-drawn out, and Mr. W. W. Haldane Gee, the author, could do no more than throw two slides on the screen and refer the audience to the Proceedings of the American Institute of Electrical Engineers (April, 1915) for details. (See also the Electrical Review of May 14th, 1915.)

In the course of the discussion Mr. Arnold Lupton mentioned that when he was living in Leeds he estimated that the cost of the smoke nuisance to him in the house he was living in was equal to a rate of 6s. in the £ on the rateable value, and he computed that smoke could be prevented by an expenditure equivalent to a rate of 1s. in the £.

Mr. W. Reid (London) thought that some people connected with gas overstated the case enormously. There were huge areas of workmen's dwellings, and it was no use going there and telling the people to put in gas stoves because they would lead to a great saving of labour. In houses of that kind there was practically no labour to save. He also mentioned that he had just had occasion to see to a new office in an old building in connection with a business he was interested in, and he made inquiries as to the cost of having gas put in. He found that the cost of putting in gas alone, before he consumed a single cubic foot, was one and a half times as much as the cost of the coal for the whole year.

The Section passed a resolution in favour of a suggestion that a committee should be formed to consider questions relating to prevention of smoke, fuel economy, and so forth, with a view to the preparation of recommendations.

"Outlets for Labour after the War" was the subject considered by Section F (Economics), and it was divided into three main heads. In the first place, attention was devoted to a report prepared by a conference called by the Section to investigate the replacement of male by female labour in consequence of the war. Secondly, Major Tudor Craig dealt with the question of employment for disbanded members of H.M. Forces; and, thirdly, Mr. C. Turnor discussed land settlement for ex-service men.

Economics and the War.

The circumstance of war has given to the Economic Science Section as great an opportunity as any Section has had this year. The vast upheaval that the terrible events of the past thirteen months have occasioned; the wastage of life and treasure; the industrial bearing of the war both in regard to the production of munitions to assist the Forces and in regard to the conduct of industry after the war; these have brought before all our minds problems of the utmost importance. Our settlement of many of the difficulties that have presented themselves has of necessity been the action of a people living "a day at a time." Everything of the kind is, more or less, temporary, and designed for the purposes of the moment. Many of the questions will have to be considered and re-considered probably time and time again in the years that are coming, but it was most appropriate that this Section should devote itself almost exclusively to some of these matters this year. We require no extraordinary gift of imagination and foresight to be able safely to prophesy that the proceedings of the Section will be equally, if not more, important next year, and the year after, and perhaps the year after that. In the past the proceedings of the Section have not greatly concerned us in these pages, but that is not so to-day when everybody interested in our national industrial life is confronted with such problems as we have indicated above. "Not the least dominant phase of this epoch-making struggle is the economic one," said Prof. W. R. Scott, the president of the Section, in the opening sentences of an address devoted to consideration of "some of the reactions of this great war upon industry, credit and finance." It is recognised by him in the course of his remarks that "the two most critical periods occasioned by war are, first, the change from peace organisation to war organisation, and secondly, the converse change after the conclusion of hostilities on a large scale." Space prevents us at the moment from quoting fully Prof. Scott's references to the manner in which specialised labour and capital were transferred from one process to another, but we quote his reference in regard to what is to follow:—

All this is satisfactory for the war period; it must be remembered that on the return of peace the reverse change will have to be made. There may be a short trade boom (arising out of the attempt to restore some of the material ravages of war), but the joint demand from it and from the trades re-opened is likely to be considerably less than the huge present expenditure on manufactures for war. Thus the unemployment occasioned by dislocation of industry through hostilities is likely to be carried forward as a species of suspense account which must be liquidated not very long after peace. Moreover, international credit is likely to re-act on the situation in a prejudicial manner. Even already the financial system of Germany is more strained than appears on the surface. The fact is advantageous to us as belligerents, but it will probably be prejudicial to us not long after the re-establishment of peace. At present much of the inconvertible papèr circulating on the Continent does not affect us here. When the inflation has to be squeezed out after the war, a disturbance of credit is not unlikely.

Prof. Scott concluded his very interesting address as follows:—

A special aspect of the problems under discussion is the provision of capital for the re-starting of trades contracted by the war and for the restoration of Belgium and other regions desolated during the progress of hostilities. Chalmers, writing a hundred years ago, supposed that in cases of this kind "in a very few years the recovery both of population and labour would be completed." The explanation he gave was far from satisfactory even for the time at which it was written, and it is still more deficient as applied to the present circumstances, when in industrial countries fixed capital is much more important than in Chalmers's day. In the last quarter of a century any great catastrophe, such, for instance, as the partial destruction of San Francisco by earthquake and fire, has been repaired with comparative ease by bringing capital from outside. But the waste of war renders capital exceedingly scarce; in fact, a famine of capital after the war has been predicted. Such an anticipation is over-pessimistic, but capital is likely to be obtainable for a time only with some difficulty. It is to be feared that after the war Europe will experience very considerable straits for several years to come. Not only must the waste of war be made good, but its evil legacy in inflated funded and floating debts must be gradually dealt with, lessening by reason of increased taxation the normal margin for new savings. Increased work and greater economy are the only remedies, aided by improved methods of production.

"It is to be hoped that some of the inevitable loss will be repaired in time by better methods of organisation and by an accelerated rate of invention. The waging of a just war results in a quickening of the national spirit. It forces a nation out of the easy and well-worn paths of custom and convention. Thus, out of all the suffering and all the loss, some good will come. The large proportion of our young manhood, which has gone to serve the country on the seas or in the field, and which returns having looked death in the face without being afraid, will not take up life where it was left. The noble qualities that have been evoked by the stress of battle will remain and will influence civil life during the next generation. The outlook will be both broader and also more simple. Methods of social legislation and administration will become more direct and less timorous. The men who have dared greatly and who have endured will chafe against the rules that have been formed during easier times. Great wars tear away the veils which hide the essential needs of living, and reveal what is fundamental. The directness of vision that has faced danger is not likely to be alarmed in facing the difficulties of our social and industrial problems. And so we may expect with confidence that our legislation will be bolder and also more sane than it has been in the past. The sacrifices of so many cannot pass, when the war is over, and leave no trace. The nation has been re-vitalised in the course of the struggle and the influence of this movement will persist.

"In many respects the economic problems that will confront us after the war will be even more serious, and certainly not less difficult. than those of the present time. Still, there can be no doubt that these will be faced with courage and patience. The period of stress through which we are passing has shown the unity of thought and purpose throughout the whole Empire. And this, in spite of many appearances to the contrary, will be a great asset in the future. The great national emergency has caused a closing of the nation's ranks, and it rests with us to keep them firm and steadfast when peace returns. There are plain signs that it may not always be easy, since so many industrial and other difficulties have been carried forward as a suspense account which is to be dealt with when the war is over. National unity is enabling us to progress towards victory, and the same unity will be required to enable us to reap the full fruits of that victory at home. It will be a mad waste not to employ the qualities of heart and mind which have been aroused in this great struggle in the service of peace and social progress. The future may be difficult for some years to come, but difficulties are the opportunities of the strong and courageous. It has fallen to us to live in an heroic age; and, if we remain true to ourselves and to our high destiny, we shall have the strength and fixity of purpose to achieve greatly in peace as well as in war."

Industrial Harmony.

After Prof. Scott had finished reading his address the Section devoted the rest of the proceedings for the day to a discussion on "Means for the Promotion of Industrial Harmony."

Prof. A. W. **Kirkaldy** (Birmingham), opening the discussion, said it might be that an outcome of that meeting would be the formation of a small, but competent and representative, committee to accumulate and dispassionately study the whole industrial situation and endeavour to agree on broad lines on a policy to secure the establishment of harmonious co-operation of all sections of the industrial army. The last twelve months had cast a lurid light over what friction gone mad could accomplish, and they needed to realise very clearly that friction gone mad in the industrial world might well produce greater calamities and suffering than had resulted from the tearing up of a "scrap of paper" in the international sphere. He was convinced from many years' close touch with industrial England that this country was threatened by a danger far greater than that of any other external enemy. Friction had existed in many spheres, but in its most acute and dangerous form it had manifested itself in the industrial sphere. In a remarkable way the war brought about a national harmony for which few had dared to hope. After a year of war there were signs that when once the compelling hand of war was relaxed—and this might come sooner than some people thought—friction in an intensified form might break out in the industrial world. It was this possibility of friction and its causes with which he was concerned. Could they lay aside prejudices dispassionately and calmly estimate the evil and realise its causes? If they could see their way to this they might be able to suggest measures which might minimise resulting harm, and even point the way to harmony instead of friction, and so enable this country to take full advantage of what would probably be a most remarkable economic situation, and thus repair in comparatively short time the loss and ravages incident to this war. There were two points which he believed would be of considerable importance:—

1. Is class war a necessity?
2. What is the truth about profits, dividends, salaries, and wages?

Class warfare had now been taught for so many years that it was in danger of being accepted as an eternal and immutable truth. But was it true, and was it necessary? Those were questions they must answer, and, in answering them, pause to consider the issues entailed. Was it not that industrial strife was really due to ignorance?—and ignorance was as profound among some employers as among some labour men. They had given themselves up as a nation to a love of gain and accumulation rather than the study of progress of economics, which meant the use of what they had in such a way that every member of the community should be able to develop his or her capacities naturally and healthily. The rush to be rich—a very mistaken synonym for happiness and well-being—was a Will o' th' Wisp that had been luring them on to national decadence. The word "economics" did not command their attention and respect, because it had come to connote things that were repugnant to common-sense and their highest interest. But that was not the fault of economics; it was due to the ignorance that existed as to economics and what economics taught. Surely, what was taught on the subject of production should commend itself to the common sense of every thinking man. To obtain the best results one of the first requisities was harmonious co-operation among the factors of production. Friction among these inevitably lessened the amount produced. Whatever tended to decrease production must decrease the real amount received as salaries, wages, dividends, and so on. What seemed to him to be required at the present time was a right judgment over the whole industrial sphere, for what concerned the well-being of the nation was not only that production should be carried on on right lines, and to the fullest extent, but that what was produced should be equitably distributed among those responsible for its production. Nor did those two cover the ground adequately, for not only must commodities or wealth be rightly produced and equitably distributed, but they must be wisely consumed. Thus, the industrial army should have correct knowledge of the production, distribution, and the consumption of the results of its labour. There was a great lack of knowledge among employers and employed on some elementary subjects. Among employers there was too great a desire to obtain wealth for wealth's sake, and on the part of workers to increase wages without stopping to consider how the fund from which profits, dividends, wages, and salaries were drawn was produced; and when wealth and higher wages were obtained there was amongst all classes of the community too great a tendency towards waste and extravagance, without a thought as to one's responsibility to the nation for the right use of one's resources. In this connection, he would like the Section to consider two points:—

1. Did class warfare lead to a diminution of production?
2. Did they take a broad enough view of their economic position?

During the first decade of this century it was estimated that trade disputes lead to the sacrifice of wages to the extent of about £600,000 per annum. Some or all of that loss might have been justifiable, and that brought him to the last point he wished to discuss there: What was the truth about wages? It used to be thought that wages were paid out of an existing wage fund, and, if that were true, one section of labour could only obtain higher wages at the expense of some other. The mistaken notion was cleared up long ago by a well-known economist who pointed out that wages were paid out of existing wealth, but only for convenience sake. Really, wages were limited by the amount of wealth produced. The more produced the greater must be the wages paid. With decreased production, in the long run there must be decrease in the real wages received. With full knowledge as to the fair share of production that was due to each grade of labour, there should be equitable distribution, and when men were convinced that they were obtaining this fair reward production would be stimulated, for with increased production each man's share might be greater. Could they discover what proportion of the wealth produced annually was the share of each participator in the work of production—could they but establish the proportion due to each factor, the task of the arbitrator in wages disputes would be enormously lightened. What was required was that the whole industrial army should be graded so that the value to the community of the most capable organiser who worked with his brain, guided by experience, might be as accurately known as the value of the artisan, the labourer, the humblest youth employed. Was it possible for some of them to give their attention to that? Could they appoint a representative committee to work at this subject and continue its labours until it had suggestions to make that might be offered for acceptance by the industrial army? If national harmony could be attained in the industrial world there could be no possible doubt as to the future of our Empire.

Sir Chas. W. Macara, Bart., was the next speaker. He said that the relationship between Capital and Labour was a subject of supreme importance at any time, but more especially in a time of national crisis such as we were now passing through. He said that he was one of those who, in the early days of the war, were approached by representatives of the Government regarding the effect the war would have upon industry, and what could be done to minimise the dislocation that was certain to ensue, and to keep the workpeople employed as much as possible. Recognising the colossal task with which the Government was confronted, and that it was essential that the assistance of the most experienced practical men should be taken advantage of, he strongly advocated that all existing organisations of capital and labour, and, indeed, of every kind, should be at once brought into requisition in preference to forming new ones to deal with the crisis. There was ample correspondence to prove, and resolutions had been passed and published showing, that this supremely important matter had been urged on the Government without avail. Everyone who had had experience of such work would realise that the creation of new organisations could not be efficiently carried out without expenditure of much time and labour, whereas it was comparatively easy to adapt existing organisations to deal with great and sudden emergencies—and time was an all-important factor. Having visited many of the principal countries of the world, and having studied their methods of working, he was convinced that, upon the whole, this country was as well organised as any, but the Government had not understood how to utilise existing organisations as they should have done, and in this respect we had been placed at a disadvantage with enemy countries whose Governments, on the outbreak of war, at once utilised all their existing organisations, and deputed to their most experienced industrial and commercial organisers, definite and important duties in connection with the carrying on of the war. Had this been done in England, instead of Ministers keeping matters in their own hands, it was his opinion that we could have faced this great upheaval much more effectively than had been the case. Efficient co-operation of the industrial, commercial, financial, scientific, transport, and labour interests with the Government would have enabled our enormous resources to have been brought into requisition from the very commencement of the war. As it was, after twelve months of war we were only now realising what proper co-ordination of all our vast resources might have accomplished; indeed, the difference, so far as practical results were concerned, between thorough organisation and the reverse could scarcely be comprehended. It was unfortunate that the services of men who had led the great organisations of capital and labour had not been taken advantage of to anything like the extent they should have been. Had this co-operation between the various organisations existed, it might have been possible to have dealt more effectively with the problems connected with the supply of the necessaries of life, which, he pointed out to the Government, would not only constitute the chief difficulty in carrying on the war, but would be the main factor in terminating the struggle. It was useless, however, dwelling upon the errors of the past which could not now be altered, and the only object in referring to them was that in the future full advantage might be taken of the experience gained so that the vast resources of the nation might be utilised to the fullest extent. At the end of his remarks Sir Chas. Macara gave the following summary of his views:—

1. That harmonious relationship between capital and labour is always of the utmost importance, and that at a time of great national crisis it is supremely so.

2. That in order to cope with such a colossal task as that by which the Government was confronted, the task would have been lightened and much would have been gained, had they at once enlisted the assistance of experienced industrial organisers, and co-ordinated all existing organisations.

3. That the United Kingdom is as well organised as any other nation, and had there been effective co-operation of the industrial, commercial, financial, scientific, transport, and labour interests with the Government from the commencement of the war, the position in every respect to-day would have been vastly better than it is.

4. That by the co-ordination of these interests, the problems connected with the supply of the necessaries of life, and with the undue raising of prices of commodities, might have been coped with much more successfully than they have been.

5. That the rise in the prices of commodities has undoubtedly been the main factor in creating industrial unrest.

6. That the only object in calling attention to the errors of the past is that we might profit by the experience gained, and so utilise to the utmost the vast resources at disposal.

7. That the interference by politicians with industrial disputes is to be strongly deprecated, often leading to inconclusive settlements, it being impossible for them to have the necessary knowledge of the intricacies of the different industries or their varied conditions of working; that such interference only engenders bitterness and does ultimate harm.

8. That thorough organisation of both capital and labour is essential to the smooth working of the industries, and that where this is the case, disputes are generally settled by negotiations between the parties themselves.

9. That disputes frequently arise from an exaggerated estimate of the return on capital, and that schemes for ascertaining this return should be promoted, as exaggerated views often lead to unreasonable demands.

10. That the Industrial Council, which was appointed by the Government in 1911, and which is composed of an equal representation of capital and labour, with a non-political chairman, has not been utilised since the outbreak of war, that no adequate explanation of this had been offered, and that the valuable report of its inquiry into industrial agreements has not been made use of.

11. That the enforcement of compulsory arbitration where large bodies of men are concerned is an impossibility, and that an inquiry into the merits of a dispute by experienced men representing capital and labour, and the publicity given to its findings, would, together with public opinion generally, supply the only effective compulsion.

12. That trade union limitation of output is against the best interests of labour.

13. That official representatives of labour are generally men of capacity and fairness, deserving of the confidence of the rank and file.

14. That the effect of the war upon industries has been varied, and that any war bonus or wages advance should only be granted after full investigation by leaders of capital and labour.

He had endeavoured to deal with a complex problem from the standpoint of one who had during the past 20 years been frequently placed in the difficult position of having to preside over conferences of masters and men in connection with disputes, while occupying the position of President of the Masters' Federation during that period. Whatever success might have attended this work was mainly attributable to being able to eliminate personal interests, and to view matters solely from the standpoint of endeavouring to act fairly between man and man. From a wide experience he had come to the conclusion that nothing was gained from strikes and lock-outs; that the leaders of capital and labour had exceptionally heavy responsibilities, and that industrial peace, especially at present, was absolutely essential. Mistakes and the difficulties they caused frequently proved to be blessings in disguise. So far as the British Empire was concerned the greater the difficulties to be faced, the greater was the energy and determination to overcome them. It was fervently to be hoped that such an arousing was now taking place and that everyone was being made to feel the seriousness of the situation, and that all classes must be prepared to take any sacrifices that might be necessary to ensure the speedy and victorious termination of the unprecedented struggle in which we and our Allies were engaged in defence of freedom and civilisation.

(*To be concluded.*)

Presidential Address to the Engineering Section, by H. S. Hele-Shaw, F.R.S.

(*Concluded from page* 333.)

Education.—A sign of the times is the inclusion of an education section in an association for the advancement of science. This has not been done on the narrow ground of improving the teaching of science in schools, but because it is now recognised, and this none too soon, that the whole problem of education must be treated in a scientific manner.

When the subject of engineering education is mentioned we are apt to think only of the training of such engineers as have been considered in a recent report issued by the Institution of Civil Engineers, and to exclude, as that report purposely does, the training of our artisans and foremen. We certainly do not connect the idea at all with the training of the artisan himself. As a matter of fact, while high scientific training of the professional engineer and manufacturer is of vital importance, the proper education of the men whom he will have to control is scarcely less so. The latter education may not be of the same kind, but it is just as vital to the country, and its present condition is a serious evil.

One of the most humiliating things of the present war has been the mutual relation of labour and capital in this country in what is probably the most critical period of our history. I will say more later on this subject, but there is no doubt the subject of industrial education needs earnest consideration. Take the first, the education of the professional man—the class, for instance, joining such institutions as the Civil, Electrical, or Mechanical Engineers; we find in one respect a most satisfactory progress as to what is insisted upon before such men are allowed to join one of these bodies. All such institutions now demand technical diplomas or University degrees, and, in addition, satisfactory evidence of practical training. But to prevent injustice to the man who may be self-taught, they hold examinations conducted by recognised men of standing in scientific and technical subjects. Great as this progress has been in recent years, there is a great deal to be done. In the first place, professors and teachers of engineering and technical subjects have to deplore the miserable previous training of a large number of students. It seems still to be a common idea that if a boy is unable to make any decent progress in the usual school subjects he can be sent to a technical school if he is useful with his hands, under the pathetic impression that the success of the engineer depends upon his hands rather than upon his head; and the first year or two at a technical school or college is thus taken up with work that ought to be done at a secondary school. It is not fair to put all the blame upon the school, for I have known students coming from the classical side of such a school with no knowledge of science and very little of mathematics who have taken the highest places in the engineering course, and, after entering their practical work, rapidly risen in the profession, and this was because such men had been well trained to apply their minds to any subject and had a sound foundation upon which to build. This only shows that a good student will always rise to the top, and does not prove that the present school system is the best for an average boy or makes him work as hard as, for instance, the corresponding school in Germany does. A large number of thinking men are convinced that our whole education system seriously needs reform. I say this not merely in reference to scientific education and technical training, but to the whole attitude of mind of the young of all classes of the community towards the serious work of life when they leave school. In the matter of education and its bearing upon technical training, we have, then, a good deal to learn from Germany. There are some things that we think are quite as good, if not better, in this country, but there is no reason why we should not try to find a way to adopt the better features of education from our enemy, and, while retaining independence of thought and originality, inculcate firmer discipline, for there is surely a happier medium in this matter.

I see in the report above alluded to there is a great divergence of opinion concerning the wage-earning value of highly technical students. Here, again, is a matter which in itself is worth a very careful discussion. The question depends first upon the student himself, next upon the kind of training he has had, and then upon the nature of the work he is expected to do. The blame in not getting the best results from a well-trained student is very often due to the employer, and our Section might do something to bring professors and employers into closer touch, and both employer and professor may have something to learn from each other.

In leaving this subject I cannot help pointing out what important continuation schools are to be found in the meetings and discussions of the younger members of various engineering societies and how much a young engineer learns in the preparation of a paper. Anyone who is accustomed to take the chair at such meetings will bear witness to the excellent outlay of money represented by the award of prizes and medals for such work. Many men to my knowledge have got jobs through thus showing acquaintance with a special subject or originality of thought.

Research.—If there is one thing more than another which the British Association can be congratulated upon, it is the work which it has done in the matter of research. To-day there is a more general recognition of the importance of research, and the recent institution by the Government of a Committee for the organisation and development of scientific and industrial research is the latest indication that the nation is beginning to realise its importance.

So far from all this making our work less necessary, there is all the more reason why we should have a permanent Committee of Research, because one of the intentions of the new Government Committee is to utilise the most effective institutions and investigators available, and the statement is made that one of the objects of the Government Research Committee is to select and co-ordinate rather than originate, and that one of its chief functions will be the prevention of overlapping between institutions and individuals engaged in research. It is more important than ever that the British Association work in research should go on, as, since its members are drawn from all parts of the British Empire, its influence should be correspondingly great.

Another reason for research being a subject of a permanent sub-committee is that suggestions for new work are more likely to be matured, and work of an advisory nature made more practical, than is possible at one annual meeting.

One more reason is that, although we have made some progress, we are still far behind Germany in the organisation of research. There is no doubt that our students and scientific men are quite capable of conducting researches, but the training for this is like the training for the officers of an army: it cannot be done hastily; and, indeed, men themselves cannot be obtained for this purpose without years of preparation. All such work must be done as a factor in the reorganisation of our manufacturing and commercial resources in the great struggle that lies before us.

There is one subject which affects both education and research, and might be reported on by our Committee. It is very rarely that a professor is both a good teacher and gifted with the power of original research. Even when a professor or lecturer is so gifted, however, it is almost impossible for a man to devote himself properly to research, and at the same time undertake the duties which are attached to a professorial chair. Why not face this subject boldly, even relieve the bad lecturer (there *are* men who admit their failure in this respect) of a certain amount of his work, provided he is doing well in research; or for the man who can do both well, see that he not only has efficient assistance, but, even more, that he is given the opportunity of devoting long periods (for instance, alternate years) entirely to research.

There are numerous other questions which would come up under this heading, and which could be usefully dealt with by our Committee.

One more subject that we might consider is a better differentiation of researches on purely industrial work, such as are often of a most profitable nature to the professor or research student, and those which are of a purely scientific character. While it is only right that every successful research, even if conducted at the expense of a public body, should bring solid return as well as fame to the worker, some steps should be taken as to the fair and equitable distribution of the proceeds. I see that one of the proposals of the new Research Committee is that discoveries by institutions, associations, bodies or individuals in the course of researches aided by public money shall be "made available under proper conditions for the public advantage." If the discovery is patentable, I assume, it would be protected at home and abroad, unless we wish to spend public funds as much for the benefit of foreign trade rivals as for ourselves. This is one of the many matters in connection with which a British Association Committee might from its cosmopolitan character render great service.

Standardisation and the Metric and Decimal System.—In the report of the Decimal Association last April, the hope is expressed that one of the changes for the better arising from the war will be a reform of our weights and measures. No class of the community would be affected more closely than the engineer, and engineers cannot fail to be interested in the question as to whether the general and immediate adoption of the metric system would or would not be a valuable means of assisting British firms in their competition with Germany and Austria, in countries where that system is in vogue. Although it is very unlikely that a wholesale change is imminent, it is certain that the metric system is gradually spreading, and in the United States and Australia very strong forces are on foot to bring about a change to that system. The British Association has over and over again had the subject before it, and our Committee might be of service in making a report on the present state of the matter.

One thing is certain: the Committee might be of assistance in recommendations which would bring into line all British engineers in duplicating tenders for countries which have the metric system.

Coming to standardisation, here we have more ground for satisfaction. The Engineering Standards Committee during the last ten years has done a work which is quite equal to that in any other country, of completing standardisation of all important matters in engineering, and, moreover, has secured the recognition of these standards in all public contracts. As giving some indication of the range of this work, it may be said that there are more than 60 committees for dealing with every conceivable engineering matter, from bridges, ships, and locomotives, down to electric lamps. One of the last of these committees, dealing with automobiles, has 11 sub-committees, many of which have already completed their work. It is almost impossible to do justice to the extraordinary achievement of bringing order out of what was apparently hopeless chaos and to the benefit to the British engineering industry of this work, largely due to the energetic Secretary, Mr. Leslie Robertson. We may justly pride ourselves that this Section was a pioneer of standardisation by taking up the subject of small screws, its work being taken over ultimately by the Standardisation Committee.

There is yet work to be done, however, and one matter of great importance would be to get a universal standard of temperature for instruments of measurement other than zero. A temperature, for instance, of about 62 deg. Fahr. would make steel rods' measures more practically workable than at present.

In connection with the subject of temperature and standardisation, I recently came across a statement by the General Secretary of the International Electrotechnical Commission (*Journal*, January, 1915) that the want of uniformity in the rating and testing of electrical machinery has been a serious evil, and he goes on to say: "The German standardisation for instance, which, through well-organised and com- effort on the part of the German makers, had previous e war become widely recognised on the Continent of pe as well as in many countries to which British inery is exported, by permitting a higher temperature han is considered good technical practice in Great Britain, inly have not assisted the British maker in foreign ets."

hibitions and Museums.—In recent years a large number mmercial exhibitions have been held of all branches of inery, and it is satisfactory to note that one of the res of such exhibitions has been the holding of scientific res, and the inclusion of the exhibition of scientific instru- s and apparatus, and also exhibits showing the relation ientific experiments to engineering work. In some of privately organised exhibitions with which I have been iated, the scientific men have been invited to take part the general lines had been settled on which the exhibi- were to be run, and thus we had comparatively little ence. I have thought from time to time that it would ell if a permanent committee of such a body as the sh Association existed, which could exert more direct ence, chiefly, of course, by reports and recommendations. managers and organisers of such exhibitions would value tance of this kind, and in return would listen to sugges- which might materially add to the scientific value of an exhibition. I know from experience that a British ition is a most important means of promoting British stry, for the number of inquiries that come from all parts e country and from all parts of the world show how h interest well-organised exhibits arouse and what long nces people will travel to attend such an exhibition. A inery exhibition was to have been held in London, the of the opening a week or two after the date at which the began, but was, of course, not held. This exhibition was ave been Anglo-Dutch, and though organised by private rprise was even in advance bringing in touch the con- ers and manufacturers of the two countries. The *Beama nal* quoted recently an American magazine in which the er was advocating the support of a permanent commercial eum for industrial purposes, and this is what he said: e produce a surplus of manufactures that must be sold. manufactured exports have about doubled in ten years— ruth a cause for satisfaction, and yet we have not accom- ed enough. . . . We have only made a beginning, con- ring what we can do and will be forced to do in the re. . . . Manufacturers must compete with old-estab- d nations in the market they seek to invade." It is note- thy that this museum, which is really a permanent bition, is a very complete organisation, containing amongst r things science laboratories.

is sad to think that the great hopes held out of the erial Institute by the President of this Association, Sir derick Abel, at the meeting held in Leeds in 1890, have been altogether fulfilled. The President expressed the ef that, amongst other objects, the Institute would com- "the continuous elaboration of systematic measures tend- to stimulate progress in trades and handicrafts, and to er the spirit of emulation amongst the artisan and indus- l classes." It may be a very fitting time to bring forward whole question, because it has often happened that an ellent scheme which has somewhat languished has upon revival at a later time, when its importance was better ised, been crowned with success.

nother matter which might be considered is the question lepartmental museums at the technical schools and univer- es throughout the country. The organisation of these is ply a matter for the enterprise of the individual professor each department. The museums in the engineering depart- nt of the colleges with which I have been associated were y much appreciated by the students, who constantly were means of securing fresh specimens, and after they had the college continued to contribute articles of great erest, such as fractures, corrosions, boiler plates, models, . This matter might be handled in a much more syste- tic manner, and possibly a report from our Committee with ecommendation to the proper quarters would be of use.

atents and Patent Laws.—This subject is well worthy of consideration of the proposed committee since progress in gineering, certainly on the mechanical and electrical sides, largely dependent upon invention, which is not likely to be iously undertaken without adequate protection, not entirely the inventor, but also for those who really make the ention practical by means of capital and business support. great deal of nonsense is talked and written about inventors, if they were a special class of being, generally mad and vays impossible. Some inventors are both, but the fact is, st engineers spend their lives seeking new ideas and devis- new methods of carrying them out; in short, in inventing. is of the greatest importance that every step should be ken to encourage sound invention and to see that anything value is secured for this country. The foundation of the unitions Invention Panel is a step in the right direction, d will, doubtless, be followed later on by Government Com- ittees for peace inventions. Such committees or Govern- ent departments dealing with various industries will be sisted by suggestions from a body like this. Colonial patent ws are all different, and differ from those of the Mother untry. It would be a splendid thing if we could bring about conference leading to unification of these diverse patent laws and have one comprehensive patent law for the whole Empire.

There are many other matters; for instance, the question of extending the time of secrecy in the provisional patent. For many important patents the close time allowed is not enough. Another is one in which the German system has certain advantages, viz., in having two classes of patents. One of these is the patent "proper," which is only granted after the most severe search and criticism, and holds the usual period when granted. The other is a secondary patent granted for the shorter term of five years, and is given for one of the hundred and one minor improvements and devices which, though of real value, only constitute small modifications in detail and not new applications of principle.

The suspicion of injustice to the British and other foreign applicants by the German Patent Office is to a great extent, if not altogether, unfounded. The German system of demanding that some definite principle is applied *to produce some definitely new effect*, might to some extent be followed, especially in view of the constant accumulation of published devices, some patented and others not.

Organisation.—This is by far the most important question of any I have raised, and practically embraces the others. To organise is to "arrange or constitute interdependent parts, each having a special function, act, office, or relation with respect to the whole." If we accept this definition, as we must, there is no question as to the all-important nature of organisation, for you will notice there are two outstanding things. The first "interdependent parts"; and the second their "relation to the whole." Thus the subject of organisation really includes the whole of industry.

When we come, however, to these interdependent parts and their relation to the whole, it is there that we find the weak joint in the armour. It is in this respect that Germany can teach us a striking lesson in the *arrangement* of these interdependent parts with respect to the whole. From the top to the bottom the whole forces of their industries are so thoroughly organised that they get all that is humanly possible out of the various factors. I do not limit this merely to the wonderful organisation of any works, like Krupps, or the Deutsche Maschinenfabrik, or hundreds of other works, but I include the organisation of all the Government departments, together with the banks, the railways, and the shipping, so that every facility is afforded for the world commerce of the German Empire.

Taking only one of these details, I remember, when the battle of the Manchester Ship Canal was being fought, what facts came out as to the difficulties in the transhipment and handling of goods. The late Mr. Alfred Holt, for instance, was one of the most earnest in pointing out that the want of co-operation and organisation in getting goods from our manufacturing centres was adding largely to their cost, and actually exceeded the cost of transporting these goods across the ocean. In Germany, on the other hand, the Government steps in, and by means of special differential rates, gives the manufacturer every facility and the lowest possible rates for obtaining raw material, and delivering the finished goods to all parts of the world. It was this organisation that not only rendered Germany so formidable a rival in times of peace, but makes her so powerful in war.

This co-ordination in Germany is carried out in every industry in a way we generally have little idea of. For instance, the other day, at a deputation to the Government, Mr. Runciman remarked that the difficulty of connecting the manufacturers with the commercial staffs in this country is deep seated, but, perhaps, not altogether incurable. Further, that the manufacturer must realise what he can get from the universities, and the university must know what the works require. Dr. Foster, the treasurer of the Chemical Society, also said that "the Germans are so imbued with the need of pursuing modern and efficient methods of education, in applying science to industry, that they hold in contempt a country which notoriously neglects such processes"; and he attributed this contempt as partly contributory to their cheerfulness in entering into the war with us.

Now while these remarks are undoubtedly true, they are only a part of the truth. The evil is far wider than in any special application, for, as the German knows perfectly well, there are innumerable individual cases of organisation in this country of equal efficiency to any in his country, and he is glad enough to learn from special cases.

I do not believe the Germans despise us for our want *per se* of the application of science to industry. I do not think they have much reason to; but what they do despise us for is the want of co-ordination, which, I venture to say, amounts to positive slackness, which they are keen enough to observe permeating the whole of this country. They see different sections, instead of being united for a common end, quarrelling with each other, filled with mutual suspicion and distrust, with, apparently, no common bond of union, and whereas the German is proud of the Fatherland, he sees in this country large numbers who seem, either through self-consciousness or ignorance, to be ashamed to mention the subject of the British Empire, or, what is worse, to acknowledge that any love of their country is or could be a mainspring and incentive to strenuous effort.

The other day, Field Marshal von Moltke stated, and there is no reason to disbelieve him, that great as was the shortage of ammunition and shells before the war, the enormous demand far exceeded all expectation, and Germany found herself for a time in the same plight as her enemies, but he further stated that Germany's emergence "from this dangerous position was largely due to the extraordinary organisation, which included not merely the adaptation of their factories for munition purposes, but *capacity for work of the people*, and the *patriotic spirit of the German workmen*."

This brings me to consider what is probably the most serious feature in our national life to-day, which I have already alluded to under the heading of education, viz., the relation of employer and workman. It is hopeless, as long as such ideas prevail as seem to do at present, to think of any sound organisation of our industrial system taking place, because the interdependent parts are not arranged (and can never be arranged until we change radically) with respect to the whole. Now as one who has served an apprenticeship, who has taken his money weekly from a tin box with hundreds of other men, who has been a member of the Amalgamated Society of Engineers (in fact, was working as an engine fitter when a Whitworth scholarship made a college career possible), I am the last man to put this evil down entirely to the working man. I know, individually, he is just as capable of patriotism as any other class. Get him by himself, even the men whose strikes have caused such despondency in the minds of our Allies, and who have seriously jeopardised the very existence of the country, and you will find (except in the sort of case to be found in all classes of society), that he, as an individual, is willing to make sacrifices, and if necessary to give himself for his country. The truth is that the canker which is eating the heart out of our industrial life is due to an entirely wrong attitude of mind. For instance, however much we may sympathise with men who see a loss of employment in the introduction of labour-saving machines, some means should be found by which they can share the benefits to the State and to their employers by the introduction of such machines. I should like, if I had time, to say something about the marvellous organisation of the Ford motor-car works in America, and how it has given the men a share in the returns of a great industry, and thereby induced them to work in a way that has enriched themselves, their employers, and their country. We have many splendid examples of this co-operation in this country. For instance, Messrs. Allen, of Bedford. Again, the employment of women in the engineering industries has taken place in many directions owing to the war. The works with which I am associated could not have undertaken much munition work without it. Some steps should be devised by which this avenue of industry is not closed to women after the war, while justice is secured for the men alongside of whom they are working, and from whom they are in many instances learning mechanical skill. Again, the questions of piecework and overtime must be seriously considered by the State, and not allowed to become the subject of disastrous disputes. Once more, there is the question of a standard wage. It is against the eternal laws of Nature to try and keep living beings at one dead level of equality and merit—*i.e.*, it is against the law of the survival of the fittest. The trade unions have a great opportunity of placing their country and themselves in a leading position amongst nations if they will courageously grapple with a great problem by recognising degrees of merit and corresponding degrees of payment. These are a few of the many matters which must be dealt with in the immediate future.

The matter of labour disputes is so serious as to demand plain speaking. It must be admitted that there are many employers and companies which, to satisfy themselves and their shareholders, extort the largest possible dividends and pay the smallest possible rate of wages, and do so apparently without the slightest idea that the men and boys under them are capable of education and personal influence. Can it be wondered, then, that men under these conditions are willing enough to listen to the orator who merely appeals to their fighting instincts and join in the game of grab as against the employer? On the other hand, strikes have occurred when employers have honourably carried out their obligations and undertakings, and the men have shamefully departed from an agreement made by their chosen leaders, throwing over the leaders the moment they have fancied it to their own selfish interests to do so and without a single thought of their duty to the community as a whole.

We have recently seen the Prime Minister and other leading statesmen struggling, sometimes in vain, to bring large bodies of men to a reasonable state of mind. Is not this (and I speak without the slightest reference to party questions) a case of nemesis overtaking us for having in so many cases pandered to the selfish instincts of large bodies of men in order to secure their votes, instead of sternly telling them unpalatable truths?

There was recently an intensely interesting article by the late Professor Friedrich Paulson, previously Professor of Philosophy in Berlin University, published in the *Educational Review* of New York. In this article, the subject of which was "old and new fashioned notions about education," he pointed out that the whole of our educational system was going wrong, and that we could not escape the conviction that a tendency towards weakness and effeminacy was its chief trait. His three mottoes were: Learn to obey; learn to apply yourself; learn to repress and overcome desires; and he remarked with great truth under the first heading: "He who has not learned to do this in childhood will have great difficulty in learning it in later life; he will rarely get beyond the deplorable and unhappy state that vacillates between ward submission and uproarious rebellion." Is not o the first things the reform of our educational system?

The other day a writer in the *Spectator* said with truth that "what Great Britain is suffering from acutely dangerously at the present time is the absence of discipli and a neutral writer in the *Times* remarked as follows: uniformity of German effort, due doubtless to their m well-organised, machine-like minds, though it renders excessively tiresome people to dwell among in peace enables their Government to extract every ounce of en in the conduct of a war." He further went on to say the British Empire "could not have been created by m like these, but it should not be forgotten that in the con tration necessary to national effort in a struggle like this German system of self-subservience to the State has enorm advantages."

One of the tasks to which the British Association m bend its energies, with the greatest benefit to the countr to bring about a reform of our educational system, so while we do not kill individual enterprise and freedom thought, which have contributed so largely to the polit organisation and constitution of the British Empire, of value of which we have had such wonderful evidence our colonies and dependencies during this war, we seek implant in the minds of young and old those ideas of discip and service to the State, the want of which so seriou threatens the successful organisation of our industrial life.

Conclusion.—In bringing my address to a close, I hop have made it clear that I have had throughout a pract object. Expressed briefly, it is that the service of ev agency is wanted for definite work at this crisis, both in actual war, and afterwards in the war of industry which be waged with equal intensity in peace time. The Brit Association cannot be said to have undertaken as a whol work of this kind, yet one finds a general desire on the of every member that something should be done. With object, I communicated with the President, and found both he and such of the officers as could be got into touch were in entire sympathy with the general proposal, advised that our section, like that of Economics, should at once with a committee on the subject. I have great ho that such a committee will be formed, but I have no ho of either our own sub-committee or the committee of Association as a whole doing any good, unless they are pared with definite suggestions and advice which cannot ignored and put aside. I have not the slightest faith in mere formation of a committee which will content itself, us say, with the mere offer of its services, even to a Gover ment department, and the mere pious expression of certa opinions. If a committee does not want to become ridiculo it must show that it is in earnest. To show that it is earnest it must take care that its reports have a practic object, can be at once grasped by overworked Ministers a officials, and are of real value. Fortunately, the British As ciation is a powerful body with great traditions, and will listened to if such work is carefully and energetically done.

We can at least congratulate ourselves that whatever t evils of the war, the country as a whole has been moved fro its usual attitude of self-complacency, and that the numero new departments and organisations are showing a desire utilise every force and agency for the service of the Stat and to grapple with the great problem of its more efficien organisation. It will be no small work of a British Associ tion committee if it can supply sound ideas and recommend tions on the many thorny problems which must be solve We cannot all of us be, as so many would like, in the fightin line, either in France or the Dardanelles, but we shall be ju as deserving of contempt as those who, having had the oppo tunity of service, have shirked their responsibilities, or th giving up of their sons, and are even thinking of the war a a matter of personal gain, either in purse or reputation, if w content ourselves with mere offers of service, and having, a we think, shelved responsibility by leaving initiative to others we pass along our way sheltering ignobly behind those me and women who are doing their duty to their country.

Prof. UNWIN, who moved a vote of thanks to Dr. Hele Shaw, remarked that a great deal of the presidential addres had touched on the question of engineering education. Pr gress had been made. One remembered days when it wa an absolute disadvantage for a young man going into engi neering to have had an education of any kind. They wer getting past that now, but were not yet entirely past it They were coming to see that besides the very practical know ledge a man must obtain in the works or factory or office h ought to have a good technical training. He thought th difference between technical training in this country an Germany had its root very much in this: in this countr much attention had been given to the education of what the called—without any idea of contempt—the lower classes. O the whole, our education of the artisan and working popula tion was probably even better than that of Germany. Bu the Germans began in a different way; they began at th top, and got some of their very best men to start the educa tion of those who were to become engineers. They made mis takes at the beginning—they made their education far to theoretical—but they had worked clear of that. In German the organisation of technical education had rather proceeded from the top downwards than as in this country from the bottom upwards.

Thermal Efficiency of a Gas Engine.

By Professors G. Asakawa and J. E. Petavel.

(*Section G.—Abstract.*)

the Birmingham meeting of the British Association a inary note bearing on the above subject was read. The igation has been continued during the last two years as led to the conclusions summarised below. The various have been separately determined by measurements not on indicator card readings, but on the rate of change e kinetic energy of the rotating parts, and thus the inherent to the indicator mechanism have been avoided. he following summary the performance of the engine is red with that of a perfect engine working on the same and with a similar gas mixture.

icated Horse Power.—At full load under the most favour- conditions the indicated horse-power of a gas-engine is r cent. of that of an ideal engine working with a similar re. This holds true for all except very weak mixtures, hich the relative efficiency is lower.

mixtures containing only a slight excess of air, the corresponds to an absolute thermal efficiency of 27 per at a compression ratio of 3.75 and 33 per cent. at a ession ratio of 5.6; for mixtures containing twice the nt of air required for complete combustion the absolute ncies are 29 per cent. and 36 per cent. The indicated ncy relative to the gas-standard falls from 88 per cent. per cent. between full and no load.

ke Horse Power.—At the full load the brake efficiency ve to the gas-standard varies from 70 per cent. at the ession ratio 3.75, to 67.5 per cent. at the compression 5.6; this holds true for all except the weakest mixtures, hich the relative efficiency is lower. The absolute brake ncy is 21 per cent. at compression ratio 3.75 and 25.5 ent. at compression ratio 5.6 for mixtures containing excess of air, and 23 per cent. and 27 per cent. respec- for mixtures containing twice the amount of air required omplete combustion. The maximum brake efficiency ned in the present experiments was 27.4 per cent., and ed at the highest compression ratio for a mixture y stronger than this.

light loads, the brake efficiency relative to the gas- rd decreases more rapidly as the compression ratio For the higher compression ratios the increase of tical efficiency is just counterbalanced by the increase in nal loss, and thus the absolute efficiency remains nt.

hanical Losses.—The mechanical losses increase slightly olute amount with the load and with the compression For the engine under test (a 25-h.p. National gas e) at normal speed (200 r.p.m.) the mechanical losses nt to 5.6 h.p. at no load and 6.3 h.p. at full load when mpression ratio is 3.75; and 6 5 h.p. at no load and 7.0 t full load when the compression ratio is 5.6.

pumping losses are an important part of the total nical losses; at a compression ratio of 4.85 they repre- l 2.3 h.p. at no load and 2.1 h.p. at full load, or 38 and cent. of the mechanical losses.

rmal Losses.—The loss of power due to thermal losses l load under most favourable conditions amounts to 12 nt. of the total available energy, and at no load to 16 nt.; of this less than one quarter is due to heat trans- n during the expansion.

A Gas-Producer for Steam Boilers.

By E. C. Mills.

(*Section G.—Abstract.*)

aims of the inventor of the Mills furnace were:—

t should not be too costly.

t must utilise the radiant heat of combustion.

here must be ample temperature to ensure complete cal combination.

ccess to boiler for examination and repairs must not be ed.

he whole of the various gases given off by the fuel e immediately burnt with their sensible heat of produc- them.

ittle or no excess air must be used.

ll ordinary qualities of coal must be useable.

ttendance must not be excessive.

results of tests on a Cornish boiler, worked on an ry internal fire and with the Mills producer, with the fuel in each case, and tested by the same expert, show ng of about 50 per cent., and there was no smoke.

s on a Lancashire boiler with the Mills producer give fficiencies and standardised evaporations ranging from b. to 11.47 lb. of steam from 1 lb. coal, and on a com- n with another boiler fired with the same fuel, but he ordinary internal fire, the tests show a saving of 18 per cent. in evaporation. In this case also there entire absence of smoke.

ent Application.—Application has been made by Francis Oddie, for the restoration of Patent No. 24,539, of or "Improvements in duplex pumping engines."

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The A.E.G. Meeting.

I have read with interest, and not without amusement, your report of Dr. Walther Rathenau's extraordinarily anti-English speech at the extraordinary meeting of the above company. This induces a train of thought which ends in the Electrical Co., Ltd., Charing Cross Road. I observe that the premises are still open, and understand that the business is still "in being." As the authorities are no doubt seeing that no enemy goods are being imported from, and that no money is being transmitted to, Germany, it can only be assumed that the Electrical Co. is selling British-made goods. All efforts to draw this company have, so far as I know, failed, but I think that the time has come when the B.E.A.M.A., the I.E.E., or the E.C.A. should take the matter up and force this company to state what kind of business it is carrying on, and where it is finding the money from to carry on. Obviously the place is being kept warm for German business and capital and staff after the war, and it would be interesting to know who the Englishmen are who are assisting in this respect. I refer not only to the staff of the Electrical Co., but to those contractors or manufacturers who are apparently helping to keep this concern "in being."

I do not think I am making a mistake if I state that the trade looks to you in a matter of this kind to agitate until something is done.

Inquisition.

September 10th, 1915.

Electric Power in India.

With reference to the three letters published in your issue of July 23rd last over the signatures of "Accuracy," "British Representative," and "A Ditcher," it is regretted that they have not had the courage to sign their name to their communications.

From the manifestly incorrect statements appearing in each letter, I can only conclude that they all have been inspired from the same source and that the experience of the initiator has been confined chiefly to wiring, electric lights, and fans, with which my paper is in no way concerned, and that the author's practical knowledge of power plant, which subject alone is dealt with in the paper, is of the most limited description.

A reference to the records of sea-borne trade of British India and foreign countries, compiled in the office of the Director General of Commercial Intelligence, would have shown at once that the percentages given by me appertaining to electric, hydro-electric, and steam turbine imports from Great Britain compared with those of Switzerland, Germany, and America are, in fact, correct, and if those who presumed to criticise my paper had taken the trouble to seriously study the paper, before attempting criticism, they would have found there a table, compiled with the assistance of the engineers in charge of the more important electric supply companies at work in India at the present time, which shows that of a total station capacity of approximately 90,000 h.p., Switzerland supplied engines to the extent of 72,000 h.p., England 11,000 h.p., and the U.S.A. 7,000 h.p. The electrical plant was supplied as follows:—

Germany no less than	43,000 h.p.
United States	23,000 h.p.
Switzerland	14,000 h.p., and
England	10,000 h.p. only.

The above facts dispose of such arguments as are contained in my critics' letters. The remainder, consisting, as it does, of mere abuse of myself, in itself sufficiently indicates personal bias to show the value of the criticisms.

The reference, however, by "British Representative" to the Calcutta Local Section of the Institution is misleading in view of the fact that its opinion can in no way be taken as representative. It does not number amongst its members many engineers who, by practical experience, are entitled to express an opinion, and who actually represent in India a number of the largest British electric power plant manufacturers.

A reference, therefore, to the local Institution as at present constituted, for its opinion on papers dealing with electric power, hydro-electric, and traction work, as distinct from wiring, lights and fans, would certainly not be welcomed by the authors.

The letter above the signature of "A Ditcher" contains allegations so damaging to my reputation, both as a professional man and as an Englishman, that I have felt constrained to place the matter in the hands of my solicitors, and, therefore, do not propose to deal with these accusations now further than to state that:—

1. I am a natural born British subject and that, to the best of my belief, I have always acted as such.

2. I am not open to look after the interests of any electrical manufacturers, but, as my profession is that of consult-

ing engineer, it is obvious that I am glad to be appointed consulting engineer to mills and factory owners.

3. It is perfectly true that whilst in the pay of the A.E.G. and the Lahmeyer Electrical Co. I did my best to further their interests, but, in order to establish a consulting practice, I resigned these two very valuable agencies when on a visit to Berlin in 1912.

4. It is equally true that I am interested in the Hupmobile, which is an American car, but with, I may add, the sanction of the Council of the Institution of Electrical Engineers.

My correspondents appear to suggest that it is an unpatriotic act to hold an agency for an American concern, and I can only say that, if this is the case, the number of patriots amongst the business community of Calcutta, or in any other large commercial centres, must be remarkably limited.

Speyer & Co.

Calcutta, *August* 18*th*, 1915.

[With reference to point No. 4, as we imagine it not improbable that the whole subject will come before the Council of the Institution of Electrical Engineers we refrain from comment at this stage.—Eds. E.R.]

Lighting Developments.

I have read Mr. Crouch's article on "Lamp and Lighting Developments" with great interest, and should be glad if you or your contributor could advise me where I can find the latest and fullest particulars of the development of the Moore and Neon lights to date? Thanking you in anticipation,

Wm. A. A. Burgess, A.M.I.E.E.

Sutton, *September* 8*th*, 1915.

Increased Charges and Special Contracts.

Now that increased charges are being made by nearly all supply undertakings in consequence of the abnormal rise in the price of fuel, caused by the war, it would be interesting to know whether proportionate increases can be made on existing special contracts; for instance, a contract made three years ago giving the consumer a specified charge for a period of five years. Can this charge be increased on the grounds that the contract was made when no one could have predicted a long and serious war such as the present one? Readers' opinions on these points would be very useful to your

Inquirer.

Church Lighting.

I should be glad if you could give me your opinion or your suggestions as to installing electric light in churches, where it is considered inadvisable to use the ordinary electroliers, these latter not being in keeping with the architecture of the building. Could the indirect lighting system be utilised with advantage? Any suggestions you could let me have through the medium of your columns would be acceptable.

Lux.

[The lighting of churches, which is so frequently effected by most unsuitable means, is quite a special branch of illuminating engineering; no two churches are alike, and every case must be dealt with on its own merits. It is, therefore, impossible to say that this or that system is to be preferred. In general, we should advise the rejection of proposals for the conversion of existing fittings and lay-outs, and the adoption of a scheme appropriate to the surroundings, under the guidance of an expert in this particular branch. The wholly indirect system could seldom be employed, owing to the height of the roof; reflecting indirect-lighting fittings, while meeting this difficulty, would be too obtrusive in daylight. The ordinary methods too often result in great discomfort to the congregation, and we strongly recommend our correspondent to obtain competent advice on the subject before embarking on a scheme.—Eds. Elec. Rev.]

Wrinkles on the Operation of Alternators.

"Switchman" puts a case where the only guides for regulating the fields of alternators in parallel are the field ammeters of the machines, but he surely does not mean me to understand that no main ammeters are in use? I have pointed out that if the fields of alternators running in parallel are correctly regulated, the sum of the main ammeter readings will be a minimum. If of two machines running in parallel, one has too strong a field and the other too weak, the resultant voltage may be normal, but idle currents will circulate between the machines and the sum of the main ammeter readings of the two machines will be greater than the possible minimum.

With regard to the last question, I should not have thought that the fact of another alternator being switched in would require any alteration whatever in the field strength of the rotary, provided all is in proper order.

E. B. Pausey.

Bury, Lancs., *September* 6*th*, 1915.

WAR ITEMS.

The A.E.G. as an Oracle.—It is now nine months since chairman of the A.E.G., presiding at the annual meeting hel Berlin last December, made an extraordinary speech in relatio the situation created by the war and the future prospects of Fatherland. No less remarkable and optimistic was the sec speech which Dr. Walter Rathenau delivered on September 3r a special meeting of the company, when sanction was sought eventually obtained to a scheme for increasing the share ca by the issue of new shares for £1,800,000 for the purpose of ef ing an interchange of shares with the Berlin Electricity W Co., of which details were given in this journal a fortnight The only omission then made—or, rather, the announcement not been published at the time—is that this proposed extensio a community of interests, which will bring the A.E.G. in asso tion with the comprehensive lignite mines in the vicinity of Bit feld, is considered to be appropriate, because the company will it necessary in the near future to make considerable change working which will render it essential for many works to re to a centre of coal production.

If we now turn to the speech itself, we find that the sh holders were first reminded of the previous address where necessity for the transformation of German industries from p work to war work had been pointed out. The change, we told, was effected in a surprisingly quick manner, and the comp for its part co-operated in the movement. In the late autum 1914 Germany was confronted with entirely new questions, bot regard to the provision of war material and peace requireme which arose from the situation which was forced upon the cou through the English blockade. How this state of affairs was Dr. Rathenau naturally refrained from informing the meet We are, however, becoming somewhat sceptical concerning constant reiteration by one company after another, by one learned society after another, that all needs of the country in raw materials have been sati by drawing upon national resources. It is certainly known some metals have been substituted for others, and that nitrates being produced on a larger scale than formerly, but when it actually stated at an assembly of technical men several mo ago that no copper was needed, as a substitute had been provi our credulity was strained to its utmost limit. The chairma the A.E.G., however, did not proceed to this extreme. He st that the anxiety in respect to raw materials had completely g way, and it could be joyfully said that this was rendered pos through the organisation of work and methods which employed with the traditions of the company. It is, howe impossible to understand how organisation of work and met could compensate for any deficiency in the supply of raw mate but that is the statement. The blockade, we are further told longer oppresses the Germans; on the contrary, the position been reversed, as the country which imposed the blockade in hope of exhausting the Germans industrially, and of killing economically, was suffering most severely for its own freedom the blockade. We alluded to this part of Dr. Rathenau's sp last week.

The actual position of the A.E.G. next engaged the atte of the chairman, who remarked that the inland indus or domestic economy led to results which influenced monetary situation of the company. The liquidity of company, whose cash resources are reported to have risen £4,150,000 to nearly £5,000,000 at the end of June, did not any anxiety to the directors. The shareholders were info that they were living in a period of great sale. The stocks at the works were diminishing as also were the outstanding and the correlative of that phenomenon was the liquidity of total means of the country and also of the company. In process of realisation—in this partial sale of goods—the chai said there would be seen a matter which was economi gratifying. The explanation of this assertion was that durin present times Germany was getting rid of all surplus stocks w were not urgently required, and it might be said that in relie herself of stocks a part was also played by the removal of d in the market. Lest his audience should conclude that A.E.G. produced drugs on the market, the chairman hasten add that he would not say that the company had such stocks, that the clearance had taken place to a far-reaching extent the company thereby felt strengthened and equipped for problems. Are we to conclude that the great sale, general appears to be from the preceding statement, represents a diversion of the goods for the purpose of finding materials fo continuance of the war? It certainly seems that this is the and that the boasted independence of external sources of materials is far from reaching the stage of being founded upon

The question of the future is of particular interest. On point the speaker stated that it could not be concealed tha double preparation with which the company was confron the preparation for the prolongation of the war and the pre tion for a speedy conclusion of peace—was perhaps the serious part of the work as compared with what had been formed hitherto. The directors believed that by strengthe the manufacturing and industrial intensity they could fi remedy for a portion of the falling-away exports, for a po of a slowed-down European economic situation, and for the e of impoverished foreign countries. The strengthening of indu intensity would be a general problem for Germany; the com did not wish to be behindhand in this respect and hoped to it satisfactorily. At present the stock of orders and the nu of the company's account were almost equal to those at the o ponding period of 1914, although the early months of the war had a paralysing influence on business which was comprised in the financial year, for which the books were now being closed. Dr. Rathenau, under these circumstances, deemed it to be premature to make any announcement as to the financial results, but he held out the prospect of a higher dividend which, however, would be partly determined by the political situation, which "is taking so hopeful a course through the brilliant victories of our armies."

If any further comment on the chairman's address be necessary it is afforded by the fact that the tone of buoyancy and confidence which characterised the speech delivered at the end of last December has entirely disappeared. But this new feature in the situation is becoming by no means uncommon in that country. At the same time, the admission is noteworthy that the Germans expect to lose a portion of the export trade in electrical engineering manufactures. Certainly engineers in the Allied countries will strain every effort to secure the exclusion of Teutonic commodities after the conclusion of peace, and they will have the right to claim that domestic customers shall give them every support in this direction. So far the Germans have entertained the idea that they would be able to resume business in the future at the stage at which it was suspended by the war, but the statement of the chairman of the A.E.G. shows that the recognition is now dawning even in German minds that business as usual can no longer be a motto as between that country and the Allied nations.

Application to the Bolton Munitions Court.—The Munitions Court for the Bolton district had before it, on the 8th inst., an application by James Vickers, an employé in the electrical department of Messrs. Henry Bessemer & Co., who desired a certificate giving him permission to work elsewhere. He had been an apprentice at the works, and had just come out of his time. He stated that he had asked for his full journeymen's wage, and, being refused, gave a week's notice. When he asked the firm for his discharge papers, so that he could go to some other munitions firm and earn more money, they referred him to the Munitions Court. It was stated for Messrs. Bessemer that it was usual for apprentices to work up to the full scale by instalments, and the same terms were offered applicant as were accepted by other employés. Questioned by Dr. Sellars, barrister, who presided, the applicant said it was not usual for an apprentice, when he came out of his time, to go on full wage, but the apprentice, added Vickers, could leave. Dr. Sellars, however, said that under the Munitions of War Act he could not leave. He could in peace time, but this Act made all the difference. The Court found in Messrs. Bessemer's favour.

Westinghouse War Relief Fund.—We have received a copy of the fifth statement of receipts and expenses in connection with the British Westinghouse Employés' War Relief Fund. Of the total contributed to August 31st last, amounting to £14,625, £10,134 has been contributed by the employés and £4,491 by the company, and out of this sum £8,598 has been paid to dependents, £2,500 set aside for a Widows' and Orphans' Fund, and over £1,200 has been spent in donations to outside funds, Christmas gifts 1914, and payments to Red Cross workers. The number of families receiving relief is 621, and the number of the company's employés who have joined the King's Forces is 1,572. The very considerable amount of work involved in administering the funds has been performed by members of the company's workmen and staff voluntarily, and without expense to the fund. Everybody concerned is to be congratulated on so fine a statement.

War Lighting Restrictions.—As there has been some interference with the street lights on the part of pedestrians, who think that at air-raid times in the metropolis it is necessary to still further reduce the public illumination, it may be as well to refer readers to the statement on the matter issued to the Metropolitan Borough Councils. This was published in the ELECTRICAL REVIEW for June 25th, 1915, p. 888. The Commissioner of the Metropolitan Police now draws attention in the Press to the fact that any person unlawfully extinguishing a street lamp commits an offence, and is liable to summary arrest. The present reduction of street lighting has been effected in accordance with a considered scheme, and the unauthorised extinction of lamps may create confusion and danger.

Trading with the Enemy.—As doubts have arisen regarding the position under the proclamations in force relating to Trading with the Enemy of incorporated companies or bodies of persons which, though not incorporated in any enemy country or in territory in hostile occupation, carry on business in any such country or territory, a new proclamation is now issued declaring as follows :—For the purposes of the proclamations for the time being in force relating to Trading with the Enemy, the expression "enemy," notwithstanding anything in the said proclamations, is hereby declared to include, and to have included, any incorporated company or body of persons (wherever incorporated) carrying on business in an enemy country or in any territory for the time being in hostile occupation.

Controlled Munitions Factories.—On September 4th, Mr. Lloyd George announced that 180 additional establishments were now controlled establishments under the Act, making the total 715.

"The Message of the Flag."—Mr. Charles R. Wylie, who is an old Silvertown cable engineer (he was with the company for more than 20 years), some time ago wrote a song—"The Message of the Flag"—set to music by Capt. R. W. Mockridge, and sold by West & Co. It is dedicated to "every man who is doing his little bit for the honour of the Empire and for England." Capt. Mockridge is now at the Front in France, and Kennerley Romford and others are singing the song to the men on active service there and elsewhere. The first verse and chorus read :—

It's only a wisp of bunting, made of red and white and blue,
Growing rather worn and tattered, for it's long since first it flew
Through rain and fog and tempest, through battle smoke and flame,
And it's flapping out a message in the dawning :

REFRAIN. *Repeat for Chorus optional.*

"Here's to the swinging turret ! here's to the rolling drum !
And the bugles shrilly sounding that 'The Day' has come,
And here's to ev'ry fighting man who answers to the Call
For the honour of the Empire and for England."

America and the Russian Market.—According to a Reuter dispatch from Chicago (*Financial Times*) plans for the establishment of closer trade relations with Russia by means of an American co-operative sales company are under consideration by leading American manufacturers. They propose to take advantage of Russia's invitation to sell goods in Russia now while sentiment is friendly to the United States. The manufacturers' association is to be known as the International Manufacturers' Sales Co., of America, and will have offices in Chicago and Moscow.

Elementary Mechanics for Wounded German Soldiers.—The Physical Section of the Elektrotechnische Lehranstalt, of Frankfort-am-Main, is devoting special attention to the instruction of soldiers who have lost limbs in the war. Some time ago it inaugurated a course in elementary mechanics at the convalescent home in connection with the Orthopædic Hospital, while now it is announced that it is starting a similar course for one-arm soldiers.

Board of Trade List.—The Commercial Intelligence Branch of the Board of Trade during the week ended September 4th received inquiries for sources of supply of the following goods (List No. 37) :—

Aluminium bars, notched.
Engines, petrol, small and cheap for driving pumps and churns.
Furnaces, small electrical, for experimental purposes.
Switches, E.L. tumbler.

BUSINESS NOTES.

South African Trade Figures.—The Customs Department has issued a statement of the trade of the Union and of British South Africa for the month and six months ending June 30th. The figures are, in some respects, remarkable. During June the total imports, including specie, were actually nearly as large as in June of last year, the figures for the two months in question being £3,119,350 and £3,150,305. The imports of merchandise amounted in value to £2,523,296, as against £2,752,286 in June, 1914. Leaving specie movements and Government purchases of stores out of account, the actual value of the imports of the past six months amounts to £12,509,221, as against £17,346,047 in the first six months of 1914. The decrease in the war period has been at the rate of nearly 28 per cent., and it has been spread over a variety of articles of commerce. An important table attached to the Blue Book shows the value of imports of merchandise into British South Africa, distinguishing countries of origin, during the six months of 1915 and the first six months of 1914. In the first half of last year the imports from Germany represented 9½ per cent. of the total imports, the value being £1,715,472. During the past six months, of course, German trade with this country has practically ceased to exist, though it may be remarked that by some means or other German goods to the value of £71,925 are recorded as having entered the Union. Presumably these were already *en route* before the outbreak of the war. In the case of the United Kingdom our imports increased from 55·4 per cent. of the total to 57·7 per cent., and, if we take in the figures for the rest of the Empire, it will be found that the increase was from 66·8 per cent. in 1914 to 69·2 per cent. in the present year. The United States has, however, benefited most materially by the destruction of German trade. In the first half of 1914 our imports from America were £1,685,000, or 9·3 per cent. of the total, and this year they were valued at £1,833,000, or 14·2 per cent.—*South African Mining Journal.*

Our Trade in China.—The Board of Trade announces (says the *Times*) that arrangements have been made by the Foreign Office in accordance with which his Majesty's Commercial Attaché at Peking, and the Assistant Commercial Attaché, who is stationed at Shanghai, will be prepared to assist British firms in need of agents in China by putting them in touch where possible with suitable British agents in that country. Firms desiring to take advantage of this offer should communicate with his Majesty's Commercial Attaché for China, care of the British Legation, Peking, or with the Assistant Commercial Attaché, care of his Britannic Majesty's Consul-General, Shanghai.

Bankruptcy Proceedings.—HERBERT PAGE, electrical engineer, 63, Queen Victoria Street, E.C.—Under this failure a sitting of the London Bankruptcy Court was held on Tuesday before Mr. Registrar Hope for the public examination of the debtor who returns total liabilities £2,278, of which £2,157 i expected to rank against net assets valued at £91, after deducting £85 for payment of preferential claims. In reply to Mr. Egerton S. Grey, Official Receiver, the debtor stated that prior to 1891 he was in the employment of a firm of electrical engineers. In that year he started in partnership with Mr. Charles Henry Smeeton, at 63, Queen Victoria Street, E.C., and they traded as "Smeeton and Page." Neither of them had any capital, but Mr. Smeeton borrowed £150 from a relative, who had since been repaid. The partnership was dissolved in 1894 because they did not make sufficient profit to keep two persons. Under the deed witness took over the liabilities and assets, and paid £200 to Mr. Smeeton, partly in cash which was borrowed from the bankers, and partly in bills. He (debtor) continued the business until January, 1908, and then executed a deed of assignment; the assets realised £363, and a dividend of 3s. 6½d. in the £ was paid on liabilities amounting to £1,776. That failure was due to losses on contracts and bad debts. The creditors allowed him to retain the little stock that was on hand, and he continued the business at the same address, with success, until 1912, when he was again short of capital, and began borrowing from friends and others, to whom he now owed £1,550. A balance-sheet prepared in 1912 showed a surplus of £36, but no consideration was taken of loans, and a deficit of £150 should have been disclosed instead of the surplus. During the ensuing two years the trading resulted in a loss of £390, whilst his drawings for that period amounted to £851. All his borrowing powers were exhausted by the beginning of the present year, and in May, being pressed by creditors, he consulted his solicitor, upon whose advice he filed his petition. Witness attributed his failure and insolvency to bad trade, lack of capital, to loss caused by the builders' lock-out in 1914, and to the war. A full set of books of account were kept in the business. The examination was concluded.

John Taylor Peddie, mechanical engineer, Exhibition Buildings, Aldwych Site, Strand, London.—Receiving order dated September 8th, on a creditor's petition. First meeting September 22nd: public examination October 22nd, both at Carey Street, W.C.

T. H. Rigg, electrical and mechanical engineer salesman, Green Lane, Pannel Ash.—Receiving order made September 9th, on debtor's own petition. First meeting September 24th; public examination, October 8th, at York.

V. G. Cobb, electrical engineer, Nottingham.—Order made August 19th suspending discharge for 2½ years. Assets not equal to 10s. in the £; proper books of account not kept; bankrupt continued to trade after knowing himself to be insolvent; and he failed to satisfactorily account for the deficiency of assets to meet his liabilities.

Granville Burgess, electrical engineer, Bury Street, London, E.C.—Release of trustee dating from September 1st.

Private Arrangement.—Venner's Electrical Cooking and Heating Appliances, Ltd., 66-68, Wandsworth Road, S.W.—At the adjourned meeting of the creditors herein, held last week, it was stated that the landlord, who had levied execution on the company's stock and office furniture and plant for over £300, for about two years' rent, payable in advance, had succeeded in his proceedings, although the liquidator had applied to the Court to restrain the landlord from distraining for the future rent. The Court held that as the distress was levied before the commencement of the liquidation the landlord was entitled to succeed. That took place last month, and since then the landlord had refrained from realising any of the assets in order to give an opportunity to the company of endeavouring to make some arrangement. At the previous meetings it was intimated that the directors were endeavouring to find additional capital. It was now stated, however, that up to the present the directors had not succeeded in making any definite arrangements, although certain negotiations were on foot. Since the last meeting an intimation had been received from an entirely different source that there might be some opportunity of selling the patents in another direction. It appeared that a petition had already been filed for the winding up of the company, but had since been withdrawn. The matter was discussed at some length, and resolutions were passed unanimously for the appointment of Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, of 4, Charterhouse Square, E.C., to act as the creditors' liquidator, in conjunction with Mr. Venner, the shareholders' liquidator. The latter stated that he was quite agreeable to the creditors appointing someone to represent them to act in conjunction with himself.

Neuhausen Aluminium. — According to a source closely associated with the Aluminium Industry Co., of Neuhausen, the condition of business of this Swiss undertaking is entirely satisfactory. The increasing use of aluminium during the course of the war has been stimulated by the seizure of metals in Germany, which has caused various industries to have recourse to aluminium as a substitute. The company, which is stated to have very large orders on hand for a long time forward, and which paid a dividend of 20 per cent. for 1914, reckons on very favourable results being obtained for the current year.

Trade Announcements.—The International Time Recording Co., Ltd., are removing to larger premises at 57, City Road, Finsbury, E.C., where they hope to be better able to cope with the increasing demand for Dey, Bundy, Rochester and International automatic time-recording machines.

Mr. Vernon Hill, electrical engineer, has opened new premises at 101, High Street, Broadstairs.

Book Notices.—"British Standard Specification for Electricity Meters." Report No. 37 of the Engineering Standards Committee, revised August, 1915. Price 7s. 9d, post free.—The Sub-Committee on Electrical Accessories, of which Mr. C. H. Wordingham is chairman, has been engaged on the revision of the first edition of this specification (issued in 1907) during the past 12 months, and has found it necessary to redraft it entirely, and to extend it considerably in consequence of the large increase, during recent years, in the size of individual installations arising from the extension of the use of electrical energy supplied from central stations. The first edition referred only to consumers' meters of sizes up to 100 amperes, but the revised report includes provision for meters up to the very largest sizes in use, as well as for three-wire and three-phase meters. It does not deal with electrolytic meters.

This specification is intended to apply to the purchase of new meters, governing their sale by the manufacturer to the purchaser, and has no direct bearing on any questions which may arise between the supply undertakers and their consumers in connection with such of the meters as are employed to register energy supplied from public supply mains. The requirements have, however, been so drawn up that meters conforming to them may reasonably be expected to fulfil the conditions imposed by the Board of Trade on meters used in connection with public supply undertakings, and to satisfy Inspectors under the Electric Lighting Acts during a considerable period after the meters have been put into service.

Some important modifications and additions have been made to the standards and definitions. It has now become necessary to distinguish between the portion of the main circuit in the meter and the portion outside the meter. This is done by defining, in addition to the definitions of "Main circuit" and "Pressure circuit," the "Meter current circuit" and "Meter pressure circuit."

The standard sizes of meters include sizes for currents up to 5,000 amperes. The registering mechanism is dealt with at some length, and the terms used to distinguish the different types of counting mechanism are "Pointer type" for the ordinary clock face with a rotating pointer, and "Counter type" for the so-called cyclometer mechanisms. In the latter case it is specified that the figures shall spring quickly into position, except the lowest figure used. The term "Register" is used and defined as follows:—"The term register denotes the circular scales and pointers, or the figure openings and figure wheels, as the case may be, from which are read the figures that permit evaluation of the supply to the consumer."

The limits of error are specified in a concise table, the formula used in the first edition of this specification having been discarded. Meters are required to have the testing constant plainly marked, and this constant is specified as the number of revolutions per minute which the rotor should make at the full load of the meter under standard temperature conditions.

Clauses have been added dealing amongst other things with the internal and external shunts, and resistances, pressure and current transformers, and the marking of the terminals of three-phase meters. Appendices have been added dealing with the precautions to be taken in the erection of meters, and notes on the testing of meters. Illustrations of typical arrangements of meter registers have also been added.

The report may be obtained direct from the offices of the Committee, 28, Victoria Street, Westminster, S.W.

"Calendar of the Royal Technical College, Glasgow," for the session 1915-16, commencing September 28th, 1915. Glasgow: The College.

"On the Relation of Imports to Exports." By J. Taylor Peddie. London: Longmans, Green & Co. Price 2s. 6d. net.

"*Proceedings* of the American Institute of Electrical Engineers, Vol. XXXIV, No. 9, September, 1915. New York: The Institute. Price $1.

"Classification of Alternating-Current Motors." By Val A. Fynn.—Reprint from the *Proceedings* of the American Institute of Electrical Engineers.

Catalogues and Lists.—General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C. — 8-page illustrated pamphlet (No. 1,921) briefly describing and giving prices of "Dubilier" portable X-ray apparatus, which can be easily carried from place to place and used direct on any normal electric lighting circuit.

Messrs. S. R. O. Ball-Bearing Co., 115, Southwark Street, London, E.C.—36-page illustrated catalogue and price list of the "S.R.O." ball-bearings of light, medium, heavy and special types. Particulars of bores, sizes, weights, working loads and prices are very fully detailed in some 30 pages of table matter.

Liquidation.—Spiral Regulating Dynamo Co., Ltd. —Creditors should send particulars of debts, &c., to Mr. H. C. Bound, 61 and 62, Lincoln's Inn Fields, London, W.C., the liquidator, by September 30th. A meeting is called for October 11th at that address to hear an account of the winding up.

LIGHTING and POWER NOTES.

Ashtead. — Street Lighting.—In reference to the tender for street lighting, the Council has been informed that the Gas Co.'s price was £3 per lamp, and that of the Electric Lighting Co. £2 18s. 9d. per lamp; there were already nine lamps fitted for electric light, which only required new lanterns, at a cost of about £8; they were therefore saving about £13 a year by accepting the Electric Light Co.'s tender.

Australia.—Hydro-Electric Scheme.—The project for utilising the water supply system of Grafton and South Grafton in connection with a hydro-electric power scheme, prepared by Mr. W. Corin, of the N.S.W. Public Works Department, has been submitted to the Minister. He reports that a new gravitational water supply for the two municipalities has recently been provided from the Nymboida river, by means of a tunnel half-a-mile long and a 22-mile pipe line. There is a fall of 200 ft. in the first mile or two on the Grafton side of the tunnel, and by leading a new power pipe line for this distance, it is estimated that without any considerable damming 300 KW. could be developed. The transmission would be overhead at 22,000 volts to Grafton and South Grafton, where energy would be sold in bulk to the municipalities at the rate of 2½d. per unit. The approximate cost of the hydro-electric installation and transmission line would be £23,000, whilst the distributing systems for Grafton and South Grafton would involve outlays of £4,300 and £12,000 respectively. It is estimated that with energy supplied in bulk at 2½d. per unit, and retailed by the municipalities at 6d. per unit for lighting, and 2d. per unit for power and street lighting, the expenses of the distributing systems would be covered.—*Commonwealth Engineer.*

Electrical Pumping Plant.—The electrical engineer to the Sydney Water and Sewerage Board, in his annual report, states that the 700-H.P., 5,000-volt induction motor driving centrifugal pumps at Crown Street continues to give good service. The cement-testing laboratory is fitted with electric heat baths. Motors for driving testing machines are also employed. The system of installing small centrifugal pumps, driven by electric motors, to automatically maintain the high levels full, has been extended. At Wollongong the electric power plant consists of a 45-KW., 2,200-volt, 50-cycle, three-phase generator, direct driven by a turbine at 1,000 R.P.M.; the head of 550 ft. under which the turbine operates is derived from the main supplying the town of Wollongong, and the electrical energy is transmitted to a 50-B.H.P., 2,000-volt motor-driven pump at the lower dam, a distance of about seven miles; the pump delivers water from the lower to the upper dam. At Richmond inquiries are being made with a view to adopting electric drive, as the capacity of the present steam plant, which is in need of a general overhaul, must be increased. A 00-H.P. compressing plant, driven by electric motors, has been put down near the Marrickville Railway Station, for the purpose of supplying compressed air to rock channellers and drills. Electric motors totalling 100 H.P. are being installed in connection with the rock-excavating plant at the new reservoir in Gladstone Park, Balmain. The number of electrically-driven pumping stations totals 31.—*Commonwealth Engineer.*

Annual Report.—The first annual report of the Goulburn Council electric lighting undertaking shows a net profit of £1,275 after providing for depreciation and all expenses. It is proposed to install additional plant at an estimated outlay of £7,500.—*Tenders.*

Barnet.—Street Lighting.—The North Metropolitan Electrical Power Distribution Co. has allowed the U.D.C. £39 in respect of diminished public lighting during the June quarter.

Brandon.—Street Lighting.—The North Brancepeth Coal Co., contractors for public lighting by electricity, having had a sum deducted from their account owing to restricted lighting, have informed the U.D.C. that unless the balance is forthcoming they will be obliged to terminate their contract. The Council has decided to take no action in the matter, considering that the Council should not pay for energy not used.

Braintree.—Proposed E.L. Scheme.—The U.D.C. has been informed that the canvass for prospective E.L. consumers has been favourable, but the matter will now have to stand over until the war ends. Mr. H. P. Girling, of Maldon, who undertook the canvass, is to be paid £40 out of £50 as agreed upon, and the balance when the report, delayed by the war, is completed.

Broughton.—E.L. Scheme.—The R.D.C. has decided to offer no objection to the proposal of Wrexham T.C. to extend the electricity mains to the parish of Broughton.

Dartford.—Price Increase.—The U.D.C. has, owing to the extra cost of coal and other incidental expenses, increased from October 1st the charges for electricity as follows:—Lighting, flat rate, by 1d. per unit; ditto, alternative rates for long-hour consumers, by ½d. per unit; power, by ¼d. per unit. Charges will be re-adjusted as soon as coal can be purchased at or near the rates in force before the outbreak of war.

Draperstown (Co. Derry).—Proposed E.L.—A meeting of ratepayers has appointed a Committee to report on the advisability of having the town lighted by electricity.

Dundalk.—The electrical engineer reports that the new storage battery at the power station is nearing completion. The six new cells erected recently as an extension of the battery were permanently connected last week. The first of the two new Diesel engines is about to be received from the makers. Several important connections have been made.

Hove.—Price Increase.—The Council has decided to increase the charges for electricity by 20 per cent. during the period of the war.

Ifield.—Overhead Lines.—The P.C., which is about to install electricity in place of gas for public lighting, has applied to the Horsham R.D.C. for permission to erect standards in the parish for overhead lines. The Roads Committee has been deputed to consider the matter and report.

India.—The electrification of cotton mills in Bombay from the power supply of the Tata Hydro-Electric Works at Lonawla is rapidly proceeding, about a dozen mills having been connected at the end of last month. The Pearl and the Simplex Mills are the latest additions, both being designed for the electric drive. The Simplex is a spinning and weaving mill fitted with over 800 looms and 30,000 ring spindles; the whole of the machinery is driven by eight Westinghouse motors aggregating 1,300 B.H.P., with two transformer sets of 600 KW. each. The energy consumption is about 900 units per hour or 11,000 units per day, at 0·55 anna per unit; the annual cost to drive 30,000 spindles and 800 looms averages about Rs. 1,10,000 (£7,333).—*Indian Textile Journal.*

Keighley.—Price Increase.—The Electricity Committee has decided to recommend the Council that, in view of the increased cost of production caused by the war, the scale of charges for direct-current electricity for lighting, motive power, heating and cooking purposes (but excluding electricity supplied in pursuance of existing sealed agreements) be increased by ½d. per unit from October 1st next inclusive.

London.—St. Pancras.—The B.C. has received the consent of the Treasury to the borrowing from the Ecclesiastical Commissioners of such a proportion of the £22,530 as will be necessary to cover the cost of the two boilers at the King's Road electricity station, now approaching completion. The Electricity Committee recommends that a loan of £11,265, the amount required at the present time, be taken up. The Finance Committee recommends that the sum of £6,413, remaining in the net revenue account of the electricity department at March 31st last, after retaining £4,000 as a working balance, be utilised for the relief of the rates. The electricity reserve fund now stands at £44,160.

Milnrow.—The U.D.C. has decided to inform the owners of Coral Mill that it is not in a position at present to supply electricity.

Motherwell.—Annual Report.—Mr. J. A. Wishart, burgh electrical engineer, reports that during the year there were generated 3,487,437 units, as compared with 3,620,089 units in the preceding year. Owing to restricted lighting there was a decrease in consumption of 82,171 units; power sales increased by 55,274 units. During the year 46 new installations were connected to the mains. The total income from all sources was £16,082.

New Earswick.—Overhead Lines.—The Flaxton Council has again considered the question whether electric current should be conveyed to New Earswick by overhead or underground cables. Previously the Council had decided in favour of the latter, but the general manager of the York electricity department wished it to reconsider its decision, stating that only single poles would be erected, and these would be no more unsightly than ordinary telegraph or telephone poles. The Council decided to adhere to its previous decision in favour of underground cables.

New Zealand.—Annual Report.—The report of the city electrical engineer, Dunedin, for the year ended March 31st last shows total revenue £57,627, and working expenses £18,799. After providing for interest £20,997, depreciation £3,825, and renewal fund £10,145, there was a net profit of £3,860. There were 10 999 608 units of electricity sold, as against 10,155,471 in 1914. The consumers numbered 5,015; the number of motors in use on the mains was 845 of 7,084 H.P., and the total generating and distribution costs per unit were ·402d. Average price obtained—for private lighting, 3·35d. per unit; power and heating, ·739d.; and for tramways, ·715d.

The Public Works Department is receiving many applications for the supply of current from the Lake Coleridge hydro-electric scheme. At Tai Tapu, 12 miles from Christchurch, a local butter factory is not only changing over to electric drive, but is undertaking the distribution of current on a co-operative basis to residences in the district. A larger flour mill is to be erected at Lincoln to be electrically driven; current is also to be supplied to the Lincoln Agricultural College. Negotiations are also in progress to supply current to Oxford, Hororata, and Cust, and other country towns. It is anticipated that the farmers will take advantage of electric power for carrying out farming operations as a means of cheapening production.—*Commonwealth Engineer.*

Peterborough.—Price Increase.—The Council has increased the price of energy for power purposes by ¼d. per unit as from September 30th.

Runcorn.—Prov. Order.—The R.D.C. has been informed that the B. of T. has granted Warrington T.C. an order to supply electricity to the works of the Richmond Gas Stove and Meter Co., at Grappenhall, which are in the rural area.

Sandgate.—Restricted Lighting.—The Folkestone Electricity Co. has allowed the U.D.C. a reduction of £210 from £486 due for public lighting as the rebate owing to restricted lighting. The Council considers the offer reasonable, but has asked for further adjustments on future accounts.

South Africa.—New Electric Plant.—The annual report of the Government Mining Engineer of the South African Union, dealing with machinery, shows that during the year 1914 the chief items of new electrical machinery introduced were as follows:—Transvaal: Electric generators and engines, hoists, locomotives and motors, £201,315; power cables, transformers bells, telephones, &c., £79,406. Cape Province: Electric generators and engines, hoists and motors, £25,642; power cables, transformers, bells, telephones, &c., £12,551. Orange Free State: Electric generators and engines, and motors, £4,819. There were 45 electrically-driven coal-cutters in use in the Union in 1914. The number of electric hoists licensed for the transport of passengers continues to increase; in the Transvaal, at the end of the year, there were in operation 103 induction-motor hoists, with an aggregate of 53,769 H.P., and 23 Ward-Leonard type hoists, with an aggregate of 25 575 H.P. Of the 162 elevators in the Transvaal which came under the supervision of the Mines Department, 157 were electric; in Cape Province there were 60 electrically-driven elevators; in Orange Free State 4, and in Natal 85 out of a total of 89. The number of units of electricity used for mining purposes was 451,988,177. There were nine separate accidents in connection with electric plant at the mines, classified as follows:—Direct contact with a live cable exposed through abrasion of the insulation, 3; contact with a conductor (signal wire), made live by its contact with a live cable exposed through abrasion of its insulation, 1; accidental contact with the insulated part of apparatus, (*a*) with live parts nominally exposed, 3; (*b*) with live parts nominally unexposed, but improperly exposed when live for adjustment, 1; misadventure, 1.—*S. A. Mining Journal.*

St. Anne's-on-Sea.—Out of a total of 321,191 units used up to July 31st, 44,290 units were for domestic power. This is a big increase compared with a year ago, when the figures were 28,180. The output of electricity for August showed an increased consumption, in spite of a reduction in public lighting, &c. The consumers now number 1,661, an increase of over 100.

Wakefield.—Loan Application and Price Increase—The City Council last week was informed that it was anticipated that there would be a deficiency on the electricity undertaking, and that the Local Government Board had refused to sanction any further loans for extensions of the works at present. The Electricity Committee, however, had decided to apply for sanction to borrow £1,000 to meet the cost of providing an additional boiler feed pump and a cooling tower at the works. With regard to the question of the price of electricity, the Committee recommended that the charges for power and lighting purposes be increased 12½ per cent. from October 1st.

Annual Report—The report of the city electrical engineer stated that during the past 12 months 3,132,262 units had been sold, whilst the number of consumers showed an increase of 88 at 1,025. There were 352 motors connected to the mains, with a total of 3,398 H.P. The revenue amounted to £18,055, and the expenditure to £10,856, interest and sinking fund charges absorbed £6,693, and there was a net profit of £506. It was estimated that the revenue of the undertaking would fall by about £900, on account of the reduction of lighting in the streets.

Wallasey.—Plant Extension.—The Council has sanctioned the expenditure of a further £9,000 for the installation of new plant at the electricity works.

Walsall.—As the new station and plant will not be in operation this year the Electricity Committee of the T.C. has decided to postpone work on the E.H.T. change over, and concentrate the staff upon the L.T. change over, *i.e.*, the laying of a third wire to 105-volt mains and the balancing up of 105-volt consumers on the three-wire system. The Committee has approved an extension of mains at an estimated cost of £180.

Windsor.—Street Lighting.—The electrical installation Co., Ltd., have again allowed the T.C. a rebate of £17 off the past year's account for public lighting. The Council, owing to the lighting regulations, has suggested that the present contract with the company be suspended, and that terms should be quoted for lighting on the reduced scale.

Worcester.—Mains Extension.—The Electricity Committee has decided to extend the mains in Hylton Road, at an outlay of £250, in order to supply electricity to Severn Bank tannery.

TRAMWAY and RAILWAY NOTES.

Ambleside.—Motor Vehicles.—The Council has refused the application of the Barrow-in-Furness Tramways Co., for licences for motor vehicles to ply in the district.

Ashton.—War Bonus.—An application from the tramwaymen's Union for a war bonus for tramwaymen working on the Manchester section has not been entertained.

Australia.—Suburban Railway Electrification.—When moving the second reading of the City and Suburban Electric Railways Bill in the New South Wales Legislative Assembly, the Minister for Public Works stated that the traffic was expanding so rapidly that it would practically double itself before the city railway had developed. During the last four years the train, tramcar and ferry traffic had increased 11·24 per cent. per annum, and at the same ratio would double itself in 6·5 years. Low level and high level underground schemes had been proposed, but the one before the House was what was known as the high level underground railway. It would be placed at a shallower depth than any of the other schemes.—*Aus Mining Standard.*

Birkenhead.—Female Labour.—Women conductors, all of whom are wives of soldiers, have been introduced on the Birkenhead tramways.

Bradford.—Female Labour.—A deputation from the Bradford branch of the Tramway Workers' Union met a sub-Committee of the Corporation tramways and the manager with reference to the employment of women on the tramways, the manager having publicly stated that owing to large numbers of enlistments from amongst his men there was difficulty in working the system properly. The deputation stated that the workers objected to the employment of women, maintaining that in Bradford, even more than in other places, owing to heavy gradients and "rush hours" which had no parallel on any other system, the work was unsuitable for females. There were plenty of men who had been rejected for military service, who could undertake the work better than women. As an organisation they objected to the idea until the necessity was proved. The tramway manager has indicated that he does not favour the employment of women if it can possibly be avoided.

Bristol.—Tramways Purchase.—With a view to enabling the negotiations with the company to be completed before finally making recommendations, the Tramways Option Committee has recommended the City Council to make application to the B. of T. for an order extending for one year the period during which the Corporation shall be entitled to exercise its present option to purchase the Bristol tramway undertaking. An order for an extension of time under the Act, if granted by the B. of T., will not affect subsequent periods for exercising the option of purchase.

Burton.—L.G.B. Inquiry.—A L.G.B. inquiry was held on the 7th inst. relative to the Corporation's application for a provisional order to run omnibuses and motor-cars within the borough. The borough electrical engineer expressed himself in favour of an electric 'bus to carry its own electricity, the capital expenditure for such a vehicle being about £1,200. It is proposed to have an experimental service with two or three cars at first.

Canada.—The Hamilton Hydro-Radial Union has been informed that the engineers of the Provincial Hydro Commission at work to the south of Hamilton are surveying for an electric line, not only from Hamilton to Port Dover and other points on Lake Erie, but for a line which will enter into competition with those of the Dominion Power and Transmission Co., as well as the steam road of the T. H. and B. The plans call for a hydro-radial to St. Catharines and all intermediate points, including a side line to Dunnville, Cayuga, &c.—*Canadian Engineer.*

Electric Railways.—The annual report of the Ottawa Department of Railways and Canals for the year ended June 30th, states that there are now 60 electric railways (including street railways) in Canada, aggregating 2,052·44 miles of single track. There are four railway systems, having over 100 miles of single track, viz., the British Columbia, 345 miles; Montreal Tramways, 234 miles; Toronto Railway, 133 miles; and the Winnipeg Railway, 101 miles. The passengers carried during the year numbered 794,059,593, and the car-miles run were 98,917,808. The total capital expenditure is returned at $147,595,342, and the year's net earnings were $7,867,546, and after various deductions for reserve, &c., the surplus was $1,873,955. On one-third of the lines there was a deficit on the year's working.—*Electrical World.*

London.—Women Conductors—The question of employing women as tramcar conductors in London has been put forward by the North Metropolitan Tramways Co., but the police authorities decline to issue licences.

North-Eastern Railway.—Heavy Freight Traction.—According to the *Yorkshire Post*, experimental working on the electrified portion of the N.E.R. from Shildon to Newport has commenced, and it is hoped that the whole length of the Simpasture branch, from Shildon to Erimus Sidings, Newport, near Middlesbrough, will be opened for traffic by the end of the month.

The starting point, Shildon, is the collecting ground for the West Durham coalfield, and practically the whole of the output carried over the line is intended to feed the enormous blast furnaces which are built beside the line at Erimus Sidings, between Thornaby and Middlesbrough.

Current is supplied by the overhead system, and conducted by two bows from the overhead conductor to the locomotives. Ten engines will be employed, nine of which are completed, and have made experimental runs. They are of the customary electric locomotive form, with a cab in the middle, with eight wheels, each pair of wheels having a separate motor. They have been designed by Mr. Vincent L. Raven, chief mechanical engineer, North-Eastern Railway, and built at the Darlington Works.

The electrical equipment has been designed and carried out under the supervision of Mr. Chas. A. Harrison, who has recently retired from the position of chief engineer of the company. The power is supplied by the Newcastle-on-Tyne Electric Supply Co., and the Cleveland and South Durham Companies, who have erected several sub-stations for the purpose, the pressure being 1,500 volts.

Nottingham.—Female Labour.—The City Council has decided to engage women to act as tramcar conductors, the difficulty of obtaining suitable men having become acute. Preference is to be given to young married women whose husbands are on active service or invalided home, and they will receive full rate of pay and uniform.

Southampton.—Female Labour.—The Tramways Committee of the Corporation proposes to employ women conductors during the continuance of the war, at a rate of pay of 5d. per hour, for, as far as possible, eight hours per day and six days a week.

Southport.—Annual Report.—The revenue from the tramways for the year ended March 31st last exceeded that of the previous year by £1,574, the total being £20,420.

Walsall.—Women Conductors.—The Tramways Committee is now employing females, to act temporarily as conductors, men being unobtainable for the position. They are being paid the same rate as men.

Women conductors are now engaged on the cars in Wolverhampton.

Wharfedale.—Railless Traction.—Last week the inauguration took place of the new railless route from the Guiseley terminus of the Leeds City tramways to Otley. The fare is to be 3d., and the charge from Otley right through to Leeds will be 8d.

Wigan.—Annual Report.—The report of the general manager of the Corporation tramways shows that the profit on the year's working was £902, as compared with £4,690 in the previous year; the traffic receipts were £75.248, a decrease of £2,726, and the working expenses £46,177. Interest on capital absorbed £13,866, and rent of leased lines £3,662; £13,101 was allocated to sinking fund and repayment of mortgage loans, and £4,231 was transferred to the renewal fund. The total car-miles run were about 1½ millions, and the receipts per car-mile were 12·07d., a decrease of 0·39d.; passengers carried numbered 13,811,709, a decrease of about half-a-million. The energy consumption was 1·461 units per car-mile. The total capital expenditure amounts to £481,577.

Female Labour.—Six women conductors were employed on the Martland Bridge Mill route last week.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Postmaster-General claims to have effected a saving of £25,000 by utilising scrap materials, such as metal pieces, &c., from old telephones in the departmental workshops. The material formerly largely went to waste.

Improvements in the telephone service are about to be adopted by the Postmaster-General, as the result of a general conference of telephone managers, on a report submitted by Mr. G. H. Morgan, telephone manager in Melbourne, and Mr. S. L. Monaghan, assistant telephone manager in Sydney, who recently toured America and Great Britain. Mr. Spence states that by the "attended-pay station" the caller is spared the delays and difficulties incidental to the penny-in-the-slot-system. It is specially adapted to busy centres, and is to be first tried at the central telegraph receiving office, Melbourne, and the General Post Office, Sydney. The "no delay trunk service" is a speeding-up process in the traffic between exchanges, workable on certain lines not more than 25 miles in length. It is also intended by the Postmaster-General to adopt a scheme, founded on that in existence in America, for the training of operators, and the practice of employing women operators on night duty is to be extended.

New Telephone Subscribers.—The Government has decided to impose a surcharge on new subscribers to the national telephone service. The impost came into operation on September 8th, and is intended to last during the war. It is, in fact, in the nature of a war tax, and will be applicable to the whole of the kingdom. Everybody requiring a new telephone service will be called upon to make an initial payment of £4. That is the minimum amount, and the sum may be exceeded if the installation is likely to entail much outlay. The surcharge is due entirely to the shortage of labour occasioned by the war, there having been, owing to enlistments and other causes, a considerable reduction in the number of men available for telephone extension. Under these circumstances the Postmaster-General is unwilling to undertake any new work which can be avoided. The object is to sift out applications and reject those which are not urgent, so that whatever money is spent may be used to the best advantage. The surcharge must be prepaid. On the installation being made, the ordinary tariff rates are enforced.

The Telegraph Service.—The Retrenchment Committee, of which the Chancellor of the Exchequer is chairman, has presented to the Government an interim report, in which it recommends economies in the public service which can be carried into effect at once and without legislation. The Committee considers that certain unremunerative Post Office services should be made self-supporting, and chiefly the telegraphic service, on which there is now a loss. If the recommendation is adopted by the Government, as it doubtless will be, the public may have 1s. telegrams again. Further, there is reason to believe that the Committee recommends that the low Press rates should be increased. It has been stated lately that the loss to the Post Office on this advantage given to the newspapers is £300,000 per annum.—*Daily News.*

The World's Wireless.—The 7,000 ship stations in the world require over 15,000 licensed men to operate them, while over 1,000 land stations with a working force of 3,200 men are required to handle the business which originates on board, or for, these vessels. The records of the United States show that about 2,000 amateurs have been licensed in the past few years to operate their own stations. All the best equipped warships carry wireless, and a fair estimate of the number of navy vessels at war so equipped is Great Britain 500, Germany 200, Italy 200, France 180, Russia 110, Japan 70, Austria 60. There are also a large number of small vessels under Colonial flags. The United States has over 300.—*T. and T. Age.*

United States.—The affairs of the United Wireless Telegraph Co. have been settled, after long litigation, and the company has been dissolved.—*T. and T. Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—October 25th. Six electrically-operated wharf capstans, for the Sydney Harbour Trust. Forms of tender from the Engineer-in-Chief, Harbour Trust Offices, Circular Quay.*

October 25th. For the Commonwealth Department of Defence (Navy Office). Supply, delivery and erection of power-station plant and equipment for the Commonwealth Naval Dockyard, Sydney.*

Victorian Railways.—January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

Bristol.—September 24th. Unwashed small coal for six or twelve months, for the Corporation electricity works. Mr. H. F. Proctor, Chief Engineer and General Manager, Exchange, Corn Street (returnable deposit of £2 2s.).

Burnley.—September 20th. B. of G. Electrical goods. Tender forms from Mr. J. S. Horn, Clerk.

Dundee.—September 27th. Heating and ventilating the City Hall Buildings, Dundee. Mr. Jas. Thomson, City Architect.

Edinburgh.—October 4th. Corporation. Cast-iron intake shaft, pump shaft, &c., for obtaining sea-water for condensing in connection with the new electricity station at West Bank, Portobello. The Engineer, Dewar Place station, Edinburgh.

Halifax.—September 22nd. Electrical fittings for six months for the B. of G. Mr. A. T. Longbotham, Clerk, Carlton Street.

London.—Bow.—September 21st. Electrical goods for the managers of the Poplar and Stepney Sick Asylum District. Mr. S. G. Wright, Clerk, the Asylum, Devon's Road, Bow, E.

Kensington.—September 23rd. Six months' supply of electric lamps and fittings for the B. of G. Mr. W. R. Stephens, Clerk, Guardians' Offices, Marloes Road, W.

H.M. Office of Works.—October 1st. Repair of incandescent electric lamps. See "Official Notices" to-day.

Liverpool.—September 21st. Electric supplies for six months, for the West Derby B. of G. Mr. H. P. Cleaver, Clerk, Brougham Terrace.

Manchester.—September 21st. Guardians of Manchester Union. New motor-driven compressor for refrigerating apparatus. Specifications from Mr. A. J. Murgatroyd, 23, Strutt Street, Manchester.

September 21st. Corporation Tramways Department. Supply and delivery, up to March 31st, 1916, of best house, furnace and anthracite coal. Mr. J. M. McElroy, 55, Piccadilly, Manchester. Also same date, (*b*) making up of uniform clothing, and (*c*) uniform caps.

Merthyr Tydfil.—September 21st. Electrical accessories for six months, for the B. of G. workhouse. Particulars from the Master.

New Zealand.—Dunedin.—November 3rd. City Council. Supply and delivery of insulated and bare copper wire in quantities for a period of two years. Specifications at Electrical Engineer's office, Market Street, Dunedin.—*New Zealand Shipping and Commerce.*

Shanghai.—September 24th. Municipal Council. One turbo-generator, 5,000 kw., and one or two of 10,000 kw., complete with condensing plant, &c. See "Official Notices" August 20th.

September 29th. E.H.T. switchgear, static transformers, and underground cables for 22,000 v., for the Municipal Council. See "Official Notices" August 27th.

South Africa.—Johannesburg.—October 9th. Municipal Council. Water-purifying plant with a capacity of 75,000 gallons per 24 hours, for the generating station.*

Spain.—September 30th. Registro de la Dirección-General de Telégrafos, Madrid. The construction and working, for a maximum period of 20 years of a central telephone exchange at each of the following towns:—Huesca (Province of Huesca); Lorca (Province of Murcia); Orihuela (Province of Alicante); Borjas

Blancas (Province of Lérida); and Aguilas (Province of Murcia). A copy of the *Gaceta*, containing particulars (in Spanish) regarding the installation of the necessary plant and material, may be consulted by United Kingdom manufacturers of telephone exchange equipment at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London. E C.

Swindon.—September 18th. Corporation. Supply of steam coal. See "Official Notices" September 3rd.

Warrington.—September 22nd. B. of G. Electrical goods ("none of German or Austrian origin") for six months ending March 31st, 1916. Mr. Arthur Bottomley, Clerk, Bewsey Chambers.

September 28th. Twelve months' supply of earthenware conduit, for the Electricity Department. See "Official Notices" to-day.

Whittingham.—September 20th. County Asylum. Supply during six months, commencing October 1st, 1915, of various workshop stores. Mr. H. E. Morgan, Clerk and Steward.

Wolverhampton.—September 21st. Electric fittings for six months for the B. of G. Mr. F. Harrison, Clerk.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The following contracts have been placed:—

P.M.G.'s Department, Victoria.

Item 1, one accumulator battery, Premier type, Perth, £340; item 2, ditto, South Australia, £345; item 3, ditto, Flinders Island, £305; item 4, ditto, Queensland, £305.—Warburton, Franki, Ltd.

Victorian Railways Department.

Carbons for arc lamps, £46 10s. per ton.—Aust. General Electric Co.

Kenti insulated wire: item 1, No. 14, solid, £43 5s. per mile; item 2, No. 8, stranded, £95 7s. 6d. per mile; item 3, No. 6, stranded, £115 10s. per mile.—R. W. Cameron & Co., Ltd.

One 30-kw. Silvertown shunt-wound generator complete, £138 10s.—I.-R., G.-P. & Telegraph Works, Ltd. —*Tenders.*

West Australian Government Tender Board.

Metallic-filament lamps: item 1, 2s. each; item 2, 1s. each; items 3, 4, 5 and 6, 11¼d. each.—C. Atkins & Co. —*Aust. Mining Standard.*

Aylesbury.—The U.D.C. has accepted the tender of Mr. Thos. Robinson, of Liverpool, for installing the electric light at the Town Hall, at £129.

London.—Messrs. Siemens Brothers Dynamo Works, Ltd., have received an acceptance of a tender for the supply of Wotan lamps to the G.P.O. for the ensuing six months.

The G.P.O. has also placed a contract for Royal Ediswan drawn-wire lamps.

The General Electric Co., Ltd., has for the seventh time received the G.P.O. (six-monthly) contract for Osram drawn-wire lamps. The company has also received contracts for many thousands of Osram and Robertson lamps for the Admiralty and the War Office.

St. Pancras.—The Electricity Committee reports the purchase of the following supplies of coal, in accordance with the B. of T. suggestions:—

1,000 tons Nuneaton D.S. nuts, at 22s. 6d. per ton, from Messrs. Facers and Co., and 1,000 tons Newdegate nuts, at 22s. 7d. per ton, from Messrs. J. H. Beattie & Co., Ltd., for replenishing stock.

1,000 tons Newdegate beans, at 21s. ton; 500 tons ¾-in. Hacknall, at 19s. ton, and for the deficiency in quantities necessary to be made up over the next nine months.

2,000 tons D.S. Newdegate beans, at 21s.; 1,000 tons D.S. nuts, at 22s. 6d.

Bethnal Green.—The Guardians have accepted the tender of Pope's Electric Lamp Co., Ltd., for 700 metal-filament lamps, at 1s. 3½d. each; and the tender of Messrs. Drake & Gorham, Ltd., for 300 tantalum lamps for £19 8s. 6d.

Stretford.—The tender of Messrs. Belliss & Morcom has been accepted by the Electricity Committee for the supply and fitting of new valves for the intermediate cylinders of the engines of the last 500-kw. set, at an approximate cost of £70.

Sunderland.—Last week the T.C. accepted the following tenders on behalf of the Electricity and Lighting Committee:—

E.H.T. switchgear and meters —Ferranti, Ltd.
Cable.—B.I. and Helsby Cables, Ltd.
Transformer oil.—E. Cleaton Rees.
Cable.—I.-R., G.-P. and Telegraph Works.

Walsall.—The tender of Messrs. H. Gough & Son has been accepted by the T.C. Electricity Committee, at £455, for internal alterations to the sub-stations.

Weymouth.—The T.C. has accepted the tender of Messrs. R. Cox & Son for 100 service boxes, at 9s. each.

FORTHCOMING EVENTS.

Institute of Metals—Friday, September 17th. At 8.30 p.m. At the Chemical Society's rooms, Burlington House, W. Annual general meeting.

Iron and Steel Institute.—Thursday and Friday, September 23rd and 24th. At the Institution of Civil Engineers, London. Autumn meeting. For particulars see our "Notes," September 3rd, p. 308.

NOTES.

Women Conductors.—At the Birmingham Police Court, one Joseph Judd was fined 20s. for removing the chain of a tramcar after it was full, and for rudeness to the woman conductor in charge of the car. The woman burst into tears in consequence of his offensive behaviour. The Bench signified its determination to protect women conductors, but the other passengers on the car had already shown that if need be they were prepared to take the law into their own hands.

Electricity in Steel Works.—The new electrical plant recently installed in the works of the Central Steel Co., at Massillon, Ohio, U.S.A., has given every satisfaction, as is evidenced by the statement of the directors of the company that the "Electrically operated steel mills may be considered a success." The installation was due to the efforts of the Massillon Electric and Gas Co., who succeeded in convincing the Central Steel Co. that their new steel mills should be electrically equipped, and the result is that electric power is employed exclusively in the operation of this plant. After six months' work the superintendent reports that the capacity of the plant is 30 per cent. greater than that at which it was rated, and "the very first run of steel was marketed and pronounced of satisfactory quality." He also adds that the effectiveness of the electrical installation in reducing labour costs has exceeded all expectations. The mill of the Central Steel Co. has at present a capacity of 400 tons of steel per day, but four additional furnaces are to be erected immediately, and these also will be electrically equipped throughout.

The New York Electrical Exhibition.—Arrangements are well in hand for the ninth annual Electrical Exposition and Motor Show, which is to be held at the Grand Central Palace, New York, from October 6th to the 16th. The Exhibition will, it is expected, surpass those of former years in interest, as the U.S. Government, including the Army, Navy, and Treasury Departments, and the New York City Board of Education, are uniting in an effort having this object in view; in addition to which all the leading electrical engineering and allied concerns will be present with exhibits. As regards the Army, this department will be represented by an exhibit prepared at the Springfield Arsenal, showing the manufacture of rifles and sabres. The Signal Corps of the Eastern Division of the Army will also have a display of the communication apparatus used by a modern army in the field, including wireless telegraph, telephone, and various other signalling devices.

By direction of the Naval Department, an exhibit is being prepared, comprising a 5-kw. wireless sending and receiving station and the central generating station of a Dreadnought. The U.S. Treasury is sending an interesting exhibit—a "Money Laundry," a machine for washing, drying and ironing paper currency.

Among the industrial exhibits of interest will be a dairy and a bakery, all the apparatus and machinery in connection with which will be electrically worked. The American Telephone and Telegraph Co. is arranging to give a series of demonstrations of the trans-Continental telephone line between New York and San Francisco, in connection with which brief lectures will be given on the development of the telephone and the construction of the trans-Continental line itself. The New York Edison Co. will have, among other interesting exhibits, a therapeutic display, including a model hospital and clinic, with every modern electric appliance used in surgery and the treatment of diseases. In addition, between 75 and 100 different firms have booked space at the Exhibition.

New Source of Platinum.—Most of the world's supply of platinum comes from the Russian deposits in the Ural Mountains, the average output being about 9 tons a year, while only about 300 kg. is derived from other sources. The total supply has remained practically constant since 1900, but the price has more than doubled during the past 10 years, owing to the increasing demand for platinum in the chemical, electrical, and dental industries, and to the control exercised by a company. Moreover, the richest Russian deposits are gradually becoming exhausted.

The high price of the metal has prompted prospectors to search for new sources, but their efforts have generally proved unsuccessful. However, at Wenden, in Westphalia, according to the *Génie Civil*, in the course of explorations for ores of iron, lead and copper, the presence of platinum has been unexpectedly discovered in proportions such that the deposits appear to be amongst the richest in the world. A cubic metre of the new ore contains as much as 36 to 70 grammes of the metal, compared with a content averaging 6 to 8 grammes in existing mines, and rarely exceeding 40 grammes. The discovery was due to a new method of chemical analysis, which was capable of detecting platinum not only in the free state, but also in the form of alloys with other metals such as silver, which being soluble in nitric acid would have passed without detection under the old methods of test. This fact encourages the hope that platinum may be found in other regions of similar geological formation to that of Wenden. The Austrian publication from which our contemporary derives this information, however, observes that the presence of exploitable platinum in Germany has not been fully proved.

Educational.—South-Western Polytechnic Institute.—The prospectus of the day and evening courses for 1915-16 has come to hand. Classes are provided in the usual engineering subjects, under Mr. A. J. Makower and his assistants in electrical engineering, Messrs. U. A. Oschwald and B. H. Morphy.

Strike of Dublin Electricians.—On Tuesday last, says our Dublin correspondent, all the members of the Dublin Union of Electricians struck work, and electrical work in the city was consequently brought to a standstill. The trouble arose out of the demand of the men for payment of 11d. per hour, the prevailing rate being 9½d. per hour. The employers refused to accede to the demand. Roughly, there are about 30 electrical firms in the city. Non-Union men remained at work, and some of the masters say they can proceed without the aid of those who have gone out. The Corporation electricians are not affected by the strike, there being an agreement under which they must remain at work during a local strike; but the Corporation is bound by whatever agreement as to terms may be come to by outside employés and employers. About 200 of the men on strike have left for Belfast and Glasgow. Several important contracts have had to be refused by city firms within the past few months, owing to the scarcity of electricians, numbers having gone to cross-Channel centres for munitions work. An instance has been quoted of a junior hand who, some time ago, was earning 25s. per week in Dublin, and is now getting £5 in another city. Some of the Dublin employers have advertised for men to fill the places of the strikers.

Mr. J. Gibson, secretary of the Dublin Building Trades Employers' Association, writing to the Press on behalf of the electrical section, states that the Electrical Trades Union (Dublin branch) came to an agreement with the Association in May, 1914, under which they were to receive 9½d. per hour for 50 hours per week, resulting in a weekly wage of 38s. 6½d., "which is as high as paid to any skilled worker in Dublin or district, with one exception." "The conditions of the electrical trade in Dublin since the war started are," says Mr. Gibson, "extremely bad, work being scarce and many employers finding it almost impossible to pay expenses. It has further to be borne in mind that the rate of wages in Dublin is as high as paid to any electricians in the United Kingdom with, we believe, one exception, viz., London. The increase demanded by the men amounts to 7s. 3½d. per man per week, equal to practically 20 per cent. When the men demanded this increase of wages we offered to consider the question of a bonus to men engaged on war work, but no notice was taken of this offer."

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—

Company Orders.—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week commencing September 20th, 1915:—

Drills, 6.30-7.30; 7.30-8.30. p.m.

Monday.—Section 3, Technical instruction; Section 1, musketry at range; Sections 2 and 4, Squad drill or signalling.

Friday.—Section 4, Technical instruction; Section 2, musketry at range; Sections 1 and 3, Squad drill or signalling.

Attention is called to the fact that the War Office has now decided to employ certain Volunteer Training Corps in guarding waterworks, railways and prisoners.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, September 16th, 1915:—

Week-end Parade.—Sunday.—The Corps will be visited by General Sir O'Moore Creagh, V.C., G.C.B., G.C.S.I., on Sunday next, the 19th inst. The Battalion will parade as strong as possible at Liverpool Street Station (low level entrance G.E.R.), at 9.30 a.m., for entrenching, returning about 4.55 p.m.

The Quartermaster will make the necessary arrangements for refreshments to be served on the grounds.

Regimental Sports.—Owing to the large number of entries for all the events in the Regimental Sports programme, it is absolutely necessary that all preliminary heats for the 120 Yards Handicap, and the Pole and Pillow Fight, should be got through in the morning on Saturday next, commencing at 11 o'clock sharp.

The order of the printed programme will be carried out as far as possible. Competitors not answering to their names at the time at which each of them starts will be scratched.

No. 10 Inter-Company Push Ball is cancelled. Another event will be substituted, should time allow.

Commissions.—There are a few vacancies for Commissions in the Royal Engineers (Kitchener's Army) open to members of the Corps who are engineers by profession. Age, 25-40 years. Members desirous of taking up these appointments are directed to apply to the Adjutant, at Headquarters.

Musketry.—There will be no Shooting at either Bisley or Acton Ranges on Saturday next, the 18th inst.

A. G. JOINER, *Major and Adjutant*, O.B.C.

Appointments Vacant.—Chief assistant clerk and accountant for Shanghai municipal electricity department (£46 per month); jointers (41s.) for H.M. Dockyard, Rosyth. Particulars are given in our advertisement pages.

The Electrical Photometry of Stars.—In a paper read at the meeting of the National Academy of Sciences, April 20th, 1915, Stebbins reviewed the recent work on this subject carried out at the University of Illinois Observatory. The majority of the work has up to the present been performed by the utilisation of the selenium bridge. This is mounted at the focus of the telescope, and the brightness of the illumination is indicated by the consequent diminution of resistance, which is measured by a Wheatstone bridge. The selenium bridge suffers from certain disabilities, the chief of which are that it is especially susceptible to temperature changes, and after exposure to light requires considerable time for recovery. However, it becomes more sensitive and extraordinarily more regular with decrease of temperature, so that for stellar work it is kept surrounded by an ice-pack, the whole apparatus being wrapped up in a blanket.

The selenium bridge bids fair to be displaced for such work by the photo-electric cell, which is more sensitive, and has a shorter recovery period. The photo-electric cell has a sensitive surface of one of the alkali metals, which is mounted in an exhausted glass vessel, with a small residue of inert gas. The effect of light is to release electrons from the surface, which ionise the gas, and thus a current is produced, the intensity of which is a measure of the incident light.—*Knowledge.*

Institution and Lecture Notes.—South African Institution of Engineers.—At the annual general meeting of the Institution, Mr. W. Ingham was elected president, and Messrs. Bernard Price and E. G. Izod vice-presidents. The Institution passed a resolution offering its services to the Government of South Africa for investigating proposals of a technical nature for the benefit of the Empire.

Train Lighting.—Commenting upon the recent train smash at Newark, the *Yorkshire Post* remarks "the very small casualty list is, undoubtedly, a great support for the advocates of electricity as against gas for the illumination of railway coaches. The greater part of the express was electrically lighted, and there was consequently no fire as a sequel to the smash. In almost all the railway accidents of recent years it has been the resulting fire which has been responsible for the worst horrors. The promptitude and presence of mind of the cook in shutting off the gas supply in the kitchen is particularly commendable."

Fires Due to Air Raids.—The British Fire Prevention Committee's Air Raid "Warning" as to the nature of the bombs used and how to deal with fires arising therefrom, which was first published earlier in the year, is now being re-issued in the form of a small poster, which can be obtained gratuitously upon written application (with stamped and addressed large envelope enclosed), from the Registrar of the British Fire Prevention Committee, 8, Waterloo Place, London, S.W. The "Warning" gives hints in simple, direct language as to explosive bombs, incendiary bombs, pungent fumes, and simple methods for meeting outbreaks of fire. It is illustrated with particulars of the incendiary bomb generally used by the enemy.

A Resourceful Lineman.—The foreman of construction in an Arkansas town a few days ago, after the flood had prostrated all telegraph lines, was instructed to restore communication at all hazards and without an instant's delay. The foreman was resourceful. He chartered a lifeboat and started down the stream, which covered the roadway and fields. In the course of a short time he discovered that he was getting out of sight of land. He therefore returned and obtained a mariner's compass. He started out again, this time towing a raft of telegraph poles, ranging from 20 to 30 ft. in length. He took soundings at the first place he thought would be just about right to drive into the ground one of the poles. To his surprise he found 53 ft. of water. He then proceeded further, and in a short time he discovered that he was out of sight of land. An inland lake 200 miles in extent had been formed by the flood waters. Under these conditions the foreman, not to be dismayed, returned to headquarters and sent an urgent message ordering 100 miles of submarine cable and a cable steamer to be sent by rail to lay the cable.—*Telegraph and Telephone Age.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At St. John's Church, Preston Park, Brighton, on September 6th, the marriage took place of MR. GEO. FREDK. HILTON, assistant engineer at the Ipswich Corporation electricity works, and Miss Kathleen Mary Agate, eldest daughter of the late Mr. J. Agate, of Brighton. The presents included an oak and silver biscuit box from the Ipswich electricity staff.

MR. GEORGE VAREY has been appointed chief assistant at the Wakefield electricity works during the war; an extra remuneration of £25 per annum is to be paid to him for the additional duties he will be called upon to perform.

MR. R. E. LIVESLEY has been appointed shift engineer at the municipal electricity works, Stretford, in place of Mr. T. Woodhill, resigned.

MR. A. E. WILSON, deputy city electrical engineer, Bristol, has resigned his appointment, he having been appointed by the War Office to the position of electrical engineer to the Chief Engineer of the Southern Command. The Electrical Committee recommends the City Council (1) to promote MR. A. J. NEWMAN, who has been in the service of the Committee for 11 years, to the vacant position, at a salary of £350, rising to a maximum of £400; (2) to promote MR. A. J. OSTLER, who has been in the Committee's service for 14 years, to the position of sub-station engineer, at a salary of £200, rising to a maximum of £250; and (3) to promote MR. I. A. D. PEDLER, who has a record of 15½ years' service, to the position of mains engineer, at a salary of £175, rising to a maximum of £250. The Committee is also of opinion that it is desirable, owing to the large increase in the size of the undertaking, to appoint a boiler-house superintendent whose duties will be chiefly to supervise the combustion of coal with a view to further economy in steam raising, and recommends such appointment at a salary of £200 per annum.

General.—We regret to learn that Mr. J. C. White, of the St. Helens Cable and Rubber Co., Ltd., was operated on for appendicitis last week. He is now, however, out of danger and progressing satisfactorily. Mr. White is the inventor of the patent corrosion-proof fittings that have acted as valuable accessories to C.T.S. wiring in severe situations.

On the occasion of his marriage to Miss Norah Harding Moss, daughter of Mr. Wilfred Moss, of The Knolls, Nanpantan, Loughborough, Mr. Wm. Pearson, of the staff of the Brush Electrical Engineering Co., has been presented by his colleagues with a case of cutlery.

The marriage took place at the parish church, Harpenden, Herts., on Sept. 6th, of Miss Winifred Mary Down, elder daughter of Mr. F. J. Down, M.I.E.E., of Glengariff, Harpenden, and Mr. Selwyn Dudley, younger son of the late Rev. H. T. Dudley, vicar of Whitfield, Glossop.

We regret to learn from the *Ironmonger* that M. Adolphe Greiner, of Liége, president of the Iron and Steel Institute, is seriously ill, suffering from an internal complaint. On September 1st news reached this country of an improvement in his condition.

Mr. George Dawkes, who has been appointed controller of the Telegraph Department, General Post Office, Edinburgh, in succession to Mr. Wm. Smith, who retired in May, has had a wide and varied experience. In 1874 he joined the service as a telegraphist at Leamington Spa, afterwards going to Brighton. His next appointment was to the North-Eastern surveyor's district, and later he became chief superintendent at Leeds. He was afterwards transferred to London as assistant traffic manager in the secretary's office.

Mr. W. C. P. Tapper, M.I.E.E., manager of the Stepney electricity undertaking, is a member of the London Munitions Committee.

The *Commonwealth Engineer* states that Mr. A. Fraser, electrical engineer, Sunbury, Vic., has been appointed second engineer at the new power house, Canberra, N.S.W. Mr. M. C. Henderson, assistant electrical engineer to the Dunedin, N.Z. Council, has been appointed city electrical engineer in succession to Mr. E. E. Stark. Mr. G. T. Edgar, who was employed in the electrical engineer's office as draughtsman, has been appointed assistant electrical engineer.

The *Review of the River Plate* states that Engineer Alvarez Cortes has been appointed manager of the State electric power stations of Uruguay.

It is announced in the Press that Temporary Lieut.-Colonel George R. H. Bowden, Royal Fusiliers (City of London Regiment), has relinquished his temporary rank on vacating command of a battalion.

Mr. Edwin C. Flint, who for the last nine years has held the position of senior estimator in the cable sales department of Messrs. Siemens Bros. & Co., Ltd., Woolwich, has resigned to take up a position with Messrs. Pirelli-General Cable Works, Ltd.

Roll of Honour.—Charles Cooper, of the Royal Naval Division, who was 34 years of age, and formerly worked at the Salford Corporation electricity station, has died from wounds received in the Dardanelles.

Lance-Corpl. Christopher Mooner, of the 11th Manchester Regiment, who has been killed at the Dardanelles, was employed by the Broughton Copper Co., Salford, and was in training as an electrical engineer.

Trooper Arthur Bibby, of the Life Guards, formerly in the electric traction department of the L. & Y. Railway, is recovering from the effects of gas poisoning, and is now at Birchington-on-Sea Convalescent Hospital.

Private Alex. McLaren Doig, of the 6th Manchesters, who has died from wounds received at the Dardanelles, was for four years a student at the Manchester School of Technology, and in 1912 received the Manchester University certificate of distinction in electrical engineering.

Private John W. Hogg, of the Signal Section, Royal Engineers, formerly a linesman employed by the Warrington Post Office, has met a tragic death while engaged on the repair of a telephone line. Capt. Mitcheson, in a letter to his father, states that Private Hogg went out to improve the telephone line which had been laid on the previous day. For some distance this line ran under some high-tension electric power lines. Hogg climbed up one of the poles with the telephone wire in his mouth, obviously to put it higher up on the pole, and, not realising that the wires above him were power wires, placed his left hand on one of them. He was killed instantaneously. Capt. Mitcheson pays a high tribute to the work of the deceased, and states that he was the hardest working and the most cheerful and willing man in his section. Private Hogg was 23 years old.

Private Edward Moss, of the South Wales Borderers, formerly employed by the Tudor Accumulator Co., Ltd., Dukinfield, is reported missing, and it is feared that he was drowned in the sinking of the *Royal Edward*.

Private R. Higham, a former employé at Messrs. Dick, Kerr and Co.'s works, has been wounded in the Dardanelles whilst with the Loyal North Lancashires.

Lance-corporal Baker, of the 5th Essex regiment, a member of the Chelmsford Town Council, who has been killed in action, was for many years employed at the Arc Works of Crompton & Co., Ltd., and latterly at the Marconi Works. When war broke out he became medical officer's orderly.

Private Victor E. Clarke, 1-6th Manchester Regiment, who has been killed in action in the Dardanelles, was on the staff of the Old Trafford Dynamo Co., of Manchester, which he joined after being trained at the works of Davey, Paxman & Co., of Colchester. He joined his regiment on September 7th, and proceeded a week later to Egypt for training.

Sergeant E. D. Wharldell, of the 11th Battalion Manchester Regiment, who was on the staff of the National Electric Supply Co., of Preston, has been killed in action in the Dardanelles.

Sergeant-Bugler Walter Henry Slaughter, of the 4th Sussex Regiment, who has been killed at the Dardanelles, was engaged at the Worthing Corporation electricity works prior to the war.

Troop-Sergeant Sydney Gordon Kerry, of the Berks Yeomanry, who was on the staff of the Reading E.L. Co., has been wounded in action in the Dardanelles. At first he was reported to have been killed.

Private Clifford Hitchcox, who was formerly in the test department of the British Thomson-Houston Co., Ltd., of Rugby, has been killed in action. He was serving with the Canadian Contingent.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Tilling-Stevens, Ltd. (formerly W. A. Stevens, Ltd.).—Issues on various dates from November 25th, 1913, to August 31st, 1915, of £50,000 first mortgage debenture stock, part of a series of which particulars have already been filed.

Chamberlain and Hookham, Ltd.—Capital, £100,000 in £5 shares (10,000 pref.). Return dated April 15th, 1915. 10,000 ord. and 8,000 pref. shares taken up. £5 per share called up on 7,298 pref.; £36,490 paid; £53,510 considered as paid on 10,000 ord. and 702 pref. shares. Mortgages and charges: Nil.

Contraflo Condenser and Kinetic Air Pump Co., Ltd. (110,264).—Capital, £80,000 in £1 shares. Return dated April 12th, 1915. All shares taken up. 7s. per share called up on 27,000; £9,450 paid; £53,000 considered as paid on 53,000 shares. Mortgages and charges: Nil.

Lawson's Non-Conducting Composition, Ltd.—Capital, £10,000 in £5 shares (1,600 ord., 100 defd., and 300 pref.). Return dated May 18th, 1915. 1,211 ord., 118 pref., and 100 defd. shares taken up. £5 per share called up on 889 shares; £4,445 paid; £2,700 considered as paid on 540 shares. Mortgages and charges: Nil.

CITY NOTES.

Nairobi Electric Power and Lighting Co., Ltd.

In submitting the accounts for 1914, the directors add the following comparative figures:—

	1912.	1913.	1914.
Units generated	604,392	723,852	1,020,038
Customers connected at December 31st..	508	610	633
Motors connected, B.H.P.	248	373	422
Private lights connected (8-C.P. equiv.)	10,658	13,745	22,808
Street lighting	2,000	2,000	2,000

The schemes for the utilisation of the Thika Falls, for which tenders were received and necessary financial arrangements made, had to be stopped owing to the outbreak of war. The Treasury prohibition of new capital issues being most stringently applied when it is a question of using the same outside the United Kingdom, has also effectively stopped the company's schemes. Sanction was, however, obtained for the issue necessary to provide the auxiliary steam plant to be erected at Nairobi to prevent the inconvenience which would be caused to the community by complete stoppage of the development of the company's undertaking.

Two of the directors were called up for war service, viz., the managing director, Lieut.-Commander R. C. Bayldon, R.N., and Colonel A. W. Mayo-Robson, A.M.S., in consequence of which the board elected their consulting engineer, Mr. E. W. Monkhouse, to be a temporary director of the company.

Southern Electric Tramways (Buenos Ayres).—The report for the year ended June shows a credit balance, after depreciating plant and machinery by 10 per cent., of $87,364, to which had to be added $23,293 brought forward. The sum of $1,747 is transferred to reserve and $4,368 to contingency account, after which a dividend of 2 per cent. is declared and $20,565 is carried forward.—*Financial Times.*

Direct Spanish Telegraph Co., Ltd.—The board has decided to pay, in addition to the dividend at the rate of 10 per cent. per annum on the preference shares, an interim dividend at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares, both for the half-year ended June 30th, 1915.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer register and register of debenture stock-holders will be closed from September 18th to October 1st, 1915, for the preparation of warrants for the half-year's interest, payable on the 1st prox., on the 4½ per cent. first debenture stock.

Manila Electric Railroad and Lighting Corporation.—A dividend of 1½ per cent. for the quarter ended September 30th, on common capital stock, is announced.

Dundee, Broughty Ferry and District Tramways).—The directors' report for the year ending July 31st states at the profit (including the sum brought forward from last year), ter providing for interest on debenture stock, amounts to £3,599. om this is deducted the interim dividend paid on preference ares for the half-year to January 31st at the rate of 6 per cent. r annum, less tax, £1,354, leaving £2,244. The directors prose to pay the final dividend on the preference shares at the rate 6 per cent. per annum for the half-year ending July 31st, less x, £1,334; to renewal fund £400; to sinking fund for the demption of debenture stock, £400; to carry forward £109. uring the year a portion of the company's line, 1,540 yards in ngth, was acquired by the city of Dundee, under compulsory wers.

Dumbarton Tramways Co., Ltd.—Mr. Geo. Balfour, airman, in moving the adoption of the report at the annual eeting, said that the directors regarded the result of the year's orking as satisfactory. The total receipts from traffic and adversing amounted to £23,304, being a decrease of £259. Receipts om interest on deposits and temporary loans and transfer fees ere £45 less than last year. Traffic and power expenses had creased by £340, and general expenses by £44; but, on the her hand, maintenance expenses showed a decrease of £485, due the large expenditure made during the previous year. The port was adopted and dividends on the preference shares at the te of 6 per cent. per annum for the half-year, and on the ordinary ares at the rate of 1½ per cent. for the year, in each case under duction of income-tax, were approved.

Halifax and Bermudas Cable Co., Ltd.—A dividend of 3 per cent., free of income-tax, is announced for the halfar, making 6 per cent. for the year, carrying £10,049 forward.

Holophane Co., Ltd.—The net profits for the year to ne 30th were £7,309, plus £11,623 brought forward, which, cording to the *Financier*, is to be carried forward.

International Light and Power Co., Ltd.—The rectors have declared a dividend of 1½ per cent., less British come-tax, on the preference shares for the quarter ending ptember 30th.

British Aluminium Co, Ltd. — The directors have ecided to pay a six months' interim dividend at the rate of 6 per nt on the preference shares.

STOCKS AND SHARES.

TUESDAY EVENING.

HE strength of the Stock Exchange markets is well maintained. lain indications of increased taxation in the near future have ttle of the effect which, in normal times, is associated with such minders of national obligation. In peace days, the hint that come-tax is to be raised is sufficient to force down the prices of ilt-edged securities, which, in their turn, drag down a host of thers. But taxation in these days is different from what our eneration has been accustomed to in the past; and the call to rther self-sacrifice which such hints imply|is accepted with somehing almost like readinesss, even by those who wonder how they re going to stand it.

American exchange problems are likely to be straightened out in he very near future by the issue of a one hundred million pounds terling loan in the United States by the British Government, but his factor New York has allowed to become overshadowed by he fresh diplomatic difficulties that have arisen between America nd Germany. These difficulties our cousins seem to take much nore seriously than we do over here, where the opinion is as strong s ever that Dr. Wilson will not allow his country to be dragged into nything likely to lead to open rupture. If the Americans could amely submit to the sinking of the *Lusitania* and accept the explanations" Germany offered therefor, she will be capable f sitting down under any sort of insult or injury, however agrant. This, at least, is a fair summary of much City opinion; nd the London Stock Exchange declines to suppose that the resent incidents will end in anything stronger than hot air.

Meanwhile, events in Mexico and in Brazil are being watched vith keen attention, since it is held that the latter country is truggling gamely through its troubles, and that even in Mexico he hopes of settlement need not be postponed indefinitely. At he same time, there is not much consolation to be drawn from he reported attitude of Carranza as to the futility of further eace negotiations at present. The British Consul at Mexico City as forwarded a complete list of the bonds and other securities vhich were removed from the vaults of the Mexican National Treasury by the Carranzist forces when they occupied the capital ast February. These securities are believed to have been leposited at Vera Cruz. The list is now available for inspection at he Commercial Intelligence Department of the Board of Trade, 3, Basinghall Street, E.C. It embraces the names of a very large mount of securities, with the numbers of the bonds concerned; o if any readers are unfortunately interested in this matter, they hould put themselves into communication at once with the lepartment.

One of the features of this week is the pronounced recovery in arious of the steam railway stocks. Started by a rally of a couple f points in Brighton Deferred, the improvement spread to the est of the list. The Brighton Company has just inaugurated a new system of third-class Pullman cars, and it is thought that this enterprising step, and the publicity given to it, have directed attention to the low price of the stock. The London and South-Western Preference issue, made primarily for the purpose of providing funds for the electrification of the suburban lines, has braced up to 100. Underground Electric Income bonds had a quick rise of 1¼, and Metropolitans and Districts are both better.

This change in the aspect of the market has come about in spite of the new agitation on behalf of the railwaymen, in which some of the authorities who cannot as a rule be accused of championing the cause of labour, have recognised a certain amount of justification. With the railway business of the country in the hands of the Government, the idea is that dividends are not likely to fluctuate to any material extent. Some ten weeks' dividends have now accrued in the prices of the Home Railway stocks; and, as this is the "fat" half of the year, Home Rails are being recommended as good investments to which can be safely entrusted, at all events, part of the money realised by the sale of American bonds, of which many thousands of pounds' worth have changed Continents within the last few weeks. The immediate outlook is hardly affected by the probability of another War Loan before the end of the present year; and it takes very little demand for stock to throw into relief the limited nature of the floating supply available to meet it.

The market for electrical supply shares is dull and heavy. There are a good many sellers about; some of them are anxious to get any sort of bid for their shares, this being the case, of course, where people are obliged to raise money. To quote one example: certain shares, nominally supposed to be 8½-9, were pressed for sale by a holder of 25, who insisted upon some sort of a bid being made him. The best offer he could get was 7¾, 15s. below the nominal price. We have used fictitious figures, but the company is one of the best in the Metropolitan list. Meanwhile, prices are not put down to any noticeable extent. For City Ordinary there are a few buyers, and the quotation has hardened to 12½.

In the manufacturing group, the principal change is one which cannot be traced in our lists. British Insulated Wire have been extremely difficult to sell for months past, but within the past day or two a buyer has been about, prepared to give 10⅝, or a little more. The inquiry no doubt is stimulated by the increase in the interim dividend, which is taken to forecast an advance upon the present good rate of 15 per cent. At the current level, the shares pay just over 7 per cent. on the money, without taking into account the possibility of improvement.

Anglo-Argentine Tramways have receded after their recent recovery. The Preferences are both lower, but the 4 per cent. Debenture stock at 73 is the turn better, following upon its rise of 1½ last week. In the Mexican issues there is still next to nothing going on. Mexico Tramways first gold bonds last changed hands about 39¾, earlier in the month; and the Seconds within the last few days have been done at 36½. Rio Tramway bonds are more active about 88, the 5 per cent. second bonds keeping about 71. The Home Tramway descriptions are quiet. British Electric Traction 5 per cent. Debenture stock was bought the other day at 79, and 63 was paid for the 4½ per cent. second Debenture stock.

Canadian Utilities have been moving sharply in price as the American Exchange rose and fell. Canada is represented on the Financial Commission now assembled in New York to consider the establishment of a credit on behalf of the Allies. The prosperity of the United States industrial companies is described as "almost scandalous" by some of their own participants in the money now being made; and there is a good deal of inquiry for most Canadian issues. Canadian General Electric Common, however, is somewhat neglected at about 107, the Preference having been done recently at 108½. Vancouver Power 4¼ per cent. Debenture stock was picked up at 62 a few days back, and Shawinigan Water changed hands on Monday at 122, there being also a little demand for the company's 4½ per cent. Perpetual Consolidated Debenture stock in the neighbourhood of 87½. Consolidated Gas and Electric Light of Baltimore Common stock is good at 108.

Activity is developing more and more in the shares of the Victoria Falls Power Company, and this week the price of the Preference has spurted to 17s. 3d., the Ordinary rising simultaneously to 5s. 6d. The 5½ per cent. Second Debentures are changing hands between 86 and 87. Added to a decided revival in Kaffir shares has been the turning off of the tap in Victoria Falls Preference which has had the effect of keeping the price depressed for some time past. Whether all the shares have been taken or not we cannot say, but a great many were absorbed just lately, and have gone into good hands.

The Telegraph market is slightly erratic. Great Northerns are £2 down. Eastern Telegraph Preference shed 4 points. Eastern Ordinary is a little lower, but Anglo-American Deferred at 21¾ is ¼ up. Marconis are a quiet, rather uninteresting market. Americans, after being 15s. 6d., recovered a few pence, but Canadian Marconis remain dull at 5s. 9d. New York Telephone 4 per cent. rallied to 98¼, on the fall in the American Exchange. It is difficult to see how these can be worth holding by British investors, who have greater attraction offered them, in the way of security and interest, in home-grown stocks and shares. On Direct Spanish Ordinary shares, an interim dividend of 4 per cent. is declared, and on Globe Ordinary the usual quarterly payment of a florin will be made at the end of this month.

The rubber share market is scarcely so animated as it was at the end of last week, when dealings were on quite a healthy scale. Supplies of the raw material are arriving in bulk, and these no doubt tend to keep down the price of the produce. But the companies as a whole are doing well. The armament group is better again; and in copper shares a slightly improved tendency became noticeable upon American buying of some of the favourite copper properties.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend, 1914.	Price Sept. 14, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	7½	—	£6 13 4
do. 7 per cent. Pref.	7	7¼	—	4 16 7
Charing Cross Ordinary	5	3¾	—	6 13 4
do. do. do. 4½ Pref. ..	4½	3¾	—	6 0 0
do. do. City Pref.	4½	3¾	—	6 0 0
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4¼ xd	—	5 17 8
do. 4½ Deb.	4½	88	—	4 17 10
City of London	9	12½	+ ¼	7 7 0
do. do. 6 per cent. Pref. ..	6	10¾	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10¼ xd	—	6 16 7
do. do. 6 per cent. Pref. ..	6	10½ xd	—	6 0 0
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6¼	—	7 4 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref. ..	6	4¾	—	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	3½	2½	—	7 0 0
do. 4½ per cent. Pref. ..	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6¾	—	7 8 2
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	$1\frac{1}{16}$	—	6 14 0
Westminster Ordinary	9	6¾	—	6 13 4
do. 4½ Pref.	4½	4¼	—	5 9 0

Telegraphs and Telephones.

	Dividend, 1914.	Price Sept. 14, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	98	—	6 2 6
do. Def.	1½	21¾	+ ½	6 18 0
Chile Telephone	8	6½	— ¼	6 3 0
Cuba Sub. Ord.	5	8¼	—	6 1 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11¾	—	*6 17 0
do. 4 Deb.	4	79	—	5 2 1
Eastern Tel. Ord...	7	115	—1	*6 18 0
do. 3½ Pref.	3½	66	—4	5 6 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	9¾	—	*7 0 8
do. Pref.	6	9¾	— ¼	6 3 0
Gt. Northern Tel.	22	83	—2	6 13 4
Indo-European	10	50	—	6 10 0
Marconi	10	$1\frac{29}{32}$	—	5 5 3
New York Tel. 4½..	4½	98½	+ ½	4 11 7
Oriental Telephone Ord.	10	$1\frac{15}{16}$	—	5 3 1
do. Pref.	6	1⅛	—	5 6 8
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5½	—	*8 6 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	11¾	—	*6 17 0
do. 4 Deb.	4	81	—	4 16 5

Home Rails.

	Dividend, 1914.	Price Sept. 14, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented ..	4	71	—	5 12 1
Metropolitan	1¼	24½	+ ½	5 2 0
do. District	Nil	14½	+ ¼	Nil
Underground Electric Ordinary ..	Nil	1½	—	Nil
do. do. "A"	Nil	5/9	—	Nil
do. do. Income ..	6	72	+1½	*9 10 8

Foreign Trams, &c.

	Dividend, 1914.	Price Sept. 14, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Arg. Trams, First Pref. ..	5½	9¾	— ½	7 6 8
do. 2nd Pref.	5½	8¼	— ½	8 9 2
do. 4 Deb.	4	73	+ ½	5 9 7
do. 4½ Deb.	4½	72	—	6 5 0
do. 5 Deb.	5	74	—	6 15 2
Brazil Tractions	3½	47	—	7 9 0
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds ..	—	40	—	Nil
do. 6 per cent. Bonds ..	—	35	—	Nil
Mexican Light Common	Nil	25	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	40	—	—
Adelaide Sup. 6 per cent. Pref. ..	6	5	—	6 0 0
do. 5 Deb.	5	98	—	5 2 0

Manufacturing Companies.

	Dividend, 1914.	Price Sept. 14, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	$2\frac{3}{16}$	—	6 8 5
British Aluminium Ord.	5	$1\frac{1}{16}$	—	4 14
do. Pref.	6	18/3	—	6 9
British Insulated Ord.	15	10⅝	—	7 1 2
do. Pref.	6	5⅞	—	6 2 2
British Westinghouse Pref.	7½	32/6	—	9 7 6
do. 4 Deb...	4	68	—	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref...	5	4½	—	5 11 3
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	3½	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	58	—	6 18 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/-	—	7 7 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	14	—	*8 3 3
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	8¾	—	5 14 3
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

Direct West India Cable Co., Ltd.—A dividend of 3 per cent., free of income-tax, is announced for the half-year, making 6 per cent. for the year, carrying forward £63,319.

British Insulated and Helsby Cables, Ltd.—The directors announce an interim dividend of 5 per cent. actual on the ordinary shares on account of the current financial year.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances

Wednesday, September 15th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec
a Acid, Hydrochloric	per cwt.	..	..
a " Nitric	"	..	..
a " Oxalic	per lb.	1/-	..
a " Sulphuric	per cwt.	..	..
a Ammoniac Sal	"	£49	..
a Ammonia, Muriate (large crystal)	per ton	£40	..
a Bleaching powder	"	£9	..
a Bisulphide of Carbon	"	£23	..
a Borax	"	£23	..
a Copper Sulphate	"	£28	..
a Lead, Nitrate	"	..	..
a " White Sugar	"	..	..
a " Peroxide	"	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	..	..
a " Chlorate	per lb.	1/4½	..
a " Perchlorate	"	1/6	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	"	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers ..	"	£11 10	..
a " Recovered	"	£8	..
a " Lump	"	£8 10	..
a Soda, Caustic (white 70/72 %) ..	"	..	..
a " Chlorate	per lb.	1/3	..
a " Crystals	per ton	45/-	..
a Sodium Bichromate, casks ..	per lb.	5d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	..	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	..	..
b " Sheet, in ton lots ..	"	..	..
p Babbitt's metal ingots	"	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/1 to 1/1¾	½d. to ¾d. dc.
c " Tubes (solid drawn) ..	"	1/1 to 1/1¼	..
c " Wire, basis	"	1/1 to 1/1¼	..
c Copper Tubes (solid drawn) ..	"	1/1¼ to 1/1½	..
g " Bars (best selected) ..	per ton	£98	..
g " Sheet	"	£98	..
g " Rod	"	£98	..
d " (Electrolytic) Bars ..	"	£93	£1 10 dec.
d " " Sheets ..	"	£101	£1 10 dec.
d " " Rods ..	"	£90	£1 10 dec.
d " " H.C. Wire	per lb.	11d.	⅛d. dec.
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	1/10	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/4¾	..
l Iron Pig (Cleveland warrants) ..	per ton	64/10	3½d. dec.
l " Wire, galv. No. 8, P.O. qual.	"	£26	..
g Lead, English Pig	"	£24	15/- inc.
g Mercury	per bot.	£16 15	10/- dec.
e Mica (in original cases) small ..	per lb.	4d. to 2/6	..
e " " " medium	"	3/- to 5/-	..
e " " " large ..	"	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	"	Nom.	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/2 to 1/3½	..
p " " rolled strip & sheet	"	1/3½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£85	£5 inc.
g Tin, Block (English)	"	£154	£1 10 inc.
n " Wire, Nos. 1 to 16	per lb.	2/7	..
p White Anti-friction Metals ..	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.	h Edward Till & Co.
b The British Aluminium Co., Ltd.	j Bolling & Lowe.
c Thos. Bolton & Sons, Ltd.	k Morris Ashby, Ltd.
d Frederick Smith & Co.	l Richard Johnson & Nephew, Ltd.
e F. Wiggins & Sons.	n P. Ormiston & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	o Johnson, Matthey & Co., Ltd.
g James & Shakspeare.	p
	r W. F. Dennis & Co.

Electro-Bleach and By-Products, Ltd.—Mr. H. J. Mackinder, M.P., presiding at the annual meeting held at Manchester on September 9th, said that the company did not commence manufacturing until January. During the eight months of this year an interim dividend had been paid, which told the meeting that, in the directors' opinion, they had not worked at a loss, but they had had difficulties. He was not certain whether it was fortunate to be the successors of a bankrupt company, because the public was very slow to come forward under such circumstances. The company was struck by the war before the payment of capital was completed. The last call was not made until last October; every penny had now been paid up.—*Financier.*

Liverpool District Lighting Co., Ltd.—An interim dividend at the rate of 4 per cent. per annum for the past half-year is announced.

Stock Exchange Notice.—The Committee has ordered the under-mentioned to be quoted in the Official List :—

Metropolitan Railway Co.—£500,000 5 per cent. preference stock.

ELECTRIC VEHICLES IN LAUNDRY SERVICE.

That the electric vehicle is especially adapted to house-to-house delivery and other transportation requirements demanding frequent stops is indicated by the fact that American department stores, bakeries, breweries, laundries, &c., have adopted its use on a large scale. In fact, the largest transportation delivery fleets in the world are chiefly composed of electric vehicles. It is significant that these fleets are a result of repeated orders extending over a period of 10 to 15 years. The following is a table of some of the largest electric fleets in the United States :—

Ward Baking Co.	610	
Adams Express Co.	326	in two cities
American Express Co.	220	,, ,,
Jacob Rupert	145	
George Ehret Brewery	136	
Commonwealth Edison Co.	114	
New York Edison Co.	130	
Gimbel Brothers	119	
Carson, Pirie & Scott	67	
Marshall Field Co.	230	

One reason why electric vehicles compose such a large percentage of big transportation fleets is that large and successful organisations usually approach their transportation problems upon a practical engineering basis. Unfortunately thousands of smaller concerns and individuals buy motor delivery wagons with but a small conception of their suitability for a particular service.

Fleet of Electric Vehicles for Laundry Delivery Service.

The Electric Vehicle Association, U.S.A., while promoting the sale and use of electric vehicles for all purposes, is also conducting investigations with a view to ascertaining lines of business particularly suited to the electrics. As soon as these applications become thoroughly known, the operating costs and other data are systematically distributed to users in that class.

One of the industries that has been under examination by the Association for some time is the laundry business. In no other delivery service can the electric be applied to better advantage than in laundry work. Not only are its inherent reliability, simplicity of operation, and cleanliness, features which every laundry delivery service should have, but also its satisfactory performance and economy of operation in a house-to-house delivery are points which should appeal strongly to the clear-headed business man. A successful user of electrics is the Brunswick Laundry, of Jersey City.

The proprietor states that he is "fully convinced that the electric is the very best thing for house-to-house delivery. After three years' experience, during which time we have added to our fleet gradually, so that we now operate 18 electrics, with two more on order, I feel that I have had ample opportunity to observe the results of electric delivery service and compare them with other methods of delivery. We bought our first electric three years ago, and it gave such excellent results, that when the time came to enlarge our equipment, I decided to dispose of our horses and wagons, and buy electrics." . . . "The 18 electrics have not only done the work of the 40 horses which I formerly owned, but also take care of unusually heavy increase in business."

"I operated my electrics under this plan, at a general average of $10 a month per car. As my electric delivery wagons averaged 20 miles per day during this period and figuring on 300 working days to the year, it will be noted that the cost for current per mile was about 2 cents. As for repairs bills, I find that they are a negligible quantity in electric vehicle operation. I have paid just $16 for repairs on our first electric, which we have used constantly for over three years, and that was for new chains and sprockets. Compare this slight expense with the bills for wagon and harness repair, horse shoeing, veterinary service, &c. We are saving something over $600 a month by operating electrics. The initial cost is, of course, comparatively large, yet when the extreme longevity of the electric—10 to 15 years or more—is considered, the cost per year is very low. In addition, I consider the advertising value of the electric in the laundry business worth considerably more than the interest would be on the initial cost."

"The batteries which we use in our electrics are the nickel-iron type, and although the manufacturer guarantees them for four years, I am counting on getting about eight years out of mine."

"Tires, I find, will last from 1½ to two years on an electric. The average life of the tires on the six gasoline trucks which we use for very long hauls is from three to four months. As some one has said, an electric never wears out."

"Our electrics make on an average 25 miles per day, visiting all the outlying suburban districts. Some of our best drivers deliver as many as 900 bundles per week and make an average of 32 miles per day. . . . . . During the most severe snowstorms last winter our electrics made their usual number of trips in the same average time. There is something about the powerful motor of an electric that enables it to plough right through the snow which no gasoline truck, in my experience, has been able to do as well. Several times our gas cars were stalled and had to be towed in. . . . . The same men who had been driving our horses, and had probably never touched the steering wheel of any automobile before, learned to operate the electrics in a little more than a day. . . . . I am fully convinced that for laundry delivery service the electric is the most efficient and economic vehicle."

FIELD TELEPHONES.

By CHARLES R. DARLING.

(*Abstract of paper read before the* Royal Society of Arts, *July 28th*, 1915.)

In this greatest of all wars, the combatants on both sides find that the telephone is an indispensable adjunct in the conduct of operations in the field. By its aid communication is established between the various units, guns are fired according to orders conveyed by telephone from the battery observer, and in nearly all cases where it is necessary to keep two or more stations in touch the telephone is used. Flag signalling, being too conspicuous, has practically been abolished; and the present war has rightly been termed a "telephone war."

The telephones to which we are accustomed in civil life are unsuited to military operations for two reasons. First, they lack portability; and, secondly, they are not provided with a means of transmitting messages by Morse code in the event of speech being inaudible. It has, therefore, been necessary to design special instruments for use in the field.

The usual arrangement of parts in field telephones follows on the lines indicated in fig. 1. The primary circuit consists of a battery, B, connected to the primary winding of an induction coil, P, and to the vibrator or buzzer, V, through the key, V K. The microphone or transmitter, M, is placed in parallel with the buzzer, and may be brought into the circuit by means of the key, M K. The secondary circuit consists of the receiver, R, one end of which is connected to line and the other end to the secondary winding, S, of the induction coil, which in turn is joined to earth through a condenser, C. The arrangement at the other end of the line is identical with the foregoing, and to establish communication the operator at either end connects the line to the terminal L, and attaches the terminal E to an earth-pin driven into the ground. In different forms of field telephones this circuit is modified in various ways. Most modern instruments possess a third terminal, placed between the condenser and the secondary winding of the induction coil, so that the condenser may be cut out or brought into the circuit as desired. In the Stevens telephone the induction coil serves to operate the buzzer; in the Service instrument, known as the "D Mark III," the buzzer windings perform the functions of the induction coil, and a second receiver, inserted in parallel with the first, is provided. The circuit shown in fig. 1 may, however, be regarded as the fundamental type upon which the others are based.

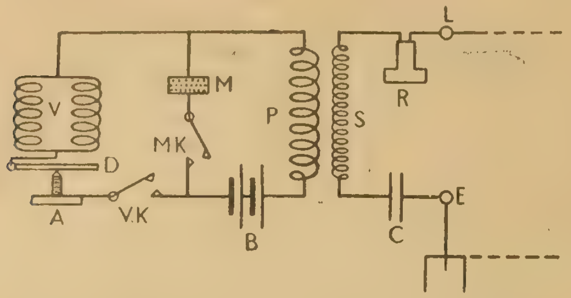

Fig. 1.—Typical Circuit of Field Telephone.

In the regulation Service telephone the battery consists of two "dry" cells, of external dimensions $3\frac{3}{4} \times 1\frac{1}{2} \times 1\frac{1}{2}$ in., connected in series.

Operation. Two cells in series used.	Current (amperes).	Useful life of cell.	Final voltage.
Using simple buzzer ...	0·2—0·3	15 hours	1·2 or less
Using polarised buzzer...	0·1—0·15	25-30 "	"
Speaking through microphone	0·2—0·4	12 "	"

Frequent renewal of cells is necessary when the telephones are in active use. The best clue to the condition of a cell is furnished by the readings of a voltmeter placed across its terminals, and any cell showing a less figure than 1·3 should be replaced by a new one. Voltmeters used for this purpose should be of the moving-coil pattern, and capable of reading accurately to $\frac{1}{10}$ volt.

The induction coil used in field telephones is usually 2 to 3 in. long. The resistance of the primary winding is about 0·5 ohm when used with a simple buzzer, and about 3 ohms when in conjunction with a polarised buzzer, as in the "D Mark III." The secondary winding possesses about 30 times as many turns as the primary.

The buzzer or vibrator serves the double purpose of acting as a call-up, and also as a means of transmitting messages by Morse code. In the simple form, the action is identical with that of an ordinary electric bell. Referring to fig. 1, the buzzer V is seen to consist of two windings, through which the current from the battery divides. These windings are provided with iron cores (not shown in the drawing), and the path of the current is continued through the iron armature D, and the adjusting screw A. When a current passes through the windings, the cores are magnetised, and attract the free end of D, thereby drawing it away from A and breaking the circuit. The cores then lose their magnetism, and the armature springs back and renews contact with A, thus restoring the circuit. The rapid to-and-fro movement of D gives rise to a buzzing sound, whence the arrangement derives its name. As the buzzer is in circuit with the primary of the induction coil, every make and break of the current caused by the vibration of D will give rise to an induced current in the secondary, which, passing through the line circuit, acts on the receivers so as to reproduce the note emitted by D. The key, V K, is used as a Morse key for the purpose of sending messages, a long contact representing a "dash," and a short contact a "dot."

The objection to the simple buzzer described, which is used in the Service "D Mark II" field telephone—now becoming obsolete—is that the note lacks sharpness, and is not suited to the rapid transmission of messages. In the Stevens field telephone the core of the induction coil, which becomes magnetised when a current passes through the primary, is used to attract the armature, a plan which simplifies construction by dispensing with the separate buzzer coils. A polarised buzzer, such as will be described later in connection with the "D Mark III" telephone, is preferable to a simple buzzer, as it requires less current to work and gives a sharper note.

For economy of weight and space, the receivers of field telephones are made in the "watch" form, wound with coils of combined resistance about 200 ohms. For convenience of rewiring, the terminals are, or should be, placed on the exterior of the case.

The microphone or transmitter consists of a replaceable capsule contained in a metal case, the top of which screws on to the lower portion, and holds the capsule in position. The capsule contains a carbon block, with cavities in its upper surface, which are filled with small spherical granules of carbon. Touching the granules is a carbon disk, protected from moisture by a covering of mica. When in use the current from the battery passes through the granules, and when the carbon disk is vibrating, the area of contact at this part of the circuit is constantly changing. This results in changes in the strength of the current, and, as the primary of the induction coil is in the circuit, induced currents are produced in the secondary and its connections, which cause the diaphragm of the receiver to vibrate in unison with the disk of the capsule.

Although not essential to the transmission of sounds, a condenser, inserted in the line circuit, is a useful adjunct to a field telephone. It is made up of alternate sheets of tin-foil and paraffined paper, and possesses a capacity of $\frac{1}{30}$ to $\frac{1}{40}$ microfarad. A condenser, whilst stopping the passage of direct currents, permits alternating currents to pass through, although somewhat impaired in strength. Owing to this property, a pair of field telephones, with their condensers in circuit, may be attached to an existing telegraph line, and messages sent without interference. The direct currents used in telegraphy cannot pass through the telephones owing to the condenser; the alternating currents due to the telephones do not affect the telegraph instruments; and hence both operations may proceed simultaneously. This fact is frequently taken advantage of in the field. It is also customary to use a condenser in the circuit when tapping a telephone line, as less current is then diverted through the instrument used for tapping, and the communication from end to end is not unduly interfered with. In the D Mark II telephone a condenser is permanently in the circuit; in more modern forms, such as the D Mark III, Stevens, and Siemens instruments, the use of the condenser is optional, and is only resorted to for the special purposes mentioned above.

The use of an earth return for a field telephone has the advantage of saving a second line, with the attendant trouble of laying out. Contact with the ground is secured by means of a pointed iron pin, about 14 in. long and $\frac{3}{4}$ in. in diameter, which is driven in to a depth of several inches. This pin carries a terminal, and is connected to the telephone by a short wire. In damp ground a pocket-knife, or even a wire inserted into the ground, gives sufficient contact. In dry, sandy ground it is difficult to secure a good "earth," and it is necessary to pour water round the pin. Should this fail, a return wire must be used.

In the D Mark III and Siemens telephones a metal base, permanently connected to the earth terminal, is provided, so that when placed on the ground an earth-pin is unnecessary. The International Electric Co. provide a special heel-plate, to which a wire from the telephone may be attached, so that a telephonist may use his instrument whilst walking.

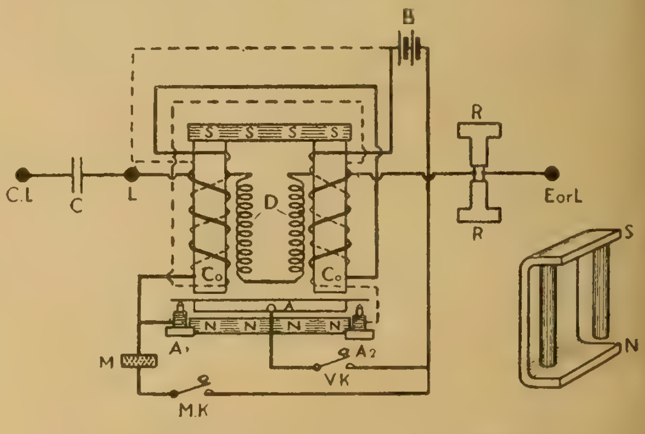

Fig. 2.—Circuit of D Mark III Field Telephone.

The Service D Mark II pattern was much used at the commencement of the war. It superseded an older and smaller form known as the Mark I, but is in turn being rapidly replaced by the Mark III. It possesses a simple buzzer, mounted with the induction coil on a fibre block. Beneath this are placed two dry cells, and a metal box containing two condensers, one of which is connected permanently to the line circuit, and the other placed across the buzzer terminals to diminish sparking at the contact with the armature. The microphone and receiver are connected by flexible copper wires to terminals on the top of the fibre block; and the whole is contained in a leather case provided with pockets for holding the microphone and receiver when not in use. The line and earth terminals protrude from the side; and a soft portion of the leather lid enables the buzzer to be worked without opening the case. A shoulder-strap is provided, and the total weight is about $5\frac{1}{2}$ lb. The circuit is identical with fig. 1, with the addition of a condenser between the armature D and the screw A.

The chief defects of the instrument are the unsuitable character of the buzzer for Morse signalling; the high current required to work the buzzer, which soon exhausts the cells; and the liability of the connecting cords of the microphone and receiver to breakage. It requires constant supervision to keep in order, and its complete withdrawal in favour of the D Mark III will be an unmixed advantage.

The special features of the D Mark III Telephone, which is the latest service pattern, are the use of a polarised buzzer, and the arrangement by which the windings round the cores of the buzzer are made to constitute the induction coil. The circuit is shown in fig. 2, and at first sight appears complicated. The action of the buzzer resembles that of the polarised bell used in ordinary telephones, but whereas this bell is actuated by an alternating current, a direct current only is available for the buzzer. The same result is secured, however, by causing the battery current to pass alternately through each of two windings round the cores, which, being oppositely disposed, produce opposite magnetic effects. The iron cores, Co, are mounted on the south pole, S, of a permanent magnet bent twice at right angles, as shown at the side of fig. 2. The lower extremities of the cores will therefore possess S polarity. An iron armature pivoted at its centre is placed between the ends of the cores and the N pole of the permanent magnet. The upper face of this armature has N polarity, and carries at either extremity a thin strip of steel. In the position of rest, one of these strips touches an adjusting screw A_1, the other being free of the screw A_2. Each core possesses two windings, one right-handed and the other left. On pressing the buzzer key, V K, the current flows through the armature to the screw A_1, and thence round the cores by the path indicated by the full line. This results in the S pole of the core opposite A_1 becoming strengthened, whilst that of the core opposite A_2 is weakened; and hence the armature is drawn away from A_1 and makes contact at the other end with A_2. The circuit completed by this contact is shown by the dotted line, and the effect now is to strengthen the S pole opposite A_2, and to weaken the other. Hence the armature leaves A_2, and again makes contact with A_1, and thus is set into rapid vibration. When the screws are properly adjusted, so as to make the throw of the armature even on both sides, a keen, sharply-defined note is obtained, suited in every respect to calling-up or rapid Morse signalling. This buzzer requires a minimum current of 0·1 ampere for satisfactory working, this being only about one-half that needed for a single buzzer. A better result is thus secured, with less current, and consequent extension of the life of the battery.

The secondary of the induction coil, D, shown in the drawing at the sides of the cores, is wound over the buzzer coils, and every make or break of contact between the armature and the screws results in the production of an induced current in the secondary circuit, which, passing through the line and receivers at both ends, produces a response to the note of the buzzer.

The microphone, M, is connected so that when its key, M K, is pressed the current passes through the full-line winding of the buzzer cores, which then serves as the primary of the induction coil, the fluctuations in current caused by speaking into the microphone resulting in induced currents through the secondary circuit as in the case of the buzzer.

Two receivers, R, are used, joined to the same terminals. The terminal marked L or E is connected to a metal plate at the base of the instrument, which serves as earth contact. The condenser, C, is placed between the terminals L and C L, and is only in the circuit when the line is connected to the latter.

The instrument consists of two compartments, provided with lids, the taller containing the cells and the lower the buzzer and condenser. On the lower lid are mounted the buzzer key, terminals for the two receivers and microphone, marked R and M respectively; and also three terminals lettered L, C L, and L or E, for connection to line and earth. The buzzer itself is fastened on the under side of the lid, and the condenser is at the bottom of the compartment. One of the two receivers is contained in a leather case provided with a head-strap, so that it may be fastened to the ear when awaiting a call, leaving both hands free. The other receiver forms the upper part of a hand combination, which may be telescoped into a small size for packing; the lower part being the microphone, the key of which is in the handle. For transit, all the parts are placed in a leather case, 8½ in. × 4 in. in plan, and 6½ in. high, to which a shoulder-strap is attached. The total weight is a little over 8 lb.

The use of two receivers is a distinct advantage. If the cords of one should break the other may still be used, and the line circuit remains intact. A very important message may be heard simultaneously by two men, the risk of misinterpretation being thereby greatly reduced. Further, one of the receivers may be detached and re-wired if necessary, without putting the telephone out of action. The clear note of the buzzer is of great value, as Morse code messages are frequently the only means of communication in the firing line, talking being inaudible. The only weak point is the tendency of the connecting cords to break, and this might be overcome by the use of stranded steel wire instead of copper. With this improvement, and renewal of the cells when the voltage of each falls below 1·3, this telephone would remain in order under all normal conditions.

The lines for field telephones are made of steel wire, which possesses greater mechanical strength than copper wire, and is, therefore, not so easily broken. A thin, single-stranded steel wire, with an insulation of varnish, is much used when a temporary communication has to be established, or when a body of men moving forward have to keep in touch with the rear. Such a wire has the advantage of lightness, and a considerable length may be contained on a small reel. For work of a more permanent character, wires composed of several steel strands, and insulated with rubber and woven fabric, are used, and are less liable to short circuits to earth than the former. Reels of different sizes, according to the length of wire contained, are employed; the smaller reels are carried on a body-belt by the lineman, whilst the larger are mounted on special barrows. The lines are laid on the surface, or placed a few inches underground, according to circumstances, and in the latter case perfect insulation is absolutely necessary. In laying a surface wire between two stations, the safest route, even if circuitous, is taken. Open spaces are avoided, the wire being laid along a hedgerow in preference to crossing a field. If a road has to be crossed, two trees or other suitable objects are chosen, the line to be tied to the base of the first tree and drawn tightly up the trunk, and then passed over a suitable fork at a minimum height of 15 ft. It is then passed over a fork on the opposite tree, drawn tight across the road and down the trunk, and secured at the base. In the absence of trees or poles the line must be buried in the road. A line should, if possible, be kept at least 10 yards away from any other line, otherwise induction effects will give rise to overhearing in both, and cause confusion.

The breaking of telephone lines by fragments of bursting shells is a very common occurrence, and as the cutting-off of communications may have very serious results, measures are taken to maintain a complete circuit as long as possible. To this end multiple lines are used, and one arrangement, known as the "ladder" system, is indicated in fig. 3. The wire is formed into a network resembling a ladder, with a connection at either end to the telephones A and B. Although numerous breaks may occur, as indicated by the crosses, a continuous circuit from A to B, marked out by the thick line, still exists. Networks of this kind are sometimes buried in the ground, and enable communication to be kept up for long periods. The method has two drawbacks: first, a large number of joints have to be made during laying; and, secondly, each break is liable to cause a short circuit to earth, difficult to locate, which would prevent messages passing between the two ends.

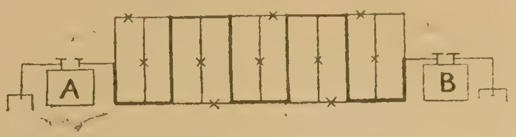

Fig. 3.—The "Ladder" System of Telephone Lines.

An alternative method is shown in fig. 4, where four lines are laid between the telephones A and B, which at one spot are brought to junctions D in a dug-out, where a lineman is placed provided with a telephone, C. It must be understood that the lines, shown parallel in the drawing, may take widely different routes between the ends and the dug-out. As indicated by the crosses, all the lines are broken; 1 and 4 on the right, and 2 and 3 on the left of D. By joining each line in turn to the telephone C, these breaks and their bearings may be discovered; thus, by connecting to 4 it will be found possible to communicate with A, but not with B, and hence a break on this line between D and B is inferred. Similarly it would be found that 2 is whole between D and B, but broken on the other side. By joining the whole portions of the lines 4 and 2, or 1 and 3, at the junction-box D, a continuous line between A and B is again established. Knowing the direction of the breaks, the lineman takes a favourable opportunity of repairing them, the repair being executed by laying bare the wires at the broken ends and tying them together by a reef knot, the bare part being then insulated with rubber tape or tubing. This method has the advantage that a break may be located, and that a broken line which causes a short circuit to earth may be disconnected until the broken part has been repaired.

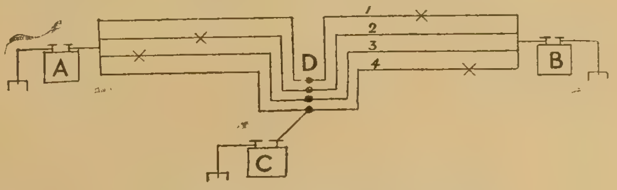

Fig. 4.—Multiple Line System.

When several telephones require to be kept in touch, an exchange is used. A battery commander may thus communicate with his observer, ammunition wagons, and guns, or any of these units with each other. A small portable exchange, provided with plugs or switches, is used in this and similar cases.

The office of field telephonist is one of great responsibility. He must be capable of keeping his instruments in order, and of executing ordinary repairs such as re-wiring the parts. He must be capable of laying lines, detecting and locating breakages, and repairing them satisfactorily. He must also be able to transmit and receive messages by Morse code at a minimum rate of 12 words per minute. He is often compelled to act in an emergency, frequently at the risk of his life, in order to restore or keep up communication. His everyday duties demand knowledge, skill, and courage, and are important in the highest degree.

The training of a field telephonist cannot be accomplished by drill alone. He must, if he is to be thoroughly reliable, possess a knowledge of the working parts of his instrument, so as rapidly to detect and rectify a fault. And this leads me to suggest that science teachers throughout the country might with advantage be used to impart this necessary knowledge in all localities where special instruction is not available. Such instruction should be carried out on an approved plan, and would require co-operation with the military authorities, in order that the actual instruments might be available for demonstration. By this means an abundance of reliable men could be secured in a short time, and with little expense.

THE ELECTRICAL EQUIPMENT OF THE ARGENTINE BATTLESHIP "MORENO."

By H. A. HORNOR.

(*Abstract of paper read before the* American Institute of Electrical Engineers.)

(*Concluded from page* 352.)

The third division of the electrical equipment is classified under the head of interior communication systems, although a few of these are solely for exterior use.

The systems comprising this division are given in the following list:—

Call bells.
Reply signals for mechanical telegraphs.
Fire alarm.
Electric clock.
Shaft revolution and direction indicators.
Electric log indicator.
Fuel oil indicator.
Ammunition hoist indicators.
Gun firing.
Engine revolution order telegraph.
Helm angle and steering telegraph.
Turret telephone.
Fire control telephone.
12 in. (304·8 mm.) fire control telegraph.
6 in. (152·4 mm.) fire control telegraph.
Turret danger zone.
Turret tell-tale.
Engine order telegraph.
Fire room telegraph.
Turret salvo.
Torpedo defence salvo.
Anchor handling.
Coal bunker alarm.
Boiler firing.
Boat hour gong.
Day battle salvo.
General alarm.
Cease firing.
Torpedo firing.
General telephone.
Captain's telephone.
Fire and engine-room telephone.
Azimuth.
Course telegraph.
Gyroscopic compass.
Pyrometer.
Anemometer.
Electric whistle.
Wireless telegraph.

These systems are supplied with power from two stations on the vessel, the forward interior communication room and the forward dynamo room. There are two central signalling stations, one forward on the upper platform deck below armour and the other on the gun deck aft. The vessel is further provided with two conning towers, one forward and one aft; two observation towers; and several gun control stations.

A number of these equipments operate on 220 volts direct current, supplied in duplicate from the forward and after main distribution switchboards. However, certain of the telegraph systems require 120 volts alternating current; others, such as the telephone system, clock system, call bell system, require 15 volts direct current; and the fire control telephone system requires 35 volts direct current. These transformations are accomplished by means of small motor-generators, usually supplied in duplicate. The A.C. motor-generators, which are rated at 18 KW. single-phase, 50 cycles, 120 volts, being of rather large size are located one in each dynamo room. The A.C. control panel is located in one of the compartments constituting the forward central station. Supply to this panel is brought directly from the control panel of the after motor-generator set and, *via* the after interior communication control panel, from the forward motor-generator.

The 15 volt D.C. motor-generators are both located in the forward dynamo room directly below the after interior communication control panel, which contains a panel especially for this distribution. Thus the after interior communication switchboard contains three panels; one for the distribution of 220-volt D.C. circuits, one for the 15-volt D.C. circuits, and one for the 120-volt A.C. circuits. The forward interior communication switchboard contains two panels, one distributing 220 volts D.C. and the other 35 volts D.C. This switchboard receives energy from the two 35-volt D.C. motor-generators for the fire control telephone system and the two ringing motor-generators for the general telephone system. It also supplies 220-volt D.C. to the two motor-generators for the gyroscopic compass system. The 220-volt bus bars are energised directly from the after main distribution switchboard, and also from the forward main distribution switchboard *via* the after interior communication switchboard. Every possible precaution has been taken to avert any failure of operation due to lack of supply or interruption of service. A diagram of the bus-bar connections is cut into the face of all switchboards, and these grooves are filled in with coloured paint.

There are about 16 telegraph systems, such as Engine Order Telegraph, Course Telegraph, &c., which are operated on the principle of an unbalanced circuit, *i.e.*, when the circuit is undisturbed no current flows. Thus a constant A.C. field, which changes its direction corresponding to the periods of the exciter current, induces currents in the armature coils. The armature of one motor—let us say transmitter—is wound with three interconnected coils and connected by three wires directly to the armature coils of the receiver motor. The power in the armature windings depends upon the rotative position of the armature coils in the field of force. If the armatures of the transmitter and receiver have the same position relatively to the field, then the induced E.M.F.'s will be of the same value and the wires between the two armatures will carry no current. If the armature of the transmitter is moved so as to unbalance the armature circuit, then current flows in the armature windings and produces a torque, and the armature of the receiver turns to the same position. When this occurs the equalising currents disappear, and with them the torque.

Any desired number of orders can be arranged for transmission, and any number of receivers connected to the transmitter, without increasing the number of connecting wires. Five wires are needed for a simple circuit, two for the field and three for the armatures. For repeating instruments two sets of motors are employed. The transmitter motor is usually larger than the receiver motor, due to the fact that it often operates a number of receivers. Energy is delivered to this apparatus from a 120-volt A.C., single-phase, 50-cycle motor-generator, *via* a step-down transformer, which lowers the pressure to 50 volts.

These instruments have a large and varied use, as shown in the above list: sending orders from the bridge to the engine room indicating the position of the rudder direct from the rudder stock to the navigator, giving orders for a change in course of the vessel, transmitting emergency orders from the bridge or conning tower when the regular steering gear is deranged, ordering small changes in speed when in squadron manœuvres, furnishing signals from the gun-firing station to each and every gun, and many other purposes too numerous to record.

There are six boiler rooms on the vessel, from each of which are led three uptakes to the two smoke-stacks. Each uptake is provided with a base-metal thermocouple pyrometer. Nine of these 18 couples indicate at two stations, one in the forward boiler room hatch, and one in the after boiler room hatch. The indicators are of the low-resistance type, mounted in special water-tight cases and provided with a nine-point switch for the purpose of reading each uptake temperature. The thermocouples are formed of a nickel alloy wire, and capable of constantly measuring a temperature of 1,800° F., and intermittently up to 2,000° F. The head of the couple is specially arranged for mechanical protection and water-tightness.

The anemometer is an unusual equipment for battleships. The apparatus consists of a transmitter comprising a pivoted rotative vane carrying at one end a fan. The vane in orientation and the fan shaft through a worm gear translate their movements by means of electrical contacts. Thus the velocity and direction of the wind may be recorded. The instrument for the *Moreno* was ordered from France, and registers 16 directions. The direction and velocity of the wind are checked off by the pen on the registering chart in increments of one mile every time the wind changes. The maximum record for the chart is 62·13 miles, and when the pen reaches this point it automatically returns to zero. The transmitter is located on the top of the forward cage mast, and the registering apparatus in the central station. It requires five wires between transmitter and register, and operates on approximately four primary cells.

Each of the three main turbine propelling shafts is equipped with a contact-maker for indicating the number of revolutions, and a contact-maker for indicating the direction of the shaft, both located in the engine room; a synchronising clock and indicator also located in the engine room, near the working platform; and three indicators located in the pilot house, forward conning tower, and central station. Eight wires are required to each indicator, three for the direction tell-tale and five for indicating the speed. Energy for operation is taken from the 15-volt bus-bars of the after interior communication switchboard. This apparatus is manufactured in Italy, and is known as the Molinari speed indicator.

The direction contact-maker is a simple make and break contact operated directly from the shaft through chain and gearing.

The revolution contact-maker consists of a lignum-vitæ cylinder carrying three brass sectors made flush with the periphery. It is located near the main shaft, and arranged to turn at the same rate of speed. It is provided with two brushes insulated from each other and mounted on spring blocks.

The synchronising clock controls the make and break contacts of the revolution contact-maker, so that these impulses may be interpreted by the indicator in measured time. A flat commutator provided with three segments, insulated from each other, is mounted in the clock, and traversed by a metal brush. In this particular installation the "long-make" segment is designed to be maintained for a period of 15 seconds, and the two "short-make" segments two seconds each. In this manner the speed during the 15 seconds previous to reading the indicator is correctly measured. The indicator consists of a train of clock gears actuated by a spring.

The wireless telegraph apparatus is of German manufacture, and known as the Telefunken "quenched-spark" variometer system. The set is rated as 5 KW. in the antenna, with a primary power of 8 KW. The advantage of the variometer principle is that it permits of a variable range of wave length, which range may be chosen between 600 m. and 2,000 m., depending upon the capacity of the aerial.

The motor-generator set is supplied with a double feeder from both of the main distribution switchboards. This set consists of a 220-volt D.C. motor of 18 H.P. and an A.C. generator rated at 8 KW., 500 cycles, 220 volts. The normal speed of the set is 1,500 R.P.M., but can be varied for the purpose of altering the spark frequency, and thereby the note of the transmitter, about 20 per cent. in either direction. The pitch of the transmitter note can also be adjusted very exactly by varying the field of the generator.

A straight-core transformer steps up the 220-volt pressure to 8,000 volts. A primary choke coil is connected in series with the low-tension winding of the transformer. When the large capacity (five Leyden jars) is used, the choke coil is used as a quenching coil in parallel with the emergency key, *i.e.*, this coil prevents severe sparking when the emergency key is brought into action.

A secondary choke coil is connected in series with the high-tension winding of the transformer. This choke coil not only affords protection against high frequency, but also provides resonance between the transformer and the excitation current.

The closed oscillatory circuit of the transmitter consists of a battery of four or five Leyden jars of a capacity of 0·01 to 0·013 microfarad each. Four or five of these jars can be connected by means of a sliding contact as may be required. Next there is provided a 16-part quenched-spark gap which is air-cooled (maximum number of gaps to be used, 12) and a primary variometer. This latter consists of three fixed and two movable coils, which can be connected either in series or parallel by means of a switch. This gives a variable inductance in the ratio of 1 to 16. The variometer scale is graduated so as to enable any wave length to be adjusted in a moment.

The antenna will be of the L type, slanting from the foremast to the mainmast. The direct distance is 196 ft., and the hypotenuse 206 ft. The antenna capacity has been fixed to absorb an oscillatory energy of 5 KW. without loss. In this circuit is the antenna variometer, which consists of six fixed and five movable coils arranged in two groups. By means of the scale and the corresponding curves, waves up to 1,450 m. can be adjusted. For waves above this a lengthening coil is connected in series with the variometer, which increases the wave range to 2,000 m.

For receiving purposes a crystal detector is used; it operates without any auxiliary E.M.F., and the receiving apparatus does not contain a local battery. By its use the connections are very much simplified. Underneath the variable receiving transformer is a two-pole change-over switch marked "long waves" and "short waves." When the switch is on the position "short waves," the connections are as follows: Antenna lengthening coil, variable condenser, earth or counterpoise. When the switch is on the position "long waves," the lengthening coil and variable condenser are connected in parallel to form a closed oscillatory circuit. The antenna now is connected to one pole of the condenser and the earth or counterpoise to the other.

With both methods of connection, the energy is transferred from the low-tension transformer coil, which is in series with the antenna, into the high-tension transformer coil. The latter forms, with the detector, an aperiodic circuit. This requires only one circuit to be tuned, viz.—for "short waves" the antenna circuit, and for "long waves" the closed oscillatory circuit. Means are also provided for increasing the capacity of the receiver through an intermediate circuit, whereby disturbances from other stations and atmospheric discharges may be avoided.

The design of this apparatus is such as to provide every means for the protection of the apparatus and operator from high tension. Behind the vertical frame of the receiver is a high-tension terminal and the high-tension switch, to which the leads from the antenna and the transmitter are connected. By this means the antenna is connected to the receiver and the transmitting circuit automatically interrupted.

This equipment had a guaranteed range of 1,000 km. by day and 2,100 km. by night. That these guarantees will be exceeded in practice is seen in the report of trials on the sister ship *Rivadavia*, where communication was held between Boston and Colon, a distance of approximately 2,000 miles (3,218 km.).

The gyroscopic compass is of German manufacture of the Anschütz type.*

The master compass receives its energy from duplicate motor-generators. The motor-generator transforms the 220-volt direct current to three-phase alternating current at 120 volts and 333 cycles. The alternator has 16 poles and runs at a normal speed of 2,500 R.P.M.; therefore the gyro motor, which has two poles, runs at approximately 20,000 R.P.M. A control panel is provided upon which are mounted meters, switches, fuses, &c.

The peripheral speed of the gyro is 500 ft. per second, or 340 miles per hour. The air friction is so great that it absorbs 95 per cent. of the power of the gyro-motor. The directive force on the gyro-compass is approximately 15 times as great as that of a magnetic liquid compass, free from all disturbances. The gyro-compass, unlike the magnetic compass, points to the true north pole of the earth.

The equipment, as a whole, is the largest and most costly ever installed in the United States, comprising 3,000 electric lights, 4,000 rated H.P., and approximately 76 miles of cable. It is a noteworthy engineering achievement in that it was a departure from American practice in the use of 230 volts; in the employment of lead-covered, steel-armoured conductors; in the application of 220-volt tungsten lamps; in the use of electricity for the purpose of steering the vessel and operating the anchor and the bilge pumps; and many more advances in the application of electrical power. The result has been fruitful to the American manufacturer in that he is now prepared to furnish standard 230-volt apparatus designed for use on shipboard. This equipment also stands as a practical solution of the many problems involved and as a working comparison with previous equipments.

Patents and Alien Enemies.—Application has been made to the Board of Trade to avoid or suspend patent No. 5,198/08, granted to Miele, by Messrs. T. Gameson & Sons, Ltd., of Walsall.

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* See Electrical Review, December 1st, 1911, for full illustrated description.

TRADE STATISTICS OF INDIA.

The following figures of the imports of electrical and similar goods into British India in the year ended March 31st, 1914, are taken from the recently issued official trade statistics; details for the year ended March 31st, 1913, are added for purposes of comparison, and notes of any increases or decreases are given.

	1912-13. £	1913-14. £	Inc. or dec.	£
Brass, wrought.—				
From Great Britain ...	34,000	49,000	+	15,000
,, Germany	10,000	18,000	+	8,000
,, Italy	8,000	11,000	+	3,000
,, Other countries ...	20,000	31,000	+	11,000
Total	72,000	109,000	+	37,000
Copper and copper ware.—				
From Great Britain ...	813,000	1,354,000	+	541,000
,, Germany	653,000	866,000	+	213,000
,, Belgium	7,000	61,000	+	54,000
,, France	28,000	170,000	+	142,000
,, Austria	5,000	3,000	–	2,000
,, Japan	61,000	274,000	+	213,000
,, Other countries ...	14,000	17,000	+	3,000
Total	1,581,000	2,745,000	+	1,164,000
Iron wire.—				
From Great Britain ...	55,000	74,000	+	19,000
,, Germany	47,000	38,000	–	9,000
,, Belgium	23,000	15,000	–	8,000
,, Other countries ...	26,000	33,000	+	7,000
Total	151,000	160,000	+	9,000
Iron and steel plates and sheets.—				
From Great Britain ...	3,194,000	4,723,000	+	1,529,000
,, Germany	284,000	328,000	+	44,000
,, Belgium	147,000	155,000	+	8,000
,, United States ...	200,000	33,000	–	167,000
,, Other countries ...	1,000	4,000	+	3,000
Total	3,826,000	5,243,000	+	1,417,000
Locomotives (excluding those for railways).—				
From Great Britain ...	62,000	104,000	+	42,000
,, Germany	9,000	19,000	+	10,000
,, Other countries ...	1,000	—	–	1,000
Total	72,000	123,000	+	51,000
Prime movers, other than locomotives.—				
From Great Britain ...	312,000	512,000	+	200,000
,, Germany	8,000	28,000	+	20,000
,, United States ...	5,000	7,000	+	2,000
,, Other countries ...	2,000	8,000	+	6,000
Total	327,000	555,000	+	228,000
Electrical generators.—				
From Great Britain ...	32,000	20,000	–	12,000
,, Austria-Hungary ...	6,000	—	–	6,000
,, Other countries ...	—	1,000	+	1,000
Total	38,000	21,000	–	17,000
Electrical motors.—				
From Great Britain ...	76,000	83,000	+	7,000
,, Germany	12,000	5,000	–	7,000
,, United States ...	4,000	3,000	–	1,000
,, Other countries ...	7,000	2,000	–	5,000
Total	99,000	93,000	–	6,000
Other electrical machinery.—				
From Great Britain ...	91,000	195,000	+	104,000
,, Germany	6,000	30,000	+	24,000
,, Italy	3,000	2,000	–	1,000
,, United States ...	3,000	2,000	–	1,000
,, Other countries ...	—	3,000	+	3,000
Total	103,000	232,000	+	129,000
Mining machinery.—				
From Great Britain ...	50,000	64,000	+	14,000
,, Germany	1,000	2,000	+	1,000
,, United States ...	11,000	28,000	+	17,000
,, Other countries ...	1,000	2,000	+	1,000
Total	63,000	96,000	+	33,000
Railway carriages, &c.—				
From Great Britain ...	1,495,000	2,988,000	+	1,493,000
,, Belgium	22,000	25,000	+	3,000
,, Germany	65,000	116,000	+	51,000
,, Other countries ...	2,000	2,000		—
Total	1,584,000	3,131,000	+	1,547,000

	1912-13. £	1913-14. £		Inc. or dec. £
Rails and fishplates.—				
From Great Britain ...	769,000	874,000	+	105,000
,, Germany	7,000	5,000	−	2,000
Total	776,000	879,000	+	103,000
Machinery, other (except textile, agricultural, and printing).—*				
From Great Britain ...	574,000	753,000	+	179,000
,, Germany	45,000	64,000	+	19,000
,, Belgium	5,000	2,000	−	3,000
,, United States ...	31,000	35,000	+	4,000
,, Other countries ...	10,000	33,000	+	23,000
Total	665,000	887,000	+	222,000

* The details for the two years are not strictly comparable, those for 1912-13 including some items which were not included in 1913-14.

Locomotives and tenders, and parts thereof.—				
From Great Britain ...	596,000	1,203,000	+	607,000
,, Germany	7,000	59,000	+	52,000
,, Other countries ...	—	7,000*	+	7,000
Total	603,000	1,269,000	+	666,000

* Belgium, £7,000.

Electrical instruments, apparatus, &c.—				
From Great Britain ...	432,000	546,000	+	114,000
,, Germany	54,000	43,000	−	11,000
,, Belgium	4,000	7,000	+	3,000
,, Austria	7,000	14,000	+	7,000
,, United States ...	34,000	79,000	+	45,000
,, Other countries ...	21,000*	27,000	+	6,000
Total	552,000	716,000	+	164,000

* Italy, £15,000.

Electric fans.—				
From Great Britain ...	20,000	32,000	+	12,000
,, Italy	14,000	16,000	+	2,000
,, United States ...	19,000	23,000	+	4,000
,, Germany	3,000	4,000	+	1,000
,, Other countries ...	1,000	7,000	+	6,000
Total	57,000	82,000	+	25,000
Electric lamps and parts.—				
From Great Britain ...	33,000	42,000	+	9,000
,, Germany	8,000	9,000	+	1,000
,, Austria	2,000	6,000	+	4,000
,, Japan	2,000	1,000	−	1,000
,, United States ...	2,000	1,000	−	1,000
,, Other countries ...	2,000	2,000		—
Total	49,000	61,000	+	12,000
Electric wires and cables.—				
From Great Britain ...	132,000	144,000	+	12,000
,, Germany	15,000	5,000	−	10,000
,, Belgium	2,000	3,000	+	1,000
,, Other countries ...	2,000	6,000	+	4,000
Total	151,000	158,000	+	7,000
Scientific, &c., instruments.—				
From Great Britain ...	80,000	82,000	+	2,000
,, Germany	4,000	5,000	+	1,000
,, United States ...	2,000	2,000		—
,, Other countries ...	6,000	3,000	−	3,000
Total	92,000	92,000		—
Telegraph construction materials.—				
From Great Britain ...	8,000	7,000	−	1,000
Telephone construction materials.—				
From Great Britain ...	19,000	22,000	+	3,000
,, Germany	1,000	1,000		—
Total	20,000	23,000	+	3,000

In addition to the foregoing, the following were imported as Government stores:—

Instruments, apparatus, &c. (except musical).—				
From Great Britain ...	136,000	135,000	−	1,000
,, Germany	3,000	1,000	−	2,000
,, Other countries ...	—	1,000	+	1,000
Total	139,000	137,000	−	2,000
Machinery.—				
From Great Britain ...	169,000	201,000	+	32,000
,, Germany	1,000	1,000		—
,, United States ...	3,000	1,000	−	2,000
,, Other countries ...	—	1,000	+	1,000
Total	173,000	204,000	+	31,000

	1912-13. £	1913-14. £		Inc. or dec. £
Iron wire.—				
From Great Britain ...	10,000	12,000	+	2,000
Iron and steel plates and sheets.—				
From Great Britain ...	50,000	82,000	+	32,000
Railway carriages.—				
From Great Britain ...	734,000	1,209,000	+	475,000
,, Other countries ...	—	6,000	+	6,000
Total	734,000	1,215,000	+	481,000
Locomotives.—				
From Great Britain ...	482,000	612,000	+	130,000
Rails and fishplates.—				
From Great Britain ...	198,000	385,000	+	187,000
Telegraph construction materials.—				
From Great Britain ...	72,000	97,000	+	25,000
Copper and copperware.—				
From Great Britain ...	97,000	102,000	+	5,000
,, Other countries ...	58,000	68,000	+	10,000
Total	155,000	170,000	+	15,000

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Reducing Gearing.

An apparatus for obtaining reduced speeds from high-speed electrical machinery, steam turbines, &c., is shown herewith. It is called a "turbo-gear," and consists of a large internal double-helical gear, a double-helical pinion, and three intermediate double-helical gears. The internal gear is an open-hearth steel forging, and is heat-treated to increase its ductility and to ensure uniform hardness. The pinion is cut integral with the high-speed shaft, and is of chrome-vanadium steel heat-treated in an electric furnace to resist wear. The intermediate gears are of Lumen manganese-bronze and are mounted on hardened forged steel shafts secured to the cast-steel low-speed member by means of a taper fit and Woodruff keys. The low-speed member, to which is secured the low-speed shaft, is mounted on heavy-duty S K F ball-bearings and is supported directly by the heavy housing. The low-speed member and shaft carrying the intermediate gears and the high-speed shaft and pinion are supported independently of each other.

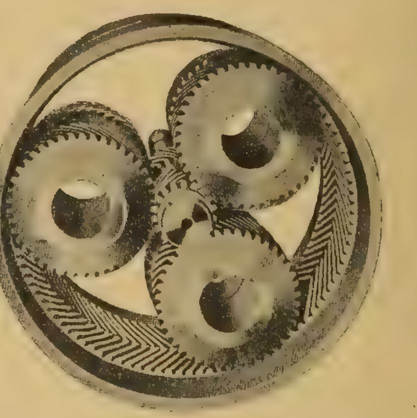

Fig. 1.—Internal Members of Speed-Reducing Device.

The housing is of cast-iron and is split horizontally. It is well ribbed, the manufacturers claim, to provide a rigid support for the gear members. The high-speed shaft is provided with a central passage through which oil is pumped, and a continuous stream of oil is sprayed on the gears through radial passages in the pinion. The high-speed bearings are also provided with oil rings. The superfluous oil from the high-speed bearings is collected by a centrifugal oil ring and forced through the hollow shafts carrying the intermediate gears, flushing their bearings. The oil after lubricating the bearings and gears is drained to the main oil reservoir in the base of the housing, where it is strained, cooled, and returned to the pump and used over again. The device shown in the accompanying illustration is designed to transmit 120 H.P. at a speed of 6·66 : 1. It is manufactured by the Turbo-Gear Co., Industrial Building, Baltimore, Md.—*Electrical World.*

Combined Switch and Indicator.

A neat combination device for small cooking and heating apparatus has been brought out by the Hart Manufacturing Co., of 76 and 77, Rochester Row, Westminster, S.W. As illustrated herewith, it consists of a push-button switch, three-way receptacle

and plug, and an illuminated bull's-eye, which indicates when current is on, thus safeguarding against accidental oversight of the fact. A similar device without the plug and socket is also made, and the carrying capacity of the parts is 750 watts.

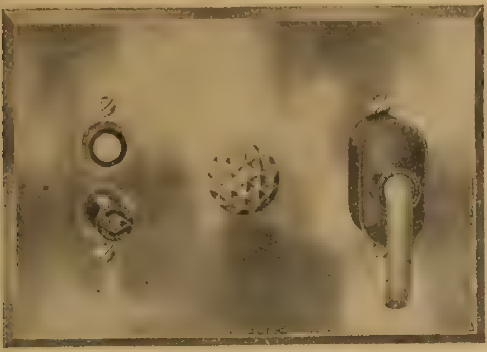

Fig. 2.—Combined Switch and Socket, with Indicator.

OUR LEGAL QUERY COLUMN.

"Inquirer" writes: "I am connected with an electric supply undertaking for which the Board of Trade granted a Provisional Order in 1901, the said Order being taken over by me, by an agreement with the Corporation in 1905, by which the supply of current for lighting purposes was agreed not to be charged at a higher rate than 5d. per B.T.U. In view of the increased cost of generating, due to the war, the company which was formed to carry out the Provisional Order has applied to the said Corporation to be allowed under the present circumstances to increase the price by 10 per cent. The Corporation have refused the application. What is the position of the company? Can it reasonably expect the Board of Trade to bring pressure to bear on the Corporation to grant what appears to be a reasonable request, owing to the present exceptional conditions prevailing due to the war? The last dividend paid was for the year 1913. No dividend was paid for the year 1914, and it is improbable that any will be paid this year."

*** With reference to the above query, it is clear that "Inquirer" has no legal right to compel the Corporation to allow him to supply current at a higher price. The war has not had effect to dissolve or modify the contract, and it is not easy to say, in the total absence of any authority or precedent on the matter, what the attitude of the Board of Trade would be. They might say that they had no jurisdiction to interfere, but it would be well worth "Inquirer's" while to bring the matter before them. He could lay stress on (*a*) increased cost of production due to war; (*b*) diminution of demand owing to economy and police regulations; (*c*) the fact that he would be content to accept a temporary modification of terms.

Another plan would be simply to give due notice to consumers and then refuse to supply any consumer in future except on the terms of his paying the added rate, and let the consumers take the matter into Court if so advised. The feasibility of this method of dealing with a difficult situation depends on the terms existing between "Inquirer" and his consumers, as to which one can only speculate. A letter to the Board of Trade setting out all the facts may work wonders.

"One Interested" writes:—"An electric supply company has a contract with a local authority under which it supplies electric current for a certain number of lamps in the district The last agreement was made for a period of four years, and a fixed sum was to be paid per lamp per annum. This was to be made by quarterly payment, and each quarter's payment was to be due the month following the end of the quarter. Since the beginning of this year the local authority have become, apparently, somewhat nervous, and they ceased all the public street lighting, on the ground that this was desirable for military and naval purposes, although, as a matter of fact, the majority of the lights are invisible from the sea. The local authority claim that they are only called upon to pay for such lights as are now actually kept lit, and are refusing to pay any further sum. They claim that they are entitled to do this, but that as soon as the war is over they are entitled to continue the contract under the old conditions. The electric supply company argues that it is perfectly willing to make some concession to the local authority. In fact, it made a voluntary offer to do this, but it claims that as it has had to spend large sums of capital in obtaining the necessary machinery, laying the required cables, and erecting the lamps for street lighting, and for this outlay it borrowed money on debenture, the interest upon which is payable as a first charge, it is therefore entitled, in any event, to receive a sum equal to the interest payable on the debentures issued to provide for the capital outlay made for this purpose and to provide for depreciation thereon.

"The company would like to know your views upon this question, and also as to whether it is justified in claiming, that as the local authority have committed breaches of the agreement by not paying upon the prescribed scale in the prescribed time, the contract is annulled, and that if any current is to be supplied in the future it must be done under a new contract and on fresh terms."

*** It is presumed that the company in question supplies electricity under a provisional order which incorporates the provisions of the Schedule to the Electric Lighting (Clauses) Act, 1899. Approaching the query from this point of view, it is clear that by S. 27 (2) (b) of that schedule it has power to protect itself. It is there provided that: "Every owner or occupier of premises requiring a supply of energy shall . . . if required by the undertakers, enter into a written contract with them to continue to receive and pay for a supply of energy for a period of at least two years of such an amount that the payment to be made for the supply, at the rate of charge for the time being charged by the undertakers for a supply of energy to ordinary consumers within the area of supply, shall not be less than 20 per cent. per annum on the outlay incurred by the undertakers in providing any electric lines required under this Section to be provided by them for the purpose of the supply, and if required by the undertakers give to them security for the payment to them of all moneys which may become due to them by the owner or occupier in respect of any electric lines to be provided by the undertakers, and in respect of energy to be supplied by them."

If the agreement between the company and the local authority contains any clause embodying these provisions, it is clear that a remedy is to hand; but in the absence of any such terms, the remedy is not so obvious. It is difficult to advise with certainty without having access to the agreement itself, especially in view of the statement that "a fixed sum was to be paid per lamp per annum." Does this mean, "whether that lamp be lit or not" or is it to be implied that nothing is to be payable if the local authority, for reasons which do not concern the company, decide not to use any energy at all? Upon the whole, one inclines that it was to be implied that, during the currency of the agreement, the local authority were bound to pay for such lighting as would, in the ordinary course, have been used for illuminating the streets, and if they have not lit the lamps it is their own look-out. Their action in refusing to pay except for the lamps actually lit would probably justify the company in treating the contract as at an end, and refusing to supply any further light except upon special terms. Before taking this step, however, it would be desirable to take a legal opinion founded upon the terms of the agreement, the correspondence, and all other relevant documents.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NORTHERN RHODESIA.—Under a new tariff which has recently been put into force, goods of British origin not otherwise mentioned in the tariff, a heading which includes a number of electrical goods, will pay duty at the rate of 9 per cent. *ad valorem*. Similar goods of foreign origin will pay 20 per cent. *ad valorem*. The new tariff came into force on May 1st last, and will remain in force until July 31st, 1916, unless otherwise enacted.

VENEZUELA.—The Board of Trade have been advised by H.M. Minister at Caracas that British exporters of goods to Venezuela should take care that the goods are declared in the Consular invoice strictly in accordance with the denominations employed in the tariff, otherwise the consignee in Venezuela is liable to a fine.

SOUTH AFRICA.—The South African Government Gazette of July 23rd contains a Government notice giving the text of a Proclamation relative to the duties leviable on goods imported into the Territory, hitherto known as "German South-West Africa." Under this proclamation it is provided that the importation of goods into the said Territory is permitted subject to the following conditions:—

1. Subject to the provision of paragraph (2) of this Proclamation, Customs duties shall be paid on all goods imported into the said Territory. Those duties shall, for the present, and until further provision is made, be in accordance with and subject to the tariff fixed in respect of the Union of South Africa as set out in the Union Act No. 22 of 1914, as amended by Act No. 22 of 1915, and the Customs laws and regulations in force in the Union of South Africa shall, until further provision is made, *mutatis mutandis*, have force and effect throughout and in respect of the said territory.

2. Goods which are grown, produced or manufactured in the Union of South Africa shall, when imported into the said territory, be free of Customs duty.

3. In the case of goods imported through the Union of South Africa into the said territory, the Customs duties as aforesaid shall be paid to the Collectors of Customs in the Union.

4. Goods shall be imported by sea into the said territory only through the ports of Walvis Bay and Luderitzbucht and by land into the said territory only by rail.

5. Goods imported from or through the Union of South Africa shall be accompanied by a copy of Export Form No. 41, as set out in the Schedule to the Union regulations under Government Notice No. 1,094 of 1913, and such copy shall be handed by the importer, in the case of goods brought by sea to the officer of Customs at the port of entry, and, in the case of goods brought by rail, to the station master at the place of destination.

[Note.—The form No. 41 referred to in the above paragraph relates to the Bill of Entry for goods exported from the Union.]

RUSSIA.—The following goods have recently been prohibited to be exported: Asbestos in all forms and manufactures thereof; graphite; tar, youdron and asphalt; petroleum, lubricating and other mineral oils; celluloid and manufactures thereof; all metal ores; all metals, their alloys and manufactures, scrap and brack.

FRENCH COLONIES.—A Decree has been issued abrogating a previous decree which permitted the exportation of graphite without authorisation from French Colonies and Protectorates (other than Tunis and Morocco) when consigned to France, French Colonies, the United Kingdom, British Dominions, Colonies and Protectorates, Belgium, Japan, Montenegro, Russia, Serbia, and the United States.

CHILE.—The Chilean Consulate in London has notified the Postmaster-General that invoices of goods sent through the post to Chile must be vised by the Chilean Consul at the place where the goods are dispatched in all cases where the declared value exceeds £5.

ARGENTINA.—The following rules have been laid down for the presentation of bills of lading in connection with the clearance through the Customs of goods imported into the Republic of Argentina:—

These rules have been drawn up in view of the delay which, owing to postal censorship and other abnormal conditions due to the war, now frequently occurs in the receipt, by consignees in the Argentine, of the bills of lading relating to goods dispatched from European countries.

1. For the presentation of documents in connection with goods dispatched with bills of lading made out to a named consignee, the following procedure shall be followed in order that consignees may avoid the fine of 2 per cent. prescribed by Article 929 of the Customs Regulations:—

The goods may be declared for Customs purposes without the bills of lading, on the sole responsibility of the consignee, when the latter is of acknowledged standing in the town;

Should the legal period (*i.e.*, eight days) expire before the bills of lading have been produced, the Secretary of Customs shall undertake, at the request of the interested parties, to open the envelope containing the documents as soon as it comes to hand, noting the day on which the unopened envelope is submitted and the date indicated by the postmark.

2. The presentation of documents for goods consigned to order may be made, without fine, after the expiration of the legal period (eight days):—

(*a*) When the interested parties allow the Secretary of Customs to open the envelopes and packets containing the bills of lading, in the same way as is described under (1) above;

(*b*) When the interested parties present to the Customs, within eight days from the date indicated by the postmark, the envelope in which the bill of lading arrived made out "to order" and addressed to a bank.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

12,414. "Electric transmission systems." R. E. Raven. August 30th.

12,418. "Means for joining up electrical conduits." F. W. Uren & O. J. Nilsen. August 30th.

12,428. "Plug for telephone switchboards and the like." P. P. Craven. August 30th.

12,431. "Valve for controlling and governing mechanically and electrically the speed of a pump, turbine, Pelton wheel, or the like, driving a dynamo-electric machine, and also for controlling and governing the pressure on such dynamo-electric machine." W. F. Rhodes & J. Firth. August 30th.

12,434. "Loaded telephone line system." T. Shaw & W. Fondiller. August 30th. (Convention date, September 12th, 1914, United States.) (Complete.)

12,444. "Systems of electric ship propulsion." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). August 30th.

12,516. "Switches for resistances." L. Kamm. August 31st.

12,536. "Method of generating high-frequency electric currents." T. F. Wall. September 1st.

12,561. "Telegraph systems." British Insulated & Helsby Cables, Ltd., and H. H. Harrison. September 1st. (Complete.)

12,564. "Wireless signalling systems." British Thomson-Houston Co., Ltd (General Electric Co., U.S.A.). September 1st.

12,583. "Manufacture of electric insulating materials and the like." W. E. W. Richards. September 1st.

12,614. "Electrical signalling or distant controlling plant." Fried. Krupp Akt Ges. September 2nd. (Convention date, September 2nd, 1914, Germany.) (Complete.)

12,617. "Methods of marking glass." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). September 2nd.

12,630. "Selective calling devices for use in electric telegraphy." A. H. Morse & Indo-European Telegraph Co., Ltd. September 2nd.

12,666. "Rectifiers for electric currents." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). September 3rd.

12,671. "Impulse transmitters for automatic telephone systems." G. A. Betulander. September 3rd. (Convention date, January 26th, 1915, Sweden.) (Complete.)

12,673. "Automatic telephone systems." Relay Automatic Telephone Co., Ltd. September 3rd. (Convention date, November 17th, 1914, Sweden.) (Complete.)

12,680. "Locking device to prevent the theft of electric lamps held by bayonet joints." P. E. Correll. September 3rd. (Complete.)

12,687. "Electrical aids for deaf persons." C. W. Hawksley. September 3rd.

12,702. "Electrical heating elements." H. Cheshire (trading as Cranmer and Cheshire). September 4th. (Complete.)

PUBLISHED SPECIFICATIONS.

1914.

252. Relay Arrangements for Alternating Currents. G. G. Von Arco and A. Meissner. January 5th.

12,277. Apparatus for Electric Signalling and for Controlling the Current in Electric Circuits, especially applicable to Wireless Telegraphy. A. F. Sykes & Ford. May 18th. (Cognate application, 24,259/14.)

18,464. Prepayment Electricity Meters. Landis & Gyr, Ltd. (S.A.). August 8th (August 9th, 1913.)

18,660. Electro-medical Apparatus. H. W. Cox & Co., Ltd., and H. E. Donnithorne. August 14th.

18,737. Dynamo-battery Electric Systems. G. E. Mortley. August 17th.

18,780. Electric Visual and Audible Signalling Appliances, more particularly for use in Mines. H Green & W. de Manoel Landon. August 18th. (Cognate application, 4,253/15.)

18,872. Electric Mercury Switches. G. Jacobus van Haersma Buma. August 20th.

18,887. Variable Pole Dynamo-electric and like Machines. F. Creedy. August 20th.

18,954. Electro-magnetic Circuit Controlling Devices for Railway Signalling and other purposes. J. Gardner. August 22nd. (Cognate applications 20,006/14 and 24,787/14.)

19,057. Speed-controlling Devices for Electric Motors. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). August 25th.

19,737. Sparking Plugs for Internal-combustion Engines and the manufacture of the same. A. A. Lines, H. G. Longford, Longford & W. A. Clark. September 14th.

19,794. Electromagnetic Switches. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). September 15th.

19,818. Electrically-driven Clocks. F. H. Walker. September 15th.

19,849. Treatment of Materials for Impregnating them Electro-osmotically. Ges. für Elektro-Osmose. September 16th. (September 19th, 1913.)

20,786. Methods and Apparatus for the determination of the Complex Energy delivered by Alternating Currents. R. Arno. October 9th. (Addition to 9,580/10.)

20,959. High-tension Windings for Electrical Apparatus. W. H. Wilson and F. W. Wright. October 14th.

21,189. Method of Influencing the Electrical Charge of a Diaphragm for Processes Depending on Electro-osmosis. Ges. für Elektro-Osmose. October 19th. (November 6th, 1913.)

21,389. X-ray Devices. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 22nd.

21,798. Electric Incandescent Lamp Holders. C. G. M. Bennett & C. H. Jeffcoat. October 30th.

23,283. Telephone Receivers. L. Brown & C. Macintosh & Co., Ltd. November 30th.

1915.

5,591. System for the Generation of Electric Currents. C. F. Benites. April 14th. (Addition to 17,811/14.)

5,717. Electric Switches. J. H. Tucker & J. A. Crabtree. April 16th. (Divided application on 21,175/14, October 19th.)

7,088. Electric Diaphragm Horns. A. H. Midgley & C. A. Vandervell. May 11th.

8,332. Holders for Electric Incandescent Lamps. A. H. Midgley & C. A. Vandervell. June 4th.

9,477. Means for Cooling Electrically-operated Tools. Frankfurter Maschinenbau Akt. Ges. Vorm. Pokorny & Wittekind. June 29th. (June 30th, 1914.)

"The Firebrand."—This is the title of a monthly publication which is being issued by the Pyrene Co., Ltd., of 19 and 21, Great Queen Street, London, W.C. Among other things stated in the first number (September) now before us is an announcement that the British Government has placed further orders for Pyrene extinguishers, making its total 42,000. These extinguishers are being very largely used in electrical works (Pyrene is an absolute non-conductor of electricity), and has been taken up for re-sale by large firms interested in the electrical industry. The monthly circular will keep dealers and users posted with current information regarding what the extinguishers are doing.

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Vol. LXXVII.] CONTENTS: September 24, 1915. [No. 1,974.

Page
Electric Cooking and Heating ... 385
Copper ... 386
The Italian Market ... 386
Russia and German Influence ... 387
The Very Non-Technical Press ... 387
A Machine for Scale-Marking of Indicating Instruments (*illus.*) ... 387
Insurance against Hostile Aircraft ... 389
London and South-Western Railway Electrification (*illus.*) ... 390
Metal Spray Processes in Engineering, by J. Calder (*illus.*) ... 391
New Electrical Devices, Fittings and Plant (*illus.*) ... 393
Correspondence—
  An Automatic Electric Cooker ... 396
  Pocket Dry Batteries ... 396
  Church Lighting ... 396
Efficiency Considerations in Heating Water Electrically (*illus.*) 397
War Items ... 398
Business Notes ... 399
Notes ... 403
City Notes ... 407
Stocks and Shares ... 407
Share List of Electrical Companies ... 408
Exports and Imports of Electrical Goods during Aug., 1915 409
The British Association.—III. ... 410
  Industrial Harmony (*concluded*) ... 411
  War Credit and Finance ... 412
  Economic Problems after the War ... 413
  Manchester Electricity Supply Undertaking ... 413
  The Manchester Corporation Gas Undertaking ... 414
  A Self-Adjusting Commuting Device (*illus.*) ... 414
  The Control of Fuel Consumption ... 415
  A Note on "Earth Resistance" ... 415
Legal... ... 416
New Patents Applied for, 1915 ... 416
Abstracts of Published Specifications ... 416
Contractors' Column ... Advertisement page xx

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ELECTRIC COOKING AND HEATING.

THE tendency to follow on the beaten track may be observed in the development of almost all new industries and inventions; we feel our way from step to step, groping more or less blindly, often retracing our steps to branch off in another direction—and in the long run we arrive at results which, in the light of later knowledge, frequently appear to be the perfectly obvious outcome of quite early stages in the process of evolution. Thus, for example, the first railway coaches were designed very much on the lines of the existing road vehicles, and only by slow degrees acquired new forms and characteristics; the electric radiator still tries to resemble a coal fire, and the electric oven has usually been in the main a gas oven electrified. The march of progress, however, is introducing us to new ideas and new methods, and modifying our innate prejudice in favour of things as they are.

The fact that an egg could be cooked in boiling water did not directly reveal to us the deduction that meat in general could be cooked at the same temperature, or lead us to the conclusion that most of our cooking could be accomplished in a similar way, and consequently we have adhered to the established practice of countless generations when attacking the problem of electric cooking. We are, therefore, somewhat taken aback on learning from an Australian correspondent that the egg-boiling system of cookery has been seriously considered on the west coast of America, and has been brought to a remarkably high pitch of efficiency. The ingenious apparatus which has been evolved is described in our "New Devices" columns, and merits commendation on the score not only of its novelty and efficiency, but also of the simplicity of its construction and mode of operation. The system has obvious limitations, and cannot be expected to fulfil all the functions of a well-designed electric oven of the customary type; on the other hand, it has advantages which the latter does not possess, and which should render it invaluable in many households. From the figures given by Mr. Fisher, it is clear that the cost of cooking with this type of oven is less than half the cost with gas, whether we take the prices of gas and electricity that he gives, or reduce them to the rates prevailing here—roughly, two-fifths of those quoted; the low cost of electricity in this case is largely owing to the diminished loss by radiation and convection, due to the low temperature employed. The automatic regulation is another very valuable feature of the device, solving as it does the much-debated question whether it is better to try to teach the cook the use of a thermometer, or to trust to her common-sense, which is a decidedly doubtful quantity.

We do not suggest that this type of cooker would be suitable for an establishment where the magnitude of the culinary operations or the means of the owner warranted the employment of a competent cook and the installation of a complete outfit of cooking appliances; but where the mistress of the house herself performs all the domestic duties of a small household, the liberty of action and the freedom from all anxiety as to the progress of the cooking afforded by this method should prove an immense convenience to her, while the load resulting from the use of such cookers, inherently possessing a good load factor and small maximum demand, would be a most desirable one from the station engineer's point of view. We commend the idea to the attention of British manufacturers as offering a very promising field for their enterprise.

We wish to bring to their notice also the article on efficiency in connection with the electrical heating of water, which appears elsewhere in this issue. The necessity of attention to small details in design, which might seem trivial, but are really important, is clearly demonstrated, and we think that designers of electrical apparatus for this purpose will find it worth their while to study the suggestions that are put forward.

Copper. There has been a period of firmer markets in copper during the last few weeks, but, for all this, there seems to have been little improvement in the underlying conditions of the market in the United States. The dominant factors are regular production, and an enormous falling off in European consumption. Competent authorities are of opinion that during the month of August—even assuming that the United States home consumption was equal to that of the largest month on record—there must have been an increase in the stocks of refined copper held by refiners there of about 12,000 to 13,000 tons. It would appear, therefore, that the exports from the United States must either increase very substantially, or output must be reduced, before the copper can be stated to stand in a sound position. On the other hand, the bear account in the London market has been practically wiped out, and, apart from manipulative possibilities, it really needs no common courage to buy copper for the rise under the conditions at present ruling. The disparity between the prices of standard copper and refined copper is, moreover, a disturbing consideration, therefore it is a matter for satisfaction that further quantities of rough copper have been purchased here by the Government, and will be shipped to America for refining, the finished product being returned to this country. The statistics just issued were certainly better than had been expected, there being a reduction in the total stocks in England and France of over 2,000 tons during the first half of the month, while the European visible stocks underwent an almost identical reduction.

The greatest interest has been, and is still, paid in Australia to the efforts made by the authorities there to wipe out German interests in all departments of the Australian metal industry, and the *Australian Mining Standard* is taking a leading part in the agitation conducted there against all companies interested in the Australian metal trade and having Teutonic connections. It is beyond dispute that German influences have for many years predominated in the Australian metal trade, and the fact that this condition of affairs arose entirely from the blindness and indifference of British interests, seems now to have spurred the latter on to recover that dominance in the industry which it should never have lightly forfeited. That the Australians are inflexibly determined to drive out all interests smacking of Germany is a matter for patriotic congratulation, although whether the Commonwealth Government will succeed in their endeavours to establish firmly a metal exchange which can approach in importance that already existing in London, is a matter upon which there may easily be two opinions. The Federal Attorney-General is prompted by the very natural desire to preclude all Australian metals getting into the enemy's hands, or into the hands of neutral friends of the enemy, and to prevent British and allied buyers being exploited by the manipulation of the market, while having in view the preparing of the way for the control of the industry after the war by British firms. Meantime, the Melbourne Metal Exchange is to be under the direct control of the Commonwealth authorities, and the closest scrutiny will be kept upon all exports.

The prime factors in the Australian metal trade were of course the Metall-Gesellschaft and Aron Hirsch & Son, both of Germany, who were represented there by local houses. It is against these and the British connections of the first named, Messrs. Merton, that the activities of the Commonwealth Attorney-General and the Commonwealth Press are mainly directed. There can be no question but that a very strong case has been made out by the Commonwealth authorities as against German interests and German influences, and there can equally be no doubt whatever that these interests and influences can find no place in Australia for years to come. Australia has complained bitterly that her soldier citizens should have fallen in thousands by means of Australian copper, lead and spelter, and they are running no risks of any repetition of this state of affairs. Possibly in years to come the bitterness may subside, but all patriotic Britons are agreed in this, that the best place for Germans to-day is Germany, and that the Australian Commonwealth has no use or countenance for the type of people which has developed under the *régime* of "Kultur," and whose political perfidies and military atrocities reek to High Heaven.

The Italian Market. Apart from the home production of electrical machinery and apparatus in Italy, the market in that country for some years past, as has repeatedly been shown, has been largely dominated by German and Swiss firms, and on the entrance of Italy into the war arena at least one company in Italy felt constrained to give public intimation that Teutonic interests were not concerned, or were no longer concerned, with the undertaking. On the conclusion of the war it will only be natural for the Swiss firms to endeavour further to extend their export trade with Italy, whilst the German manufacturers will put forth efforts to recover the trade lost during the period of hostilities. But as in various other countries so in Italy has a movement been started for securing freedom from Germanism. Indeed, the initial steps were taken two or three years ago by one of the leading banks which, finding Teutonic influence becoming rather irksome, adopted measures whereby the withdrawal was obtained of the German directors on the board and the leading German officials on the staff; and the present war has merely served to accentuate the desire further to eliminate Teutonic interests from the trade of the country. Our advisers in Italy have frequently affirmed that if British firms are to replace their hostile competitors a radical alteration will be necessary in their business methods. According to Mr. R. Bagot, who brought the question recently before the London Chamber of Commerce, the difficulties in the way of British firms are as follows:—

1. The high prices of British goods as compared with German articles of the same kind and of little inferior quality.
2. The use of English in correspondence, and English systems of coinage, weights and measures.
3. The failure to grant easy terms of credit and payment.
4. The lack of travellers.
5. The want of branches of any important English bank in the Italian cities and industrial centres.

Mr. Bagot has brought forward the problem from a general point of view, whilst the engineering standpoint was raised several months ago by an English engineer who has resided in Italy for a period of 10 years. Such a long term of years naturally enables a man to speak with authority in regard to the Italian market for machinery. This engineer, representing as he did a British engineering firm, does not go quite so far as Mr. Bagot does, perhaps, because, being on the spot, he was engineer and traveller combined, and could give quotations in Italian currency and weights and measures. What he states is that no English firms will be able to keep pace with the Germans unless they change their business methods in the engineering trade as well as in all other branches of trade, and that Englishmen never occupy the first place in Italy. The Germans, he declares, actually offer more for the money, and if the quality of their goods in some cases is less satisfactory this defect is equalised by their conditions of payment; and they accommodate themselves to Italian conditions in a manner which is rarely the case with Englishmen. The requirements are consequently cheap and good machinery and long credit, and in this connection surprise is manifested at the small percentage of bad debts incurred. If the Germans are entirely beaten in the war the engineer concludes that they will still remain a factor the importance of which cannot be under-estimated in regard to the Italian market. These statements deserve the serious consideration of those British firms who hope further to promote trade with Italy which is now anxious to shake off the German yoke for ever.

Russia and German Influence.

The now well-known determination of Russian manufacturers to secure emancipation as far as possible from German industries has been followed by the adoption of preliminary measures by the legislative assembly in the same direction. For this purpose the Duma recently decided to appoint a Commission to inquire into the best means for combating the systematic penetration of Germany in all the departments of Russian life. The Commission has just met for the first time and settled its working plan by resolving to divide the labours among four sub-commissions. The first has been entrusted with the examination of all documents submitted to the Commission; the second has to deal with the German incursion into agricultural operations; the third with the contest against German monopolies in industry, commerce and finance; and the fourth with questions concerning the Baltic provinces. It will be obvious from the scope of the inquiry that the proceedings will be of a prolonged character, but with the assistance of the leading representatives of the industries concerned the foundation should be laid for the elimination of the German element from Russia. The most important problem from the Russian point of view, having regard to the past dependence upon Germany for the absorption of an enormous amount of agricultural produce, is the discovery of new markets for the products of her soil, as in that event the new markets would, or should, be able to send manufactures in exchange and thus tend to oust Germany from the Russian market. Failing these markets Germany in all probability will continue largely to monopolise the Russian import trade, in so far as the Russians do not help themselves by developing their own manufacturing industries, and thus rendering themselves more independent of commodities of Teutonic origin.

The Very Non-technical Press.

Our contention that the lay Press would do well to include on its staff at least one member with a smattering of scientific knowledge was once more fully justified by a report which some of our daily contemporaries rashly published last week. It related to an Italian engineer, residing at Marseilles, who had "solved the problem of maintaining a body suspended in space absolutely motionless"; his apparatus "is four metres long, 75 cm. in diameter, weighs 95 kilograms, and can raise 45 kilos . . . it can remain for 24 hours in the air, and come down at a point 200 kilometres from its starting point." "The apparatus can be set in motion at a prodigious speed in any direction whatever, and can be stopped at any point, and all this is to be accomplished without any mechanical motive power, but merely with the use of the Hertzian waves. The principle of this invention, the telegram adds, is based on the special distribution of electric and magnetic forces," &c. The *Daily Chronicle* headed its announcement "Law of Gravity Set Aside." Certainly, as a practical joke on the daily Press it is not without a humorous aspect, but that is not what the *Chronicle* means.

Now, any fool engineer can see at a glance that this report is pure and unadulterated piffle—an invention indeed, but not a discovery. The statement is as fanciful and fantastic as Jules Verne's story of a journey round the moon, without, however, the basis of fact and feasibility which that gifted author always built upon. To the classical experts of the daily Press, whose scientific education has presumably been confined to the views of Aristotle and Archimedes, such fables present no difficulties; but they are supposed to educate the public!

If the editorial offices harbour no tame scientists, why do the Editors not avail themselves of the assistance of their technical colleagues? We speak not only for ourselves, but also, we feel sure, for the technical Press in general, when we say that an inquiry on the telephone as to the merits of such reports would be gladly answered, without a thought of remuneration; for we wish to see in the daily Press only the truth regarding scientific and engineering matters, and for this purpose our services are always at the disposal of our non-technical colleagues.

A MACHINE FOR SCALE-MARKING OF INDICATING INSTRUMENTS.

[COMMUNICATED.]

The marking of scales for indicating instruments, such as voltmeters, ammeters, and wattmeters, &c., is usually carried out by hand, as it has been found that even identical instruments give slightly different characteristic curves which would render stereotyped printed scales too inaccurate.

In addition to this drawback, a tremendous number of patterns would be required, not only on account of the many ranges asked for by clients, but also because of the ever-growing multiplicity of sizes and shapes.

Now, it is a matter of experience that hand-marked scales are not always satisfactory, while their cost is a rather serious item in the labour bill of the individual instrument.

These considerations have led to the adoption by various makers of mechanical devices, in order to obtain better work, to reduce the cost of labour, and to turn out work more expeditiously than is possible with the old methods.

A common procedure in scale-marking, which is now very largely superseded, consists in putting a blank scale on the instrument, and in first of all marking the length of the pointer in three positions, so as to be able later on to find the centre of the circle of which the end of the pointer traverses an arc.

The next operation is to fix an evenly-divided and numbered auxiliary scale to the blank one on the instrument. Of course, instruments would rarely be taken singly; usually several dozens, or as many as possible of the same range, would be connected in parallel or series, according to whether volt or ammeters are being dealt with.

After the covers are put on, the instruments are properly levelled, and the zero positions of all the pointers, as shown on the auxiliary scales, as well as a sufficient number of convenient (calibrated) readings, are taken down.

From these data, which, for instance, for a 50-ampere ammeter, might be in the following form:—

Zero	...	2·5	30 a.	...	70·3
10 a.	...	15·2	40 a.	...	110·1
20 a.	...	33·7	50 a.	...	147·6

the blank scales on the instruments can be marked in pencil, and the draughtsman can now proceed to construct the scale according to the particular style adopted by his firm. He will first find the centre mentioned above, then trace the necessary concentric lines with compasses and pen, and after this sub-divide the scale.

This sub-division, at least in the case of instruments having quadratic characteristics, will be more or less guesswork, but this is usually considered near enough for practical requirements.

If a special accuracy is guaranteed for a certain part of the scale, it will be necessary to take more calibrated readings than we have mentioned for the sake of illustration, and to plot a curve from which intermediate points can be obtained.

The method outlined above has its obvious disadvantages, and one of the most important is that the calibrated readings taken by means of the auxiliary scale have to be marked on the blank, which means two possible mistakes, one in reading and one in marking, or, at least, the introduction of two small errors due to the human equation.

These errors are being added to by the draughtsman, so that the resulting scale may be out by more than is admissible, unless skilled and very reliable workers are employed. Such workers, however, are not too plentiful, and as mentioned before, reduction of cost being a desideratum, the utilisation of mechanical means becomes imperative.

Of the various methods in use, we propose to deal with one which only requires a skilled observer to take the calibrated readings, while all the other operations in producing the finished scale can be carried through by unskilled female labour. The method presupposes that all the instruments are standardised, especially as regards length of pointer, and that all scales of the same size and type are immediately interchangeable.

The difference from the old method starts with the first operation, inasmuch as no blank scales are put on the instruments. Instead auxiliary scales, which are standard in every respect as regards mounting, fixing holes, &c., but which are evenly divided into, say, 150 divisions, covering a sufficient angle, are used.

If the types of instruments dealt with in this fashion have been sufficiently developed, it will be possible to arrange for beginning and end of the scales to be in absolutely identical positions, and in such cases intermediate calibrated readings only need be taken.

When turning out large quantities, the data obtained when calibrating should be entered on printed cards providing space for all necessary particulars, and also, at least for some types of instruments, squares for plotting curves. These cards are indexed and filed for reference after the first set of scales has been completed.

We have now to describe the little machine which does this work with the help of the data supplied on the cards. The machine consists mainly of a turntable of sufficient diameter to take the largest scale to be made, and is provided with means to fix scales of various sizes and patterns.

The circumference of the turntable is divided in a convenient number of divisions, say *x*, which are marked from 0 to *x*. The turntable can be rotated by means of worm and wheel, the ratio being so chosen that, say, 1/*x* revolution of the turntable—that is, one division on the scale—corresponds to one complete turn of the worm. By arranging a wheel on the spindle carrying the worm, and dividing the circumference of this wheel into 10 or 100 parts, one or two decimals can easily be introduced, and, if backlash is properly guarded against, and indices (on the circumference of the turntable and the wheel) are provided, it is possible to reproduce any particular position of the turntable any number of times with a high degree of accuracy.

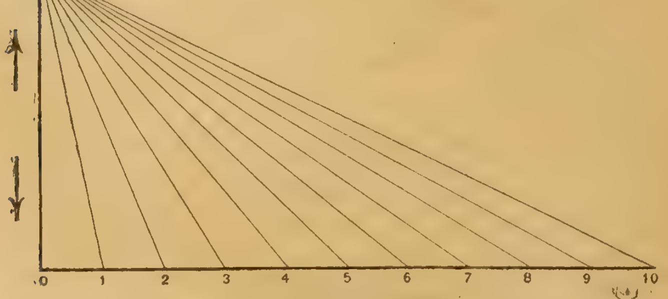
Over the turntable, in the direction of a diameter, the tracing or printing apparatus is suspended. It is fixed to a bracket connected to the base on which the turntable is pivoted.

In the case of a pen being used, this can move radially in relation to the turntable, the length and width of stroke being regulated by ratchets actuated from a lever provided, which is worked with a reciprocating movement by the left hand, while the right hand sets the turntable by means of the decimal wheel, in accordance with the data on the cards referred to.

In another type of machine type-wheels are used, and all strokes forming divisions and sub-divisions are actually printed.

The auxiliary scales mentioned are all produced on the machine, and with care it is easy to arrange several machines in such a way as to make the scales turned out on them interchangeable.

There remains to explain how the sub-divisions are obtained. To this end a transparent slide is utilised, which is divided as shown in the illustration below, and, further, a movable index is pivoted in the centre of the turntable and is capable of being fixed in any point to the scale of the latter.



Division of Transparent Slide.

The slide shown above would be suitable for subdividing into 10 equal divisions, and is so arranged that it can be exchanged at a moment's notice for another one. This provision is useful if different types of instruments are dealt with by the same machine, as it is then easy to use slides divided according to the particular characteristic curve of each type.

The slide is movable in the direction of the arrows, and perpendicularly in relation to the plane of the turntable. The distance between 0 and 10 must be slightly more than the longest distance—to be sub-divided into 10 divisions—between two calibrated points on any scale likely to be wanted.

Using the data given in our example, we will now proceed to print a scale on the machine.

The first operation is to fix a blank scale to the turntable. The machine having been adjusted beforehand to obtain the proper lengths and widths of strokes and to ensure the latter being in the right position, the operation to follow would be to determine the zero. This, in our case, is at 2·5 of the turntable scale, and the decimal wheel is turned until the indices indicate exactly this position. Now the first stroke is printed by pulling the respective lever, care having been taken that the ratchets governing length and width of stroke are properly set.

The next point to be marked is, say, 10 amperes, situated at 15·2, and its location is found by turning the decimal wheel accordingly.

As from this point our scale is to be sub-divided to 1 ampere, the slide now comes into action.

The vertical (zero) line of the slide will be found on 15·2, and the slide is now moved vertically until the slanting line 10 passes through point 33·7 on the turntable scale. For greater accuracy in reading, the use of a magnifying glass is advisable (as in Kelvin balances).

The distance from 15·2 to 33·7 is, through the foregoing operation, divided into 10 equal sections, and the corresponding strokes can be printed on the scale. To this end the movable index referred to is fixed on 33·7, then the decimal wheel is turned until the slanting line 9 coincides with the movable index, when the first sub-divisional stroke can be printed. This done, the decimal wheel is again turned, and the process mentioned repeated with slanting line 8, and so on until all sub-divisions are formed.

The next interval 33·7—70·3 dealt with in the same way, and so forth, until the scale is completed.

The concentric lines, also the figures and the wording, can either be printed by hand or, if the quantities warrant it, stocks of stereotyped printed scales, either paper covered or enamelled can be kept. Of course, zero and end position only would be marked on these scales.

In the case of engraved scales the engraving tool or tools are worked direct by the machine, or where chemical engraving was resorted to, the tracing would be done by means of a pen (on the machine), and the ink used would have to be capable of withstanding the acid in the subsequent etching process.

The machine and method outlined are also applicable with slight modifications to transparent scales and to edgewise instruments. Of course, the machine itself can do nothing; a very carefully thought-out organisation is required, but given this, the results obtained are remarkable.

The present writer found it possible to work the whole scheme with girls, and it was really astonishing to see how quickly, under proper instruction, they developed into reliable workers.

The system of instruction followed was to show every operation down to the minutest detail, exactly in the form which experience showed to be the quickest and most efficient, and to insist on its being invariably followed. Workers who could not, or would not, suppress extra turns of their own, if it were ever so slight a deviation from the regulation procedure, would be given other work or dismissed.

The advantages of the system of scale marking outlined above are important. Not only can unskilled female labour be employed throughout (with the possible exception of the taking of the calibrated readings), but the results are much superior to those obtained with the old method.

The accuracy is obviously much greater, since calibrated readings are only taken once, so that the human equation is only introduced once; all other work is purely mechanical, and can be rendered as accurate as may be desirable.

One of the chief merits of the system is undoubtedly that a permanent record of all scales and their accuracy is obtained (the checkers putting their remarks conveniently on the original calibration cards), which affords a continuous control over the instruments turned out, and is most helpful in case of disputes, or when considering alterations or improvement of types.

This permanent record, properly filed, also makes it possible to reconstruct any scale at a moment's notice, a contingency which may arise at any time, but which usually means a return of the instrument in question to the works.

The present writer remembers cases where, in order to save duty, large quantities of instruments and scales were sent as separate consignments, and where not infrequently the scales, being packed in a very small case, were mislaid or lost in transit. In those cases it was very much appreciated both by maker and client that there was no need to return the instruments, but that new scales could be shipped out practically by the next boat.

INSURANCE AGAINST HOSTILE AIRCRAFT.

[BY OUR LEGAL CONTRIBUTOR.]

Many of the daily papers have recently dealt with the all-important question of insuring against damage caused by hostile aircraft. No doubt most prudent readers of the Electrical Review have insured long ago without pausing to inquire whether, in the event of disaster, the liability to make good the damage was upon them or their landlords; but there may be others who are still hesitating. With a view to showing how necessary it is to be guided by the maxim, "When in doubt, *insure*," it is proposed to consider the legal aspect of the matter.

The case of the freeholder is simple enough. The Government has declared that since the scheme of State insurance was inaugurated, compensation for damage caused by bombs will not be paid by the State. For the freeholder, then, the question is: "Shall I make a small money payment, and get an insurance company to bear the burden, or shall I be my own insurer?" It is said that one of the victims of the recent raid upon the "London District" had stoutly refused to take out a policy, on the ground that the chance was 1 in a 1,000,000. On the day after the raid he found that an unlucky bomb had made him a ruined man!

In the case of a limited liability company it is beyond question the duty of the directors to insure. It is true, as was stated in the case of Overend & Gurney *v.* Gitt ((1872) L R 5 H L, 480) that "facts which may show imprudence in the exercise of powers clearly conferred upon directors will not subject them to personal responsibility unless the imprudence amounts to *crassa negligentia;*" but where there is insurance available at Government rate, it is obvious that no director could be charged with extravagance in laying out the necessary premium. Even if his failure to do so fell short of negligence in law, he and his co-directors would have a very uncomfortable quarter of an hour at the next shareholders' meeting should the premises of the company be destroyed by one of the products of German "Kultur."

Coming next to the cases where the incidence of liability may present some difficulty, one has to consider the respective positions of landlord and tenant. Unless there is a covenant "to repair" or "to yield up in repair," it is obvious that the loss must fall on the landlord. On the other hand, it was laid down in the middle of the seventeenth century that where a lessee undertakes without qualification to keep premises in repair during the currency of the lease, he is liable if they are thrown down by enemies. In Paradine *v.* Jane ((1647) Aleyn, 26), it was stated that: "Where the party by his own contract creates a duty or charge upon himself, he is bound to make it good, if he may, notwithstanding any accident by inevitable necessity, because he might have provided against it by his contract. And, therefore, if the lessee covenant to repair a house, though it be burnt by lightning, or thrown down by enemies, yet he ought to repair it."

So stands the law as it affects 99 out of every 100 lessees in this country. The ordinary fire risk is generally covered by a policy taken out by the landlord, the premium being paid by the tenant; but it is now a matter of notoriety that the ordinary fire policy is not so framed as to make the company liable for the damage done by an incendiary bomb.

The modified repairing covenants which appear in some leases merit a few words of explanation. Suppose, for example, that the following words occur:—"Reasonable wear and tear and damage by fire alone excepted." It has been held that the words "reasonable wear and tear" do not extend to relieve the tenant from responsibility for damage caused by overloading the floors of a building. So (or, rather, *a fortiori*), it is conceived that these words would not excuse the tenant from liability to make good the damage caused by a bomb. As to a fire caused to premises which are the subject of a lease containing such a clause, it is conceived that the tenant might possibly escape liability from the results of a fire howsoever caused.

With regard to rent due and accruing while premises are being reinstated, it is important to remember that the tenant's liability to pay rent remains, and in taking out his policy of insurance he should remember this important fact.

The purely legal aspect of the matter has been considered above. Broadly speaking, the tenant is liable and should insure; but the landlord must consider the matter from his point of view. True, if the premises are destroyed he has a claim against the tenant; but will it be worth anything? With the premises, the tenant's stock-in-trade and goodwill may be entirely destroyed. There will be nothing left on which the landlord can issue execution. He will have nothing but a lawsuit on his hands. It is therefore prudent for every landlord either to satisfy himself that his tenant has insured, or else take out a policy himself.

There remain a few minor points to consider. When deciding the amount for which a policy shall be taken out, the business man—say, a dealer in electrical fittings—has much to consider besides the actual value of his stock-in-trade. He has, upon his premises, numerous files of correspondence intrinsically valueless but indispensable for his business. A barrister or a doctor may carry his business in his head; but the commercial man cannot do so. He should, therefore, insure against the prospective loss which he must inevitably suffer if his premises are destroyed.

With regard to electric lighting companies a few words may be added. In the first place, it is conceived that the suspension of supply owing to the wreckage of a generating station would be due to *force majeure* or inevitable accident, which would absolve the company from continuing to give a supply. In other words, they could not, in such circumstances, be made liable to penalties even if a whole town were plunged in darkness. Insurance, however, of the entire undertaking would undoubtedly be prudent, and the policy should be framed so as to cover the prospective loss of consumers during the period of restoration.

Finally, care should be taken to see that the policy is in the same terms as that approved by the Government, in that it insures against damage done by hostile aircraft *and* by projectiles fired at them. Recent events have shown that anti-aircraft guns do not always hit the marks at which they are aimed; and an English shell crashing through the roof is almost as unwelcome a visitor as the very latest product of fiendish Teuton ingenuity.

Fire.—Considerable damage was done at Redford Barracks, Edinburgh, by the destruction by fire of the machinery shed and a quantity of plant, including dynamos and motors, belonging to Mr. C. Macandrew, builder.

Panama Exhibition.—Messrs. Worsnop & Co., of Halifax, have been awarded a Gold Medal at the Panama Exhibition at San Francisco for their exhibit of electric hand lamps, electric miners' lamps, motor lamps, self-starters for motor-cars, and for their "Alklum" accumulators.

LONDON AND SOUTH-WESTERN RAILWAY ELECTRIFICATION.

The decision of the directors of the London and South-Western Railway Co. to adopt electrical working on their suburban system was announced about three years ago, and some particulars of the scheme—one of the most important in this country—were given in our issue of December 13th, 1912, which were amplified in the following year (November 7th, 1913), when the work was put in hand. As then set forth, the complete scheme embraced the network of lines extending from Waterloo station to Hounslow, Shepperton, Guildford, Epsom and Wimbledon, a total length of 246 miles of single track, but in the first instance the conversion of about 47 miles of route, equivalent to about 140 miles of single track, has been undertaken, the lines which are being electrified being shown on the accompanying plan (fig. 3). The system adopted was direct current at 600 volts with a third-rail conductor, this enabling traffic to be exchanged with the Metropolitan District Railway. The company decided to generate power for itself, and has put down a power station alongside the railway at Durnsford Road, near Wimbledon, which is now practically complete; a view of the exterior is given above. The electrification of the lines is also approaching completion. The work has been carried out under the supervision of Mr. H. Jones, the company's electrical engineer; Sir Alex. Kennedy and his partners are consulting engineers to the company.

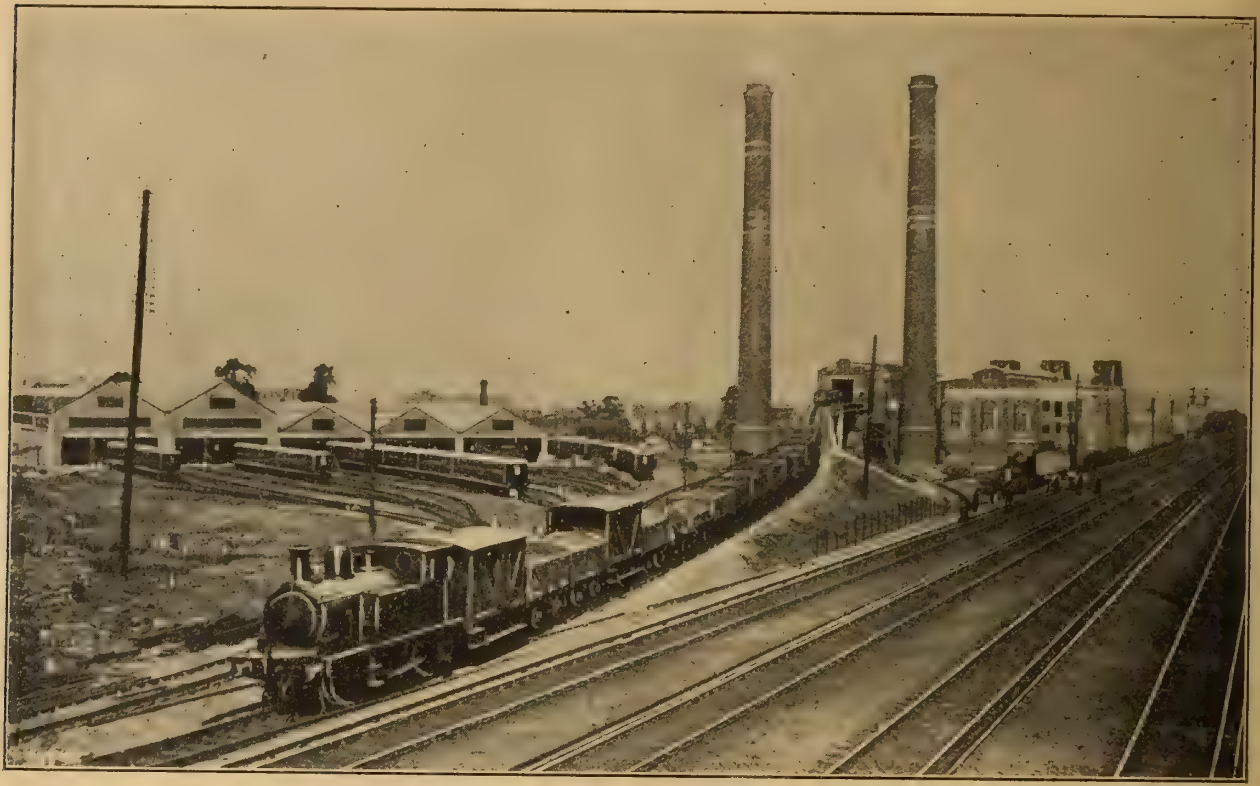


Fig. 1.—Power House, Car-Shed, and Main Line of the London and South-Western Railway Co.

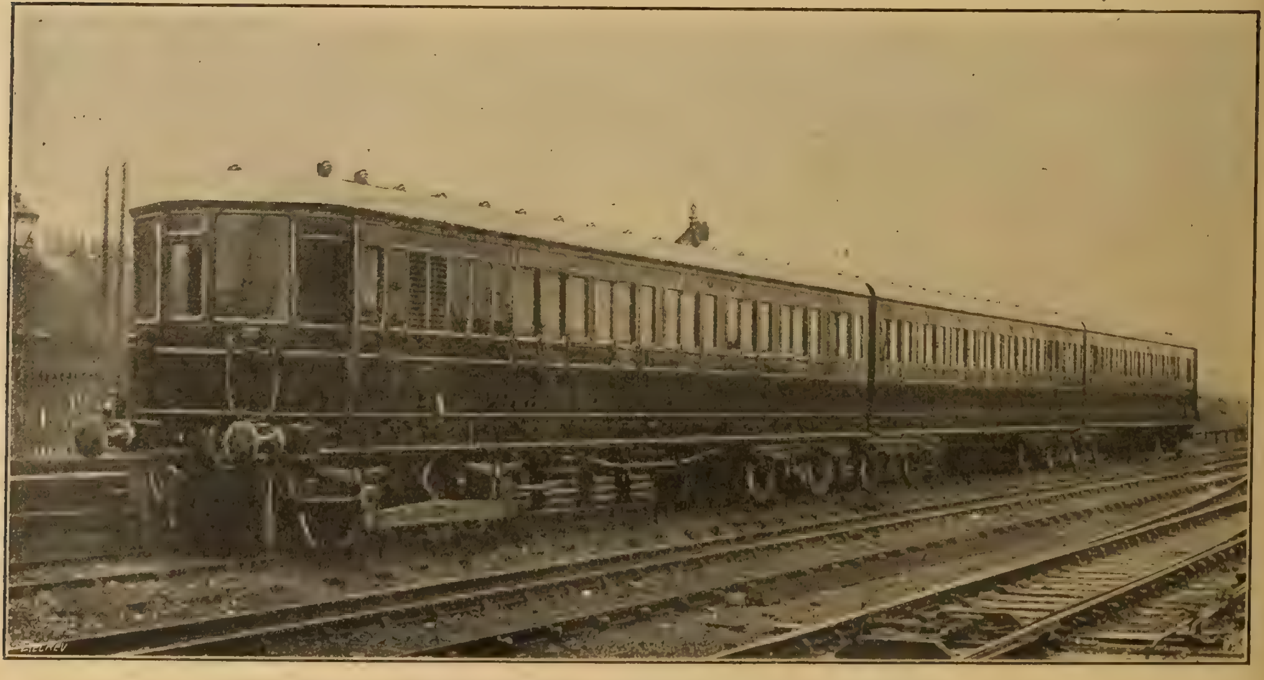


Fig. 2.—L. and S.W. Railway Three Coach Electric Train.

Photos by] [Topical Press Agency.

The trains are equipped for multiple-unit working, and are made up in three-coach units, each set consisting of two motor coaches with a trailer coach permanently close-coupled between them; these sets will be used alone or made up into six-coach units in accordance with the requirements of the traffic. One of the sets is illustrated herewith. The original rolling stock has been employed, with compartments and side doors, the necessary alterations being made to accommodate the electrical apparatus. Each set is provided with four motors of 275 H.P. each, arranged in pairs on the bogies under the driving compartments at each end of the set, and all the electric controlling gear is placed in these compartments instead of beneath the coach, the company's engineers preferring this arrangement for the sake of the greater ease of access for inspection, cleaning, and adjustment.

The power station is adjacent to the River Wandle, from which water is obtained for condensing purposes. Two ferro-concrete ducts bring the water to the station and return it to the river. During periods of prolonged drought the supply of water from the river will be insufficient, and at such times a part, or the whole, of the circulating water will be pumped over cooling towers, the tops of which may be seen in our view.

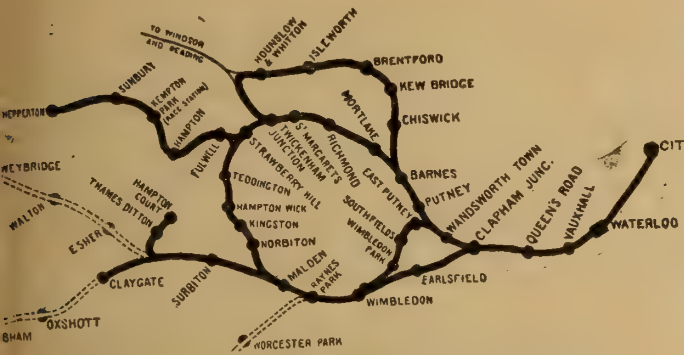


Fig. 3.—Plan of Lines now being Electrified.

The formation of the ground, which slopes from the railway towards the power house and the river, has greatly simplified the coal-handling arrangements; it has been found practicable to dispense with all the usual coal-conveying plant, and to discharge the coal from railway trucks directly into overhead bunkers in the boiler house. The viaduct constructed for this purpose, which may be seen in the illustration, is for the greater portion of its length provided with open decking, so that coal can be discharged from the trucks directly on to a reserve storage space under the viaduct; this space, which is bounded by a low retaining wall, has a storage capacity of about 10,000 tons of small coal. As the ashes are drawn from the boiler-house basement into an overhead receiver outside the building by means of a vacuum system, there are no coal or ash conveyers of the usual type throughout the station. The viaduct is 550 ft. long and 19 ft. wide, and is constructed of ferro-concrete with the exception of a 50 ft. steel girder span.

The power station, which will eventually supply power for the whole of the company's suburban system, is a brick building; the boiler house, which runs parallel with the turbine house, is 237 ft. long × 130 ft. wide, while the turbine house is 257 ft. long × 55 ft. wide, and is capable of accommodating plant of 30,000 KW. output.

The generating plant at present installed consists of five main and three auxiliary generating sets, with space for a sixth main set to be installed when required. The main sets are turbo-alternators of 5,000-KW. capacity and generating three-phase current at 11,000 volts, 25 cycles, while the auxiliary sets generate direct current at 220 volts for lighting and power.

Repair and inspection shops for dealing with the electric trains have been built close to the power house, and there are nine sub-stations on the railway, where the supply is transformed down and converted to direct current at 600 volts.

(To be continued.)

METAL SPRAY PROCESSES IN ENGINEERING.

By JOHN CALDER.

(*Abstract of paper read before the* American Society of Mechanical Engineers.)

It is the object of this paper to describe the latest mechanical process, the Schoop process, for depositing electro-positive metals on iron and steel. Incidentally, the method permits the depositing of many other metals and alloys on coherent bodies whether metallic or not.

The process takes its name from M. U. Schoop, an engineer of Zurich, who, in collaboration with other inventors, made the metal spray an effective coating agent. In the Schoop process, for which the United States patents have just been issued, the coating metal adheres to the object chiefly by mechanical union. The metal is discharged in hot impalpable particles moving with high velocity, and these when directed upon a prepared object penetrate the pores of the latter while the spray is still plastic. The coating metal thus dovetails itself into the superficial pores of the object, and does so in the presence of reducing gas which prevents oxidation at the junction of the metals.

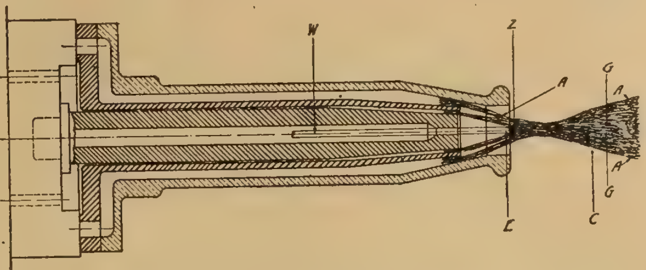


Fig. 1.—Diagram Illustrating Application of Reducing Flame to Metal Wire in the Pistol.

The evolution of the apparatus has been interesting. The liquid metal process involved a large non-portable reservoir of hot metal weighing, with the auxiliary parts, over a ton; the metal dust apparatus weighed over 100 lb., while the "pistol" of to-day weighs less than 4 lb.

The principle involved consists, as shown in fig. 1, in feeding a fine wire W of any metal into a reducing flame zone Z at such a constant speed that the position of the end of the wire E remains stationary, the melting rate being exactly equal to the rate of feed. Under such conditions the wire end melts a drop at a time and each drop at the instant of formation is struck a violent blow by an air blast A. In other words, the pistol is a machine gun which automatically manufactures its ammunition from a reel of wire and bombards the objects to be plated with plastic projectiles of extremely small size.

The resulting fog or spray of fine metallic particles into which the drops are divided takes the form of a diverging cone C with a core of reducing gas G in which the particles are entrained, and a surrounding sheath of air A which is rapidly expanding and cooling. Any suitably prepared object placed in the path of this metallic spray is plated through impact without undue elevation of temperature.

Fig. 2 shows a section of the commercial spraying pistol now in use. The principal parts of the pistol consist of an outer casing A_1, cast of aluminium, with a central projecting tube forming a handle, a wire feed mechanism mounted entirely upon the cover B_1 of the turbine chamber, the turbine C_1 actuating the wire feed mechanism, gas, air, and wire nozzles mounted upon the outer casing held in position by a hand nut D_1, and a removable cover F_1, which completes the enclosure of the outer casing.

Gas and air ducts are drilled in the outer casing. The flow is controlled by the tapered valve F provided with a handle G. The wire feed mechanism is actuated by a turbine C_1 mounted on a vertical shaft running in ball-bearings; a worm is cut in the upper end of the vertical shaft and drives by worm wheels the horizontal shafts N and O (inset), which are provided with worms in turn driving the worm wheels P and Q.

The wheels P and Q, fig. 2, are provided with slots to engage the projecting lugs of the lower feed wheel R. The upper feed wheel S, mounted in the pivoted frame T, is provided with shrouds controlling the position of the lower feed wheel R. The lower feed wheel can be engaged in either worm P or Q by raising a clip I, shifting laterally in either direction and locking in by the opposite clip. The shift can be readily made by allowing the mechanism to run slowly by a slight opening of the starting valve.

Pressure is applied to the feed wheels through the pivoted frame T by a coiled spring, and controlled by the operator by means of the release lever K. The final adjustment of the wire feed is controlled by the needle valve M. The turbine and shaft complete is assembled in the outer case and properly adjusted independently of the other mechanism.

The wire feed is entirely assembled on the turbine cover and, when properly adjusted, is secured in position. The wire nozzle base U provides an adjustment for position of wire and gas nozzles, and is secured in position by a headless set screw. The upper end of the stem of the turbine cover is provided with an annular groove, which is engaged by the spring loop V and secures the removable cover E_1 of the case. Loop V provides also a means for hanging the pistol on a conveniently located hook.

The operation of the pistol is as follows: The gas and blast nozzle faces B and C are securely clamped to form gas-tight joints by tightening the hand nut D_1. The end of the central or wire nozzle is then 0·015 in. inside the gas nozzle, and the stationary melting point of the wire is 0·03 in. inside the air-blast nozzle. The wire diameter used is from 0·0319 to 0·0375 in., except for lead and tin which are used in larger sizes owing to their rapidity of melting.

The feed gears having been set in mesh at the approximate speed required for the wire selected, the air alone is turned on and the speed tested with a short length of wire. Adjustment, if necessary, is made by the needle valve, which modifies the speed 2 ft. per minute plus or minus.

The end of the wire reel is then threaded through the stock receiving tube, between the gripping feed rolls and into the central wire nozzle, and the fuel gas pressures from the containers are adjusted by the reducing valves and gauges thereon to the tabular requirements for the metal to be sprayed. The pressures of the fuel gases seldom rise above one atmosphere, and hydrogen or Blau gas are the reducing gases usually employed. This gas is now admitted by slightly opening the starting valve, and when ignited with a match burns quietly as a pilot light.

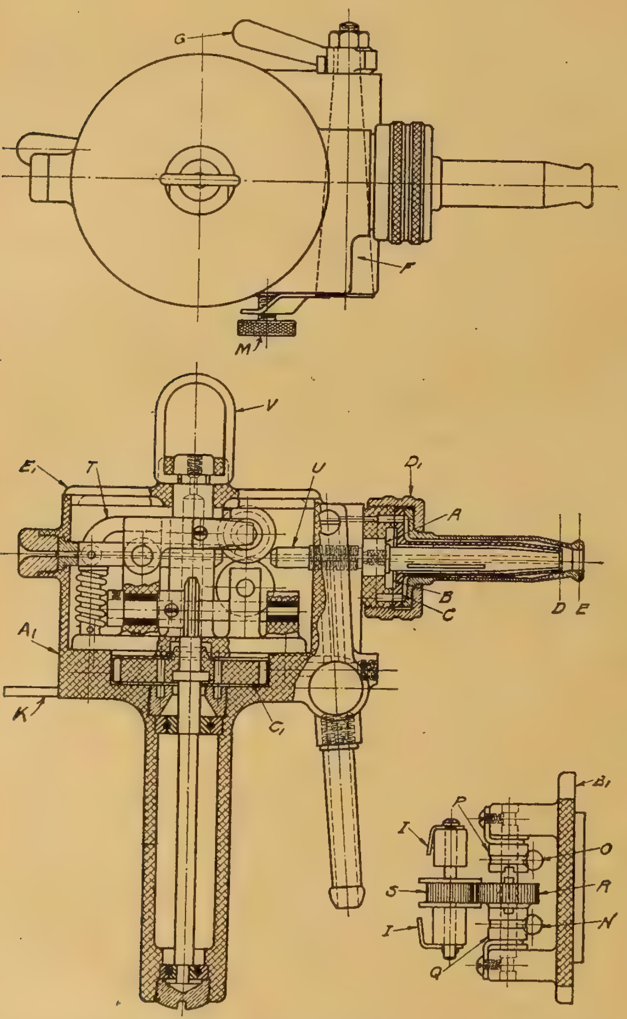


Fig. 2.—Details of the Commercial Metal Spraying Pistol Now in Use, Showing Turbine, Wire Feed Mechanism, &c.

The starting valve is then opened up full and oxygen is admitted gradually until the flame zone is established. All back-firing is avoided by keeping the reducing gas always in excess of the oxygen, the ratio being three or four to one. The above movements are made in rapid succession on a light instrument which can be held in one hand, and the spray is started up the moment the constant melting position of the wire is reached.

The spray so established is essentially a metal plating air-brush, the diameter of which, 5 in. from the pistol end, is about 2 in. Objects to be plated are operated upon by pointing the pistol normally to the surface to be coated at any moment at about 5 in. distance, and traversing the pistol across the surface with a regular motion. A single coating is about 0·001 in. thick. The operator's vision easily guides him in distinguishing between the coated and uncoated portions, and also between a first and second coat.

Two thousandths of an inch well impacted upon a surface are just as effective as a much greater thickness, and, of course, unnecessary sprayed metal increases the cost, as the latter is directly proportional to the thickness. Not only on the score of economy, but also to preserve toughness, the coating should be of minimum thickness, for the anvil action of the metallic spray on a solid metal object is lost above a few thousandths of an inch thickness, and a process of cold working follows, which produces a brittle scale readily detachable. In practice this matter is easily regulated.

Fig. 3 shows the pistol held in the hand ready for action, with the wire thread in position.

Gas bombs with fittings and air at 40 lb. pressure are the only requisites besides the pistol and its hose connections for plating non-metallic objects such as wood, stone, paper, cement, cloth, &c. All metallic surfaces should have the scale cleaned off, and their pores opened by preliminary sandblasting.

A surface 1 sq. ft. in area can be sprayed with the common metals, 0·001 in. thickness, for a small sum. The total cost for German silver is 3½ cents, for copper 3 cents, for tin 5 cents, for brass 2¾ cents, for zinc 2 cents, for aluminium 1¾ cents, and for lead 1½ cents per sq. ft.

Except in the few cases where the impacted metals have a chemical affinity, the action of the spray is purely mechanical. Any metal wire can be sprayed with varying degrees of fineness by the pistol, but a hard metal, such as copper, cannot be impacted with the same degree of adherence upon a solid copper object as it would be upon a more porous cast-iron object or upon one of the soft metals such as lead or zinc. The coatings may be ground, polished and buffed like any ordinary metals, but polished sprayings do not offer themselves as economical substitutes for cheaper and less adherent platings which are deposited in smooth condition.

The applications of the process already made are numerous, and new ones are being suggested continually. In this connection it should be noted that, though coatings of all the commercial metals and of their alloys can be made on any other metal, and on almost any coherent object, except articles containing grease, the choice of a metal coating should be conditioned by the service which it has to render.

Spraying a metal so that it plates an object gives the coating metal no chemical properties it did not possess before. Hence sprayed coatings used for protective purposes, rather than for finish or decoration, are restricted for resisting acids to lead, for resisting air, moisture, sea water, and ordinary atmospheric action to lead, tin, zinc and aluminium, and where superficial oxidation of the coating is of no importance, copper and its various alloys can be freely used also.

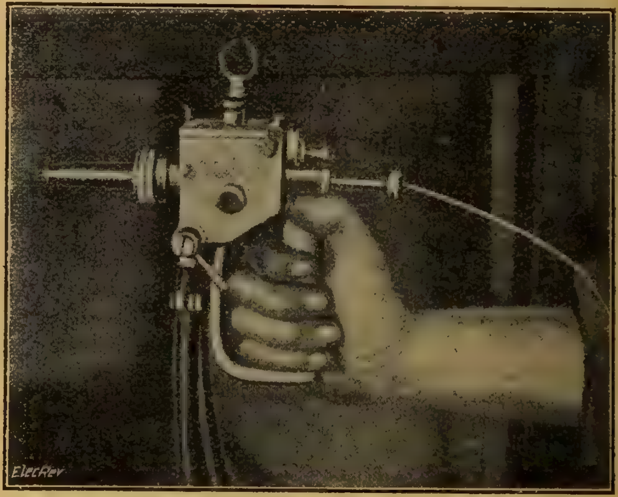


Fig. 3.—View of a Commercial Spraying Pistol in Hand Ready for Use.

Protective coatings on steel or iron may be either original coatings of the whole of an object, or any part of it, or local applications with the pistol to repair damage or wear of a coating made by another process. The repair of the troublesome defects on galvanised sheets is an example. The localisation of copper deposits on iron and steel for the purpose of the cementation process, and for controlling hardening, is easily and quickly accomplished by the pistol. The results are reported to be much better than those obtained from the necessarily irregular and soft electrolytic deposits, the area of which cannot be absolutely controlled.

Many engineering structures used in the arts, such as steel and iron tanks, girders, and machinery of all descriptions, are subject to the action of liquids and chemicals, and corrode rapidly, particularly at joints. It is not possible to plate such structures by any other coating method. In such cases, a metal is selected which will resist the corroding agent, and is sprayed on all the seams and joints, these having previously been cleaned by sandblasting. In many cases the treatment of the joints is sufficient, the solid metal resisting oils and liquors for a long time when the seams are rendered free from attack. Railroad and bridge girders can be handled by portable outfits to protect them from the atmosphere and moisture. This is a large industrial field of application in which lead, tin, and zinc sprayings are used, and proper initial treatment of this kind, or in the field during erection, dispenses with all need for repeated painting.

Laundry machinery, dairy appliances, water-heaters and similar structures exposed to moisture and chemicals, can be protected against corrosion due to electrolysis in many cases by sprayed deposits of zinc suitably located, or may be wholly tinned or galvanised by the Schoop process.

Carbon can be freely sprayed with copper, and that metal can be applied in minimum quantity to any piece or portion of a piece of apparatus.

The most recent electrical application is the construction of condensers, especially for wireless service. The Schoop pistol will spray an adherent coat of copper on ordinary sand-blasted window glass. Two-thousandths of an inch is sufficient to produce a highly efficient and cheap plate, much superior to rolled tin-foil coverings or galvanic deposits of copper on glass. Lead sprayed on glass also furnishes a very cheap and effective condenser plate.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electric Tire Heater.

Taking advantage of the properties of the transformer, the Oerlikon Works have devised a convenient and useful apparatus for electrically heating tires, hoops, toothed gearwheels, &c., which have to be shrunk on. The usual method of heating such rings with coke fires, &c., is apt to result in a temperature far from uniform, and the parts have to be cleaned before they can be put in place; gas rings necessitate the use of compressed air, and the rings have to be of different diameters to suit the work.

In the Oerlikon device, which is illustrated herewith, the ring to be heated forms the secondary of a transformer, the yoke of which can be turned aside, as in fig. 1, to admit the ring, and afterwards clamped in place, as in fig. 2. The winding of the primary is protected from the heat by a stout layer of asbestos, and is confined to one of the cores, preferably the one interlinked with the work. The yoke is balanced by a counterweight pivoted at its centre, in such a way that it can be turned over to the opposite end, enabling the yoke to be swung round on the wound core, so that rings of too small diameter to go over the winding can be placed on the unwound core. The coils are provided with terminals to permit of the use of different sections in accordance with the dimensions and material of the ring to be heated, and the rate of heating desired; in the case of metals of low melting point, such as lead or white metal, careful regulation of the temperature by this means is necessary.

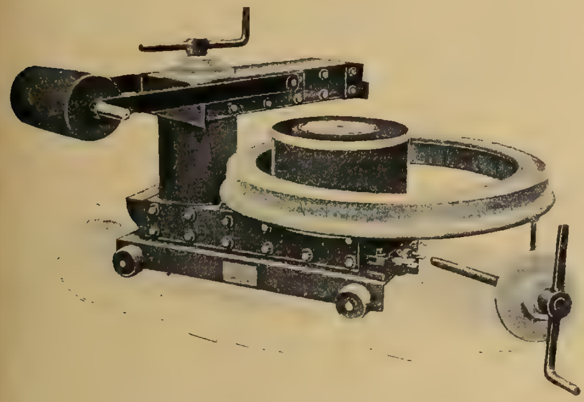


Fig. 1.—Oerlikon Tire Heater, Open.

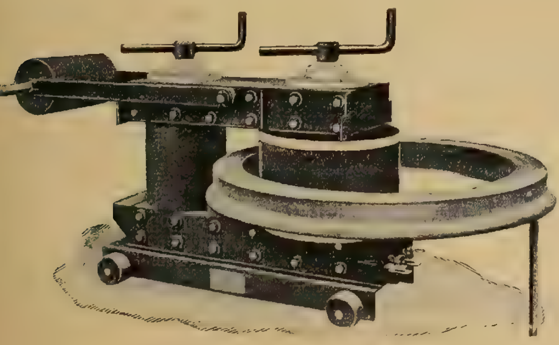


Fig. 2.—Heater in Use.

The "shrink" required for a steel tire is from $\frac{1}{1000}$ to $\frac{1}{1500}$ of its original dimensions, and in the case of a tire 700 mm. in diameter, an increase of 3 mm. in diameter is sufficient to enable it to be put in place, which is obtained by heating it to about 150° C. Such a tire, weighing 120 kg., was heated from 15° C. at different rates, with the following results:—

Time in minutes	9	35	180
Power consumed, KW. ...	17·2	6·2	2·2
Energy, KW.-hours	2·58	3·62	6·6
Temperature attained ...	146° C.	111°	127°

Evidently, therefore, it is economical to heat the metal quickly. The device weighs 400 to 440 kg. The tire is heated quite uniformly, and may be of any size that will go over the core and into the space between the cores; straight bars, &c., can also be heated, by connecting the ends with a bare copper cable or other conductor.

Another use to which the apparatus can also be applied is the removal of tires, which are heated by using a copper cable as the secondary and connecting it to opposite points of a diameter of the tire. In use it is said to be more economical than gas heating.

For the foregoing information we are indebted to *La Revue Electrique.*

Revolving-Disk Grate Stoker.

Automatic stokers of the travelling-grate type, equipped with revolving disks in place of chains or grate-bars, in order to allow good draught without danger of melting parts of the grate, are being manufactured by the Keystone Stoker Co., of Boston, Mass. The grate surfaces of these stokers are composed of closely spaced disks mounted on parallel square bars, which rotate as they move through the furnace. The disks do not mesh, and they make two or more revolutions during one passage through the furnace, thereby causing the disks to be cooled by the air currents entering the fuel-bed. As a result, the manufacturer claims that the disks have no tendency to melt, and that the fire is gently agitated in a way which aids combustion and prevents mass formation of the clinker.

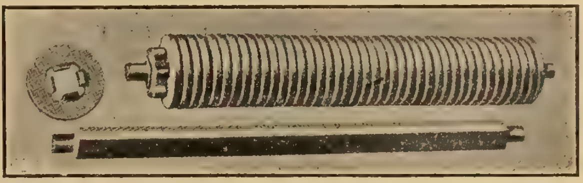


Fig. 3.—Grate Bar, Showing one Disk and Complete Unit.

The links are made with flat bottoms, which enable them to ride on the rollers with a minimum amount of friction. Each link carries an umbrella-shaped shield cap, which protects it from the fire, the shields being held in place by dovetailing into grooves in the link. These shields form the upper half of the bearings of the bars carrying the disks, and afford a quick means of replacing the bars by slipping them out of the links.

Rotating the bars while in the furnace is effected by pinions fitted to one end of the bars, and engaging with rack teeth suitably spaced along the bearer-bar, which is also fitted with the rollers that support the links, as shown in fig. 4. The freshly-supplied fuel that sifts into the ash-pit is reclaimed by falling on an apron, and being carried forward by the returning disks on to a foot-plate at the front, as shown in the section of the stoker.

The coal enters under a gate which regulates the fuel supply. Circulating water-boxes are provided at the feed-gate and at the bridge wall to prevent fires occurring in the coal-hopper and damage to the bridge wall. Dumping grates at the rear are eliminated, provision for raising or lowering the back end being made by strong eccentrics, which jack the stoker to thicken the fire at this point. In this way an excess of air through what would otherwise be the thin portion of the fire is prevented.

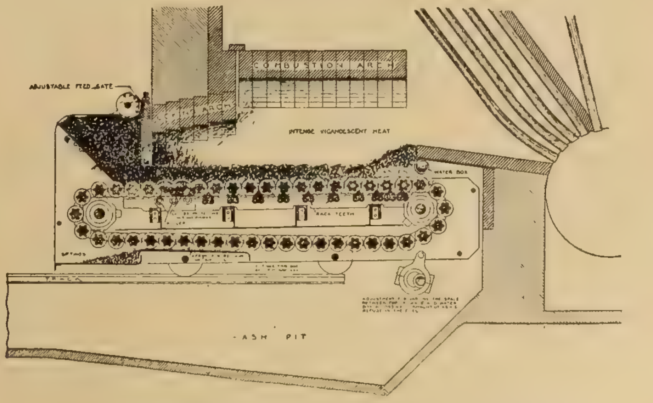


Fig. 4.—Method of Revolving Disk Grate-Bars.

Since the fire disks revolve, the tendency for clinkers to stick to the grate is avoided, with the result that there is no serious plugging of the air spaces. The continual movement of the grate keeps the fuel even and in a free state, with the result that high draught pressure is not necessary to develop high rates of duty. The fuel disks and shields are common castings, so that the renewal expenses are low.—*Electrical World.*

Line Conductor Clip.

The awkward problem of attaching a heavy overhead cable securely to a porcelain insulator has taxed the brains of many an engineer, with results not always satisfactory; a simple device for this purpose has been introduced by Messrs. Bullers, Ltd., of 6, Laurence Pountney Hill, E.C., which appears to get over the difficulty, and has been adopted by several large companies on their transmission lines in this country and abroad. It consists of a clip of copper or aluminium strip (according to the metal of which the cable is made), which embraces the head of the insulator and provides for securely clamping the conductor in position. It can be fixed without special tools other than a screw-driver or pocket wrench, and can easily be detached and used again. By the use of strip metal of high tensile strength the weight and cost are reduced, as compared with clamps of cast metal, and the clip possesses a degree of flexibility sufficient to prevent the crystallisation of the conductor at the point of attachment, which is liable to occur if rigid castings are used. The clips are mechanically very strong, and can be supplied at short notice to suit all insulators and sizes of conductors.

An Automatic Cooker.

The idea of an electric oven with automatic temperature regulation is familiar to us, but rather as an ideal to be aspired to than as an actual achievement. A letter which appears in our "Correspondence" columns to-day, however, brings it before us in the latter aspect, and we illustrate herewith the oven to which the writer refers. The basis of operation of the apparatus is the maintenance of a temperature between 220 and 250° Fah., in which respect it differs fundamentally from the "fireless cooker," the temperature of which is continually falling. It was demonstrated by Mr. Gumaer, in the paper referred to by our correspondent, that cooking can be efficiently carried on at a temperature below the boiling-point of water, provided that sufficient time is allowed for the purpose, and the automatic oven operates on the principle of low temperature for a long time, in which respect it is, we believe, unique. The food is prepared and placed in the oven at any convenient time; the time switch is then set for the hour at which the cooking is to be commenced, and the main switch is closed, after which no further attention is required until the cooked food is removed from the oven in due course. This mode of operation enables the housekeeper to prepare the evening meal in the morning, and to leave the house all day, with the comforting assurance that a perfectly cooked hot meal will be ready on her return. As the temperature is low, and the oven is completely closed, vegetables, meat, sweets, &c., can all be put in together, and left in for the full time required for the longest operation, without spoiling those dishes which are cooked in a shorter time. The heat losses are reduced owing to the low temperature, and it is stated that an actual test showed that during three hours' use the current was on for less than 35 minutes in all, the energy costing less than 2d. at a price of 5d. per unit.

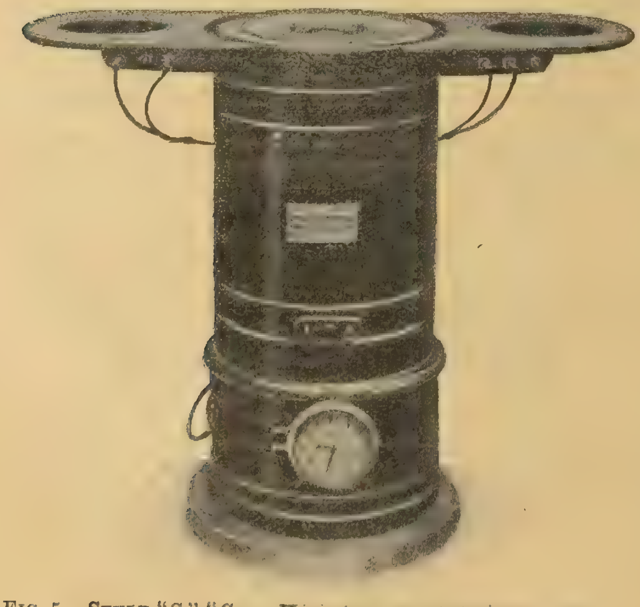


Fig. 5.—Style "C" "Good Housekeeping" Electric Cooker.

Fig. 5 shows the exterior of the "C" type cooker, which is provided with a hot-plate on either side of the oven. The hot-plate heating elements are of nichrome wire, with two heats, and can be renewed by anyone at a very low cost. The cookers are guaranteed for three years, and the oven heating elements are renewed, free of charge, if they burn out on a voltage within 25 volts of the standard pressure. The hot-plate elements are guaranteed for one year. It is also guaranteed that the energy consumption will not exceed 100 watt-hours per pound of food cooked.

The shell is of polished steel, with cast-iron ends, &c., nickel-plated over copper. The insulating materials are mica and glass, and are tested, after completion, with 1,000 volts. Mineral wool and ground cork are used as thermal insulators. As shown in the cross-section, fig. 6, there are two copper jackets forming a double-walled steam chamber, and electrically welded together at the joints; between the jackets is contained a small quantity of water, and the rest of the space is exhausted of air. A phosphor-bronze buckled diaphragm is attached to the bottom of the oven. The heating elements are placed directly under the outer copper jacket, and when energised convert the water into steam, which distributes the heat uniformly throughout the space around the cooking vessels; when the temperature reaches 250° F. and the steam pressure about 15 lb. above atmospheric pressure, the diaphragm changes its shape and presses a loose pin down, which opens the switch contacts and turns off the current. When the temperature has fallen to 220° F. the diaphragm returns to its former position, and the switch contacts close again. Long-continued tests show that the diaphragm will last without deterioration for "several generations."

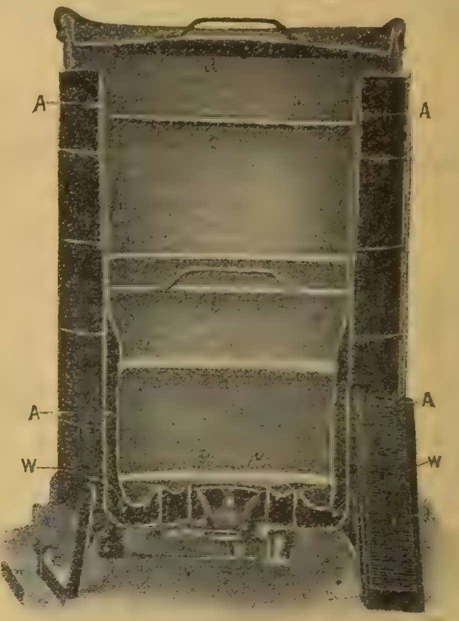


Fig. 6.—Section of Cooker.

A-A-A-A.—Double walled steam chamber. W-W.—A small quantity of water.
H—Heating element. P—Pin that opens switch contact.
D—Diaphragm operated by steam pressure. C-C—Switch contacts.
a, *b*, *c*, *d*—Cooking vessels in contact with wall.

The drawbacks to this method of cooking are obviously the long time required for cooking, which is objectionable when a meal is wanted in a hurry, and the fact that the method is not the best for frying or cooking pastry. The use of the hot plates, however, partly overcomes these objections, and there are many undoubted advantages in the system.

The oven is made by the Berkely Electric Cooker Co., of 228, Monadnock Building, San Francisco.

New Insulating and Heat-Resisting Material.

A heat-resisting insulating material, composed chiefly of mineral fibre as a base, which is called "papco," and is impregnated with a binder called "liquid papco," is being placed on the market by the Pressed Asbestos Products Co., 451, West Nineteenth Street, New York. The liquid binder is said to possess high dielectric strength and heat-resisting qualities, and is, therefore, useful for the impregnation of magnet coils, &c. The insulating material is made up in densities varying from a substance which is soft and fibrous like wood, and which will easily hold a screw, to a hard, dense material which will take a high polish. In all densities the manufacturers claim that the material can be easily machined. By varying the composition the substance is made to withstand temperatures up to 2,600° F. The material is also being made in a plastic form to cover old cables in manholes and splicing chambers without disturbing the cables. The material is not brittle, and in many respects has the same properties as wood, excepting that it does not shrink, warp or slip, and is acid and fireproof. When being moulded, it is solidified under heavy hydraulic pressure—giving it great density and a fine texture. According to the manufacturer, the material is well adapted for making handles for aluminium and copper ware, electrical tools and other devices.—*Electrical World.*

The Uni-Lectric Machine.

A new departure in the way of a self-contained electric lighting set has been introduced by Messrs. Walter D. Fair & Co., of 43, Leicester Square, W.C., who kindly afforded us an opportunity of seeing it at work last week. It consists of a dynamo, petrol-engine, and controlling apparatus all built into one co-ordinate design and mounted on a common bedplate, as illustrated in fig. 7, which is a view from the generator end. The distinctive feature of the system is that no battery is used; the engine is kept running during the whole time that light is required, and therefore it is essential to secure reliability, steadiness of running, and economy in the highest possible degree, together with the utmost simplicity of management. Fig. 8, a ghost view of the apparatus, indicates its general arrangement.

The cast-iron frame consists of an open tank on top, hollow sides, and a hollow base-plate, all of which form connected chambers in which the cooling water circulates. The engine is of the single-acting four-cycle type, with a rotary sleeve valve, and has a bore of 2¼ in. with 3-in. stroke; it runs at a full-load speed of 1,950 R.P.M. The fly-wheel, between the engine and generator, is provided with fan blades drawing air through the generator, and discharging it against the fins of the radiator columns. There is only one main bearing, next to the crank, and the bearing and journal are both of steel, hardened and ground; this is a novel practice, and would be thought objectionable but for the fact that the parts never run in metallic contact, an exceptionally generous supply of oil being continuously forced through the bearing—at the rate of no less than one gallon per minute. The crank-pin and piston-pin are also hardened and ground, and flooded with oil, so that all these working parts practically float on oil, and should last indefinitely. The outboard end of the generator shaft is carried on a ball-bearing. It will be seen, in fig. 8, that the fly-wheel and generator, parts which are least likely to get out of order, are right inside the machine; the little engine is fully exposed at the end, and is readily accessible, together with the governor and the carburetter. The starting gear is of an ingenious type, which releases the moment the engine starts, and cannot possibly injure the user in the event of a back-fire; the brush gear is just behind it, and can easily be got at.

The generator is shunt-wound, and is rated at 500 watts, at 110 volts, but can carry 750 watts, if desired, without heating or sparking. Its voltage is maintained correct by an electric governor, which varies the speed from about 1,500 R.P.M. at light load to 2,000 R.P.M. at 750 watts. This governor consists of a solenoid connected across the terminals of the generator, and acting on a soft-iron core, the weight of which is borne by a wooden float in mercury. This acts through a rack and pinion on the engine throttle, and is very effective, the pressure variation throughout the range from no load to full load being very small, and hunting being absent. The carburetter was specially designed for the machine; it is of the float feed type, and is provided with a simple set of ball valves to regulate the supply of air to the engine. The petrol tank, as shown in fig. 7, is at the base of the machine, and it is easily filled through a convenient pipe seen over the top of the sparking plug in fig. 8. The fuel is raised from the tank to the float chamber by an automatic device connected with the air intake. So long as there is plenty of fuel in the reservoir, this connection is closed, and the reservoir is open to the atmosphere through a small air vent, but when a float falls below a certain point the vent is closed and the connection to the air intake is opened, causing a partial vacuum in the reservoir. The latter is connected by a pipe with the petrol tank, and the suction thus produced draws the liquid up into the chamber until the float rises and restores the original conditions. The wall of the carburetter float chamber is a glass cylinder, through which the interior can be inspected. A magneto is used for ignition, this, the lubricating pump, and the rotary sleeve valve, all being driven by skew gear. In order to ensure perfect freedom from dirt in the petrol, the whole of the fuel supply is filtered through filter stone.

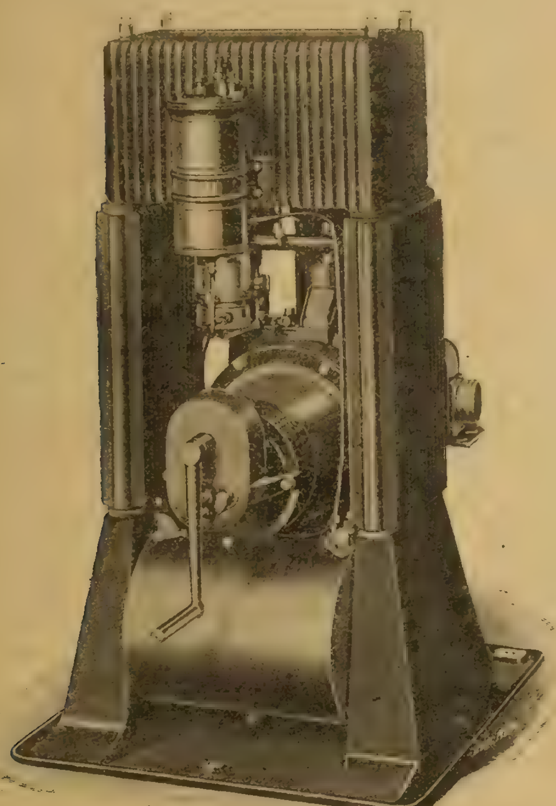


Fig. 7.—End View of Uni-Lectric Machine.

The torrent of oil through the bearings might give trouble through oil being forced out of the bearings; for this reason a partial vacuum is maintained in the crank case by a connection with the air intake, so that atmospheric pressure prevents the oil from escaping and ensures its return to the oil reservoir in the base-plate.

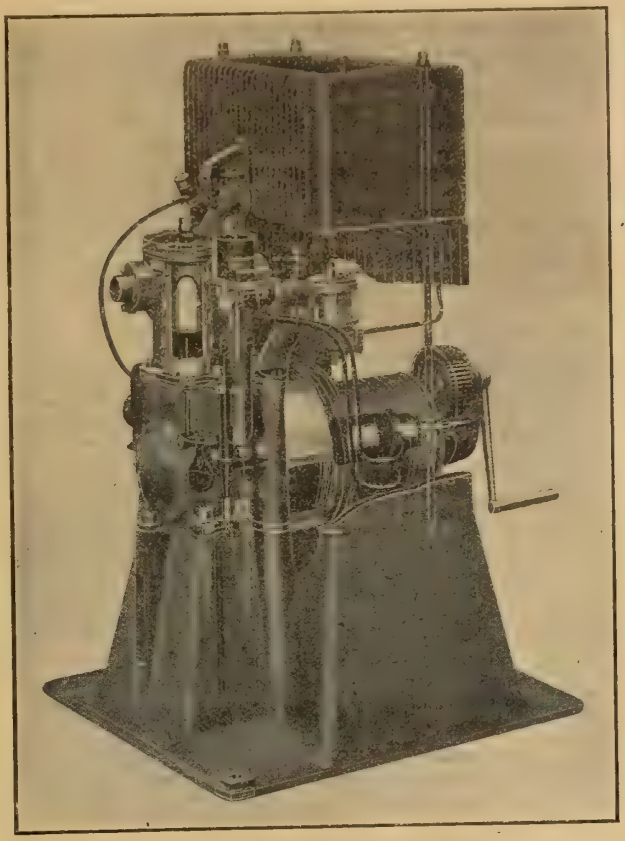


Fig. 8.—Ghost View of Machine.

The attendance required is confined to filling the petrol, oil, and water tanks, switching on the magneto, and turning the starting handle. The machine is guaranteed for five years. It runs with remarkable freedom from vibration, even when not bolted down in any way, and having seen it started and stopped, and run under various conditions of load, we can speak for the simplicity of management, and the steadiness of running which are claimed for it. It should prove a popular means of obtaining electric light—and power up to 1 H.P.—especially as it is highly economical, and of moderate first cost. The consumption of petrol on light load is half a pint per hour. Messrs. Walter D. Fair & Co. have the sole rights controlling the machine in the United Kingdom.

Showroom Window Lighting.

We illustrate herewith a lamp shade such as the Edison and Swan United Electric Light Co., Ltd., Ponder's End, are

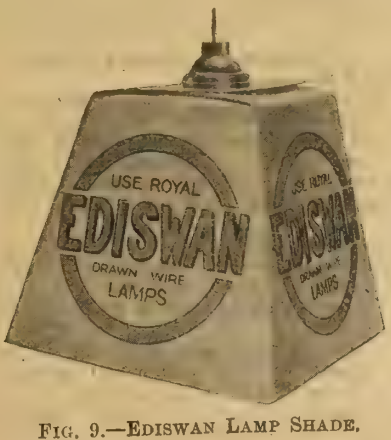


Fig. 9.—Ediswan Lamp Shade.

circulating among their customers for use in their showroom windows. We have little doubt that the shades will be very acceptable in these days of lighting restrictions.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

An Automatic Electric Cooker.

I have been very interested in the article supplied from the proceedings of the Am.I.E.E. from the pen of Mr. P. W. Gumaer on "Economic Operation of Electric Ovens."

As a constant reader of your journal, I have been struck from time to time with what one might almost call a lack of attention given to this particular branch of electric cooking by English manufacturers, the tendency seeming to be throughout to work upon the principle of a very high heat such as is applied in the ordinary range or gas stove.

There is no doubt whatever that the American engineers have gone into the matter very thoroughly as regards the above system of cooking at what is considered a comparatively low temperature, and possibly the fact that the mode of living in the States is, to a very great extent, a system of flat life, lends itself to this, especially as with a small family, and the small home comforts which the ordinary flat provides, it is only natural that the housewife wishes to be out a great deal, and, consequently, this means that there must be some automatic arrangement for cooking, or meals must be taken at restaurants.

I was rather surprised when going through this article to read the paragraph towards the end stating that the author considered that "automatic electric ovens will probably be developed in which the temperature will be accurately controlled and the necessity of constant vigilance will be removed."

As an American, I thought that he would have met with one application of this which is in vogue in the United States, but principally, I believe, in the western portion. I refer to that used by the Berkeley Electric Cooker, known, and on the market, in the States as the "good-housekeeping cooker," *re* which I enclose a small pamphlet giving a good deal of information and facts.

This cooker is absolutely automatic in action and, as can be seen from the description, is fairly well regulated as regards temperature, although, of course, not working to the ideal mentioned in the article referred to, *viz.*, one or two degrees.

A description of the arrangement is given in the pamphlet, and the application is both novel and effective, giving exceedingly even results and, as far as cooking is concerned, practically the same results as those obtained under experiment, with the exception that the temperature is hardly high enough for bread and biscuit, such as is described by Mr. Gumaer.

As far as cost is concerned, this is without doubt one of the greatest advantages of this style of cooking.

I myself have used one of these for about 18 months with excellent results, having in addition a gas stove of a well-known make recognised as one of the most efficient type.

The respective costs here in this city for gas and electricity are 5s. 3d. per 1,000 ft. for gas and 2½d. per unit for electric power and cooking.

With identical meals cooked in each, the respective costs, as a result of several tests, proved that the electric cooker was under half that of gas in every case; and with the electric meter and gas meter at convenient positions to the house it is not a very difficult matter to follow up the exact costs for testing purposes, especially as an integrating watt-hour meter registering in Board of Trade units and decimals of same, and a gas meter reading in cubic feet, are used for comparison purposes.

An average meal consisting of a joint, two kinds of vegetables, and one or two varieties of sweets, can be cooked with a consumption of under one unit, taking from three to four hours, whereas with gas it is found, on an average, 80 to 100 ft. are consumed for the same amount of cooking, whilst, in addition to this, the shrinkage in the meat is a big consideration, this being even with the most careful regulation of heat, which in conducting experiments of this kind had been carefully looked to.

The firm by whom I am employed in the capacity of engineer have taken the agency for this particular cooker, and have interested themselves very largely in the question of experimental and demonstration work on it, and the results obtained have more than carried out the opinions formed from the demonstrations given previous to going into the matter thoroughly.

When it is remembered that this is practically the first cooker of this particular type on the market (to the best of my knowledge), it is to be admitted that the science of automatic cooking, if one might almost call it that, has without doubt a very good start.

The convenience of being able to fix up a meal first thing in the morning, set the time switch and arrive home at any time between six and seven in the evening, knowing that the dinner is absolutely cooked to a turn, takes an enormous amount of responsibility and fatiguing worry off a housewife's shoulders, and when, in addition to this, it is remembered that the waste is practically nil, the amount of attention reduced to a minimum, and the saving in cost a very big item as well, it is not surprising that this has been christened in the neighbouring city of Melbourne by several interested persons "The Fairy Tale Cooker."

As regards temperature, it is, of course, impossible to raise the temperature of the oven itself to more than about 250 deg. Fahr.; but with this temperature it is somewhat of a surprise to a great number of people to find the immense variety of foods which can be cooked perfectly satisfactorily, although possibly somewhat slower than in the ordinary oven.

The average householder is a great believer in having roast meats thoroughly browned on the outside; but I am inclined to think that a great deal of this is purely habit, and once one is accustomed to not having this, the flavour which is preserved in the meat, I am inclined to think, quite makes up for this absence. At the same time, it is a very easy matter to sear the outside of a joint over a live flame or a flat electric heater such as Mr. Gumaer mentions.

As regards the insulation arrangement of the Berkeley cooker, it is more of the type described in No. 2 oven in Mr. Gumaer's article, the outside of the cooker being blued steel sheet, the top of the same where any radiation can take place being of nickelled iron, and the lid itself insulated with slag wool about 2 in. deep. After four or five hours' cooking the temperature of the steel covering is little, if any, higher than the surrounding air, and, although I have never had the opportunity to take any actual tests, I should say that the percentage of heat lost is very small indeed, and the efficiency extremely high.

The current consumption by the heater of this cooker when operating is about 500 to 550 watts; but on an average it is found that when actually cooking, current is not being taken by the heater for more than about a quarter to a third of the actual time taken for cooking, this being indicated by a small pilot lamp mounted on the side of the cooker.

I am writing more particularly with the object of obtaining information as to whether this type of cooker and any arrangement such as described is in vogue in England at present. I have seen no description nor any advertisement illustrating anything like this in the English papers, and from what I can see, an apparatus of this description, developed upon lines such as these people are working on, should offer an excellent field both for experimenting and practical utility. This particular firm evidently has been the first to adopt this principle in a commercial manner and place it upon the market in a form which can be applied by the average householder.

We have recently received a letter from Norway showing that this cooker evidently has a fairly good hold of the public there, judging by the information given. As most of the electricity supply undertakings develop their current by water power, the householder is in a very much more favourable position to purchase current than under the usual system. The companies dispose of the current, I understand, at a flat rate of so many watts day and night at a fixed rate, regardless of what the application is.

This amount being limited to the minimum required, tending as it does to eliminate peaks, current can naturally be supplied at very cheap rates, and if supplied to an economical cooker, such as the one described, one can imagine the results obtained and the low costs. This latter part is interesting, showing, as it does, the application in a foreign country and the excellent arrangement put forward for the current consumer.

In conclusion, if any of your correspondents have information which applies to this particular subject, we would be glad to hear direct from them, if possible, or through your good self, as the servant problem is quite as acute in Australia, if not more so, than in England or America, and any labour-saving ideas are always welcomed by the Australian public.

F. W. Fisher.

c/o Newton McLaren, Ltd., Leigh Street,
Adelaide, *August 10th*, 1915.

[We refer to this matter in our leading columns to-day, and the oven is described in our "New Devices" column.—Eds. Elec. Rev.]

Pocket Dry Batteries.

I noticed in a recent issue a letter signed "Dry Battery Manufacturer," wherein he complained that he was unable to obtain more than 1.4 volt per cell, and invited the experience of other manufacturers on the subject. Although not a manufacturer myself, I have for some time been making small dry batteries (for pocket lamps) for my own use, and have been able to regulate the voltage of the cells between 1.4 and 1.8 volts to suit my own convenience.

Howard Berry.

London, N., *September 19th*, 1915.

Church Lighting.

We wish to make a few remarks regarding church lighting with reference to the letter by "Lux." We have had in hand, and completed, the electric lighting of an old church which dates back to the year 1240 A.D. This was illuminated by paraffin lamps, and we can assure him we had no small difficulty to get the best effects with electric light; but by converting the old paraffin chandelier in a most suitable manner, and using a shade which nearly obscured the bulb, we obtained the result of a brilliant, yet beautiful, soft light, which gave the inside of the church a pleasing appearance when illuminated. This is in a village of 300 inhabitants, for whom we installed a water turbine plant two years ago with every success. We should be pleased to place our engineer at his disposal, and supply him with any information that he may require (gratis).

J. H. Oxley.

Skipton, *September 20th*, 1915.

[Several other correspondents have offered assistance in this matter, and have been put in touch with "Lux."—Eds. Elec. Rev.]

EFFICIENCY CONSIDERATIONS IN HEATING WATER ELECTRICALLY.

The increasing popularity of "cheap-unit" tariffs, *i.e.*, tariffs —Point Five tariffs among them—which charge ½d. or less per unit of electrical energy consumed (supplementing this charge, if necessary, by a minimum fixed charge), should arouse fresh interest among central station engineers and manufacturers in the possibility of heating water electrically for domestic use. The difficulty in the problem is entirely economic. With current at lighting rates, say 3d. or 4d. per unit, heating water electrically by the 10, 20 or 50 gallons is out of the question. With current at 1d. per unit, the electric system enters the field of practical politics, but full allowance has to be made for the (very real) monetary value of the convenience and cleanliness of electric, as compared with other heating systems. Using current at ½d. a unit, there are many cases in which electric heating for water in bulk will show distinct economy over other systems. Already domestic supply at ½d. per unit in industrial centres is being seriously discussed, and with energy at this price there is not the least doubt that electric heating of water should become general. Naturally, the charge of ½d. per unit would need to be supplemented by a fixed charge, but this would be based on the whole installation (lighting, heating and cooking), and a cheap price per unit is the necessary and sufficient condition for the healthy development of all branches of electric heating and cooking.

Though it is not sufficient simply to take account of the thermal equivalent of 1 kw.-hr. of electrical energy, 1 lb. of coal and 1 cb. ft. of gas, and the market price of each, the following estimate serves to indicate the approximate economic position of electrical water heating, and shows that this is by no means so unfavourable as frequently supposed. At 100 per cent. conversion efficiency, we may take 1 kw.-hr. of electrical energy to be equivalent to 3,414 b.th.u., 1 lb. coal to 13,000 b.th.u., and 1 cb. ft. of town gas to 640 b.th.u. With energy at ½d. a unit, coal at 25s. per ton, and gas at 2s. 6d. per 1,000 cb. ft., the cost of 1,000 b.th.u. (still at 100 per cent. conversion efficiency) is 0.146d. for electricity, 0.0103d. for coal, and 0.047d. for gas. Using an electrothermal storage apparatus built on the lines indicated below, 90-95 per cent. of the theoretical heat equivalent of the energy expended can be obtained in the hot water drawn off. The ordinary domestic hot-water system operated in conjunction with the kitchen range can hardly represent higher than 10 per cent. thermal efficiency, and there must be very few coal-fired domestic hot-water systems which attain 30 per cent. efficiency. As for gas-fired hot-water systems, 50 per cent. thermal efficiency is a liberal allowance. Allowing 90, 30 and 50 per cent. efficiency for electric, coal, and gas systems, the costs per 1,000 b.th.u. on the above basis become 0.16d., 0.034d., and 0.09d. respectively. This is with energy at ½d. per unit, and allowing nothing for the very important advantage of being able to obtain, from an electrothermal storage, hot water at any time of day or night without any delay, labour or mess.

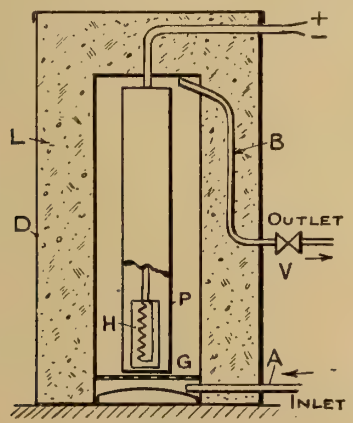


Fig. 1.

It has been claimed—and the claim appears well justified—that electric heating of domestic water can compete with other systems if the price of electrical energy is ½d. or less (using thermal storage apparatus of 90-95 per cent. efficiency), 0.4d. or less (with storage of 80 per cent. efficiency), and 0.3d. or less (with storage of 65 per cent. efficiency). As prices per unit from 0.5 to 0.25d. are either available or feasible in many industrial centres, and efficiencies of 90 per cent. or over down to 65 per cent. or 70 per cent. are attainable in large and small electrothermal storages (say, 50 to 5 gallons capacity) respectively, the problem of building suitable apparatus deserves the immediate attention of manufacturers, that of central-station engineers being directed with equal vigour to getting the apparatus extensively installed.

It is unnecessary to dilate upon the advantages accruing to central stations from this load. For best results from every standpoint, the apparatus should be in circuit continuously and operate on the accumulator principle, always supplying water at maximum temperature and, in amount, proportional at every moment to the duration of the "charge." Since the losses from a properly designed and constructed storage are very small, it is quite feasible to "charge" only during night hours if this be preferable from the station standpoint.

Conduction and radiation losses are reduced by lowering the maximum temperature to which water is heated, but the thermal capacity of the storage is simultaneously reduced in much greater proportion, so that it pays to heat the water to, say, 90 deg. C. (any higher temperature involving considerable loss by steaming). Thorough lagging is, naturally, essential, and it is important to reduce to a minimum metallic connections between the water container and outer casing, and also to prevent appreciable heat loss through the water inlet and outlet. The Rittershaussen thermal storage embodies a number of desirable features. As shown by fig. 1, an "immersion" heater H in circulating pipe P is employed. The water control valve V is in the hot-water pipe B, and the latter, which, of course, starts from the upper surface of the water, runs vertically downwards through the lagging material L for some distance before proceeding out through the casing D. The cold-water inlet pipe A terminates below a diffusing plate G.

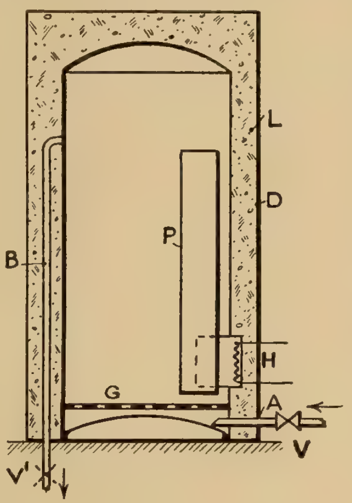


Fig. 2.

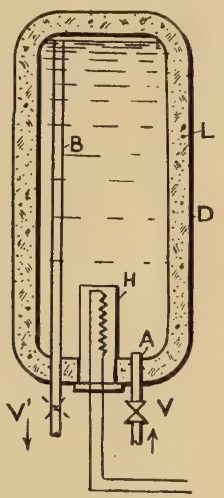


Fig. 3.

The important distinctive features of this apparatus are the *immersion* heater and the *closed* hot-water delivery pipe. Though not completely so, the side- and bottom-heaters shown in figs. 2 and 3 may be termed *external* heaters, and, as explained below, these are much less advantageous. In both figs. 2 and 3 the water control valve is shown in the cold-water inlet, the hot-water pipe being *open*. It is possible, and preferable, to place this valve at v^1 in the hot-water outlet, thus making the heater of the closed type.

The disadvantage of the open-type storage, *i.e.*, one with the hot-water delivery in free communication with the atmosphere, is that continuous loss of heat occurs by evaporation and expansion of the water as it is heated expels some of the hottest water in the cylinder. Since water expands about 3½ per cent. between 10 deg. and 90 deg. C., there is necessarily 3½ per cent. higher loss in open storages than in closed storages, where expansion of the heated water simply drives back a certain amount of *cold* water through the inlet pipe.

Immersion heaters necessarily give up the whole of their heat to the surrounding water, and the only effect of scale deposits in the water tank is to increase slightly the maximum temperature of the water. On the other hand, side- or bottom-mounted "external" heaters are necessarily subject to a certain heat loss directly through the lagging material; they raise part of the water tank above the temperature of the surrounding water, set up disturbing water currents, and are decreased in efficiency as scale collects on the heating chamber. In the latter respects bottom heaters (fig. 3) are particularly objectionable. The whole mass of water is set in circulation, so that the temperature throughout is more or less uniform instead of there being a variable volume of fully heated water. Also, solid matter precipitated from the hot water is baked on the heater casing instead of remaining clear of the heater and in the form of a loose sludge, as is the case where there is a stationary bottom stratum of cold water. If the whole of the water be kept in circulation, the hot water delivered is necessarily turbid.

In figs. 1 and 2 the cold-water inlet terminates in a practically stationary layer of cold water beneath the diffusion plate G, and there is, therefore, no appreciable conduction loss through this pipe. Advantage is taken of the very slow transmission of heat downwards through a water column to reduce the otherwise serious loss of heat through the hot-water delivery pipe, by taking the latter vertically downwards through the lagging of the storage tank.

The theoretical "charging" curve (mean temperature against time) of an electrothermal storage apparatus is a straight line and up to 50 deg. C. closed- and open-type storages with immersion or external heaters all follow the theoretical curve very closely. At higher temperatures the losses become more important, and the charging curve bends downwards, longer than the theoretical time being required to attain a given temperature. The slower the "charging," *i.e.*, the less the power expenditure per gallon, the greater the total energy expenditure required per gallon of hot water withdrawn.

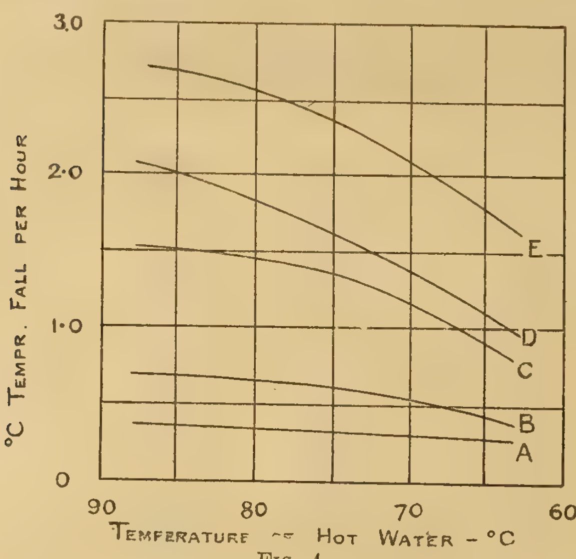


Fig. 4.

A 45-gallon storage tank heating water from 10 deg. to 90 deg. C. (50 deg. to 194 deg. F.) represents 64,800 B.TH.U. useful storage when fully charged, corresponding to, roughly, 20 KW.-hr. A power expenditure of 45 watts per gallon (2 KW. total) necessitates 10 hours for complete charging. If carried out during night hours only, this provides 45 gallons of nearly boiling water which can be used at nearly maximum temperature during the day. The curves plotted in fig. 4 are based on test data published recently in the *Elektrotechnische Zeitschrift*, and show how slow is the temperature fall in a large vessel of the type illustrated in fig. 1: what advantage there is in using a large storage (*e.g.*, a 45-gallon storage in preference to a 22-gallon storage, *cf.* curves A, B, fig. 4); and how much more favourable, from the efficiency standpoint, a "closed" storage with immersion heater is than an open storage with side- or bottom-heating. Curves C, D refer to a 5½-gallon storage of the type illustrated in fig. 2 with closed and open hot-water delivery respectively; and curve E refers to a storage of the "Therma" type illustrated in fig. 3.

If charging every night be practised, the most unfavourable case conceivable is that the whole of the water in the storage tank be raised to 90 deg. C. and no water be removed before charging be recommenced the next night. From curve A, fig. 4, it appears that the temperature of a 45-gallon storage of the type illustrated in fig. 1 would then remain between 90 deg. and 80 deg. C., and, assuming an average temperature drop of 0.37 deg. C. per hour, the loss in 24 hours would be

$$24 \times 0.37 \times 450 \times 9/5 = 7200 \text{ B.TH.U.}$$

i.e., 2.1 KW.-hr., or about 10 per cent. of the useful storage. Under average circumstances, the loss could hardly exceed 5 per cent., so that 90-95 per cent. efficiency (on a 24-hour basis) can fairly be attributed to "closed" electrothermal storages with immersion heaters. Due to the more rapid cooling shown by curves C and E, fig. 4, the corresponding efficiencies for the closed storage with side heater and the open storage with bottom heater, to which these refer, are respectively about 82 per cent. and 66 per cent.

Enough has been said to demonstrate the commercial practicability of electric water heating for all domestic purposes, and to impress upon manufacturers and central-station engineers the importance of concentrating attention upon those types of apparatus which yield maximum efficiency. The results attainable are practically 100 per cent. charging efficiency and 90-95 per cent. storage efficiency, and there is no reason why less satisfactory results should be accepted.

WAR ITEMS.

The War and American Electrical Exports.—The June exports of electrical goods manufactured in the United States again show an increase over the corresponding month in 1914. The increase amounted to roughly 600,000 dol., or about 30 per cent. of the total exports in June, 1915. The most conspicuous increases were in batteries, of which the value was practically doubled; in insulated wire and cables, of which approximately 200,000 dol. more was exported in June, 1915, than in June, 1914, and in metal-filament lamps, the exports of which were increased five times. The total electrical exports for the year ended June 30th, 1915, showed a decrease in comparison with the previous year of slightly over 5,000,000 dol., or approximately 20 per cent. The principal decrease was shown in the motor trade, which fell off by almost 2,000,000 dol. Batteries, interior-wiring supplies and metal-filament lamps alone showed increases, the last-named item having more than doubled its exports during the twelve months.—"Electrical World."

EXPORTS OF ELECTRICAL GOODS.

	June.		Twelve months ended June 30.	
	1915. Dols.	1914. Dols.	1915. Dols.	1914. Dols.
Batteries	113,950	58,521	967,146	685,640
Dynamos or generators	191,464	199,955	2,013,130	2,634,365
Fans	48,106	22,717	258,309	432,656
Insulated wire and cables	253,247	74,294	1,911,850	1,992,304
Interior wiring supplies, etc., including fixtures	70,915	51,354	753,351	721,069
Arc lamps	1,826	3,952	30,984	76,766
Carbon-filament lamps	11,432	3,094	101,923	172,064
Metal-filament lamps	78,536	15,719	473,149	219,439
Meters and other measuring instruments	41,214	—	440,916	—
Motors	283,923	231,003	2,817,743	4,541,541
Static transformers	70,543	75,392	624,483	1,455,343
Telegraph instruments (including wireless apparatus)	1,522	26,962	77,271	136,592
Telephones	44,342	69,717	1,149,361	1,552,951
All other	836,061	617,757	8,152,141	10,440,114
Total	2,047,081	1,450,437	19,771,757	25,060,844

The American "Electrical Review and Western Electrician" gives the following table of the electrical export totals for the fiscal years since 1908-1909, when the last electrical export depression reached its lowest point:—

Fiscal Year.	Electrical Exports.
1908-1909	$12,524,391
1909-1910	14,742,395
1910-1011	18,727,455
1911-1912	20,169,362
1912-1913	26,772,816
1913-1914	25,060,844
1914-1915	19,771,757

This contemporary in an editorial bearing on the matter says that an accurate measure of the war's influence on American foreign trade is obtainable from a study of the Government report on foreign commerce for the fiscal year ended June 30th last, which includes the first eleven months, or practically the first year, of the war. "The most striking fact brought out by this report is that our total exports of domestic and foreign merchandise reached the highest value ever attained in any preceding fiscal year, amounting to 2,768,589,340 dol., or over 12 per cent. above the record established in 1912-1913. At the same time the total imports amounted to 1,674,169,740 dol., or over 11 per cent. less than the record total of the preceding fiscal year. While the electrical exports show a decrease in total value as compared with the two preceding years, the reasons for this are easily understood. The monthly totals in the early months of 1914 reflected an almost world-wide depression in foreign trade which culminated in August with the breaking out of the war and made the electrical total of that month the lowest for several years. Since that time there has been a gradual picking up in electrical shipments, April and June each showing totals of over 2,000,000 dol., and the June total being an increase of more than 40 per cent. over that of the preceding year. This improvement is due chiefly to shipments of electrical war supplies, and partly to the fact that supplies of electrical materials are becoming exhausted in countries that formerly imported them chiefly from the belligerents. Although the total value of the electrical exports reported for 1914-1915 was about 21 per cent. below that of 1913-1914, in the case of some individual classes there was an increase. This was noticeable with metal-filament lamps, which increased over 115 per cent.; batteries also increased over 41 per cent. The comparative monthly figures, of course, show fluctuations in both directions of all the electrical classes, but it is noteworthy that in the case of insulated wires and cables there has been a decided increase each month since last March over the corresponding period of a year ago. This total increase for the last four months of the fiscal year was about three-fourths of a million dollars or 185 per cent. A large part of these increases are due to exceptionally heavy shipments to the entente allies. How long these will continue is problematical, depending chiefly on the continuance of the war. Electrical shipments, like those of so many other classes of merchandise, are still considerably below normal to most of the neutral countries. However, hopes of future improvements in shipments to these countries are natural, because it is reasonable to expect that the agitation for the extension of our foreign trade which is being taken up co-operatively by our governmental and commercial agencies is to bear fruit in a steadily increasing measure."

German Capital in Russian Electrical Concerns.—A book, by V. S. Zio, has just appeared in Russia dealing with the influence of German capital in Russian industry, which has found expression mostly in the form of limited companies. During the past ten years, it appears, German capital in the Russian electrical industries increased by 123,000,000 roubles (£13,000,000), and it was employed in the richest districts of the country, the favourite centres having been Lodz, Petrograd, and Moscow; and in the end, German companies served the whole Polish area, and the trading and industrial centres of Petrograd, Moscow, and South Russia. They managed to figure in the Russian electrical industries even under the French flag, as in the case of the French Electricity Co. of Warsaw, the shares in which are mostly held by Germans, who, in fact, controlled 22 electrical share companies, i.e., practically the whole electrical industry of the country. The "Novoie Vremya" says that in Russia the branches of German electrical houses executed most of the government and official municipal work. Contracts with the Marine and War Departments were particularly affected by the Germans. They furnished convenient occasions for increasing capital. All the largest electrical concerns operating in Russia were simply branches of German houses. Finland, too, was controlled by them. The Germans readily negotiated Finnish town loans: but on condition that public utility (town) work should be done by Germans. Thus the money lent returned to Germany with handsome profits added.

Trade Union Rules to be Suspended.—The executives of Trade Unions, whose members are engaged in the production of war munitions, at their conference last week passed resolutions pledging themselves to the following:—

1. To secure the suspension of all restrictive rules, practices, and customs, such as the limitation of overtime and the prohibition of piecework on war work in Government arsenals and controlled establishments subject to the statutory safeguards of the Munitions of War Act.
2. To render all possible assistance in the carrying out of a systematic investigation, not only in Government arsenals and controlled establishments, but in all other factories, with a view to determining the least possible amount of skilled labour necessary to enable the machinery to be employed for the full 24 hours in each day.
3. To assist in the reorganisation of the skilled labour employed in Government arsenals and controlled establishments in order that semi-skilled and unskilled male and female labour may be employed on a much more extensive scale subject to the conditions of Schedule 11 of the Munitions of War Act.
4. To give all possible assistance in securing the transfer of suitable men enrolled under the Munition Volunteer scheme to any district where their services may be required, subject to the observance of the conditions applying to the Volunteer Munition scheme, and to assist in the further enrolment of volunteers for this purpose.

The Conference recommended that in order to give effect to the above scheme local conferences of branch and district officials and shop stewards be held in various munition centres, at which the Minister of Munitions or other representatives of his Department shall be present.

A New Advance in German Prices.—A month ago the Sales Bureau of the united makers of insulated conductors announced an increase of 20 per cent. in the prices of rubber-insulated zinc conductors as a result of the increased cost of raw materials and the consequential rise in the cost of production. Now the leading machinery firms have issued a circular intimating for the same reasons an augmentation in sale prices by 10 per cent. from the 20 per cent. advance already in operation, as compared with the pre-war period, to 30 per cent. The new prices apply to the materials used in the construction of generators and motors, including electrically-driven ventilators, pumps, boring machines, etc., starting apparatus, regulating resistances, controllers, oil switches and other switches and railway material. The list prices for generators and motors of over 100 kw. have been abolished, as also have those for transformers of any size. The additions will be expressly stated in offers and invoices, and all offers which have hitherto not led to orders are to be considered as withdrawn. The circular is signed by the firms of the A.E.G., the Bergmann Co., Brown, Boveri & Co., C. & E. Fein, Maffei-Schwartzkopff, Esslingen Engineering Works, Saxony Light & Power, Siemens-Schuckert, and Ch. Weuste & Overbeck.

Restricted Lighting.—The Bradford Chamber of Trade, on Monday last, appointed a special committee to act throughout the winter in taking all possible steps to reasonably keep down the lighting of shops. Though in nearly all surrounding areas rigid lighting restriction orders are in operation, the Bradford order was removed a considerable time ago through the efforts of the Chamber, but a good many shopkeepers have gradually increased the abuse of the privilege, and the Chamber has warned them of the probability of a renewal of the order, with greater severity than before, for the coming winter, if better judgment of lighting is not voluntarily exercised.

Praise for the Signal Service.—In his last published dispatch from the Dardanelles, Sir Ian Hamilton pays the following tribute to the Signal Service:—"In addition to its normal duties the Signal Service, under the direction of Lieut.-Col. M. G. E. Bowman-Manifold, Director of Army Signals, has provided the connecting link between the Royal Navy and the Army in their combined operations, and has rapidly readjusted itself to amphibious methods. All demands made on it by sudden expansion of the fighting forces or by the movements of General Headquarters have been rapidly and effectively met. The working of the telegraphs, telephones, and repair of lines, often under heavy fire, has been beyond praise. Casualties have been unusually high, but the best traditions of the Corps of Royal Engineers have inspired the whole of their work. As, for instance, the central telegraph office at Cape Helles (a dug-out) was recently struck by a high explosive shell. The officer on duty and twelve other ranks were killed or wounded and the office entirely demolished. But No, 72,003 Corporal G. A. Walker, Royal Engineers, although much shaken, repaired the damage, collected men, and within 39 minutes reopened communication by apologizing for the incident and by saying he required no assistance."

An Enemy Lift!—At Fleetwood, on the 16th inst., Mr. J. H. Shorrocks, manager of the Norbreck Hall Hydro, was summoned for a breach of the lighting regulations. A police officer said he saw flashes coming from the hydro, and when he went on the roof with an employé the flashes were found to come from the door of the place containing the apparatus for working the electric lift. Each time the lift stopped or started there was a flash. The defendant had since done something to remedy the matter. For the defendant, it was stated that sometimes the lift got overheated, and the door had been opened to cool it. Defendant was fined £1.

Electrical Works Destroyed by French Artillery.—The French communiqué of September 17th contained the following sentence:—"Our artillery has succeeded in the destruction of the electric factory of Turckheim."

The Central News correspondent in Northern France refers to the matter thus:—"The French heavy artillery has wrecked the important Siemens-Schuckert electricity works at Turckheim, near Colmar."

War Workers and Fatigue.—The Minister of Munitions of War has appointed a committee to consider and advise on questions of industrial fatigue, hours of labour, and other matters affecting the personal health and physical efficiency of workers in munition factories and workshops. Mr. E. H. Pelham is secretary of the committee.

Lighting Regulations.—On the 16th inst. a Putney jeweller was fined £20 for failing to extinguish his shop lights after being cautioned. The police evidence showed that he had 36 lights of 25 c.p. each, unobscured, throwing a beam of light across the High Street.

BUSINESS NOTES.

Australian Imports.—The Queensland Government has decided that, where practicable, it will import its own requirements from London instead of through agents and contractors.—*Tenders.*

Catalogues and Lists.—Messrs. Ikin & Eads, Ltd., 47 to 57, Marylebone Lane, Oxford Street, London, W.—Sixteen-page illustrated pamphlet containing full particulars, prices and code-words relating to "Quead" electric fires, patterns being shown for heating large and medium-sized rooms, also portable models, boudoir patterns, &c.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E.—Sixteen-page illustrated catalogue (No. 47), containing particulars and prices of electric lighting accessories including various patterns of lampholders, cut-outs, ceiling roses, tumbler switches, counterweight fittings, wall plugs, watertight switches, wood blocks, distribution and fuseboards, &c.

Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, London, W.—Publication No. 245 just issued contains illustrated particulars and prices of the firm's magneto blasting machine, and the dynamo low-tension blasting machine, also details of spare parts for "Sterling" exploders.

Messrs. Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—An excellently produced publication of 80 pages (No. 1,012) deals with the subject of the heating and ventilating of factories. The matter is one of extreme importance in these times when works are going day and night and workers are working long hours and sometimes at high pressure. The publication discusses the various systems, and then gives fully illustrated descriptive accounts of the "Sirocco" heating and ventilating apparatus. A number of particular installations, for example, that at the Central London Railway repair shops, that at the works of Messrs. J. & E. Hall, Ltd., at Dartford, and that at the B.T.H. Works at Rugby are illustrated and described. Many pages follow containing an impressive list of public and other buildings where the Sirocco system is in use.

Book Notices.—*The Wireless Telegraphist's Pocket-Book of Notes, Formulæ and Calculations.* By J. A. Fleming, F.R.S. London: The Wireless Press. Price 6s. net.—Coming from the hand of a past-master in the subject dealt with, this handy compendium of information bears unimpeachable credentials, and is sure to command a wide circulation. It does not claim to be a treatise on wireless telegraphy; as the author states, it is a *memoria technica* of formulæ, data, and useful tables, for the use of telegraph operators and students. It commences with a chapter on mathematical processes, including the calculus and vector analysis, which is followed by one on units and measurement. After this general introduction, the author proceeds to deal with subjects more particularly associated with radio-telegraphy, chapters on high-frequency resistance phenomena and calculations, and problems involving inductance; the measurement of high-frequency current and voltage; capacity measurement and calculation; and the use of the cymometer for the measurement of frequency, wave-length and decrement. Numerous worked examples are given to facilitate the use of the formulæ and tables in arithmetical calculation. The theory of electric waves and radiation from antennæ is the subject of the next chapter, which includes the practical determination of antenna resistance and radiation, &c., and afterwards transmitting and receiving apparatus and detectors are dealt with. One chapter is devoted to practical information for wireless operators, including the International Morse code, the care of storage cells and wireless apparatus, and a glossary of terms; and the last chapter consists of mathematical tables, which are exceptionally well arranged and comprehensive, tables of resistance and weight of copper and aluminium wire, &c. A careful examination of the volume leads us to the conclusion that it will prove of very great value to all who are technically concerned with the design, construction and operation of radiotelegraphic installations, though a considerable portion of the contents will probably be over the heads of amateurs and ordinary operators, owing to the advanced mathematics employed.

Patent Application.—Application has been made by Wilfred Briggs for the restoration of Patent No. 27,805 of 1908, for "Improvements in or relating to brakes for motor-driven road vehicles."

For Sale.—The Corporation of Southport has for disposal a single-decked, 34-seat, tramcar, particulars of which are given in our advertisement pages to-day.

Italy.—A joint stock concern, under the style of the Unione Telefonica Padovana, has been formed at Padua, with a capital of 100,000 lire, for the manufacture and exploitation of telephone and accessory electric apparatus.

Annual Outing.—The Siemens Brothers Woolwich Works Foremen's Association held their first annual outing on Saturday, September 11th. The party (48 in number) journeyed in motor char-à-bancs, *via* Bromley, Keston and Westerham, to Limpsfield. After a ramble, the company took tea at the King's Arms Hotel, Westerham.

Dissolutions and Liquidations.—Belling & Co., Derby Road, Edmonton, electric heating specialists.—Messrs. H. E. How, C. L. Arnold and C. R. Belling have dissolved partnership. Mr. Belling will continue the business alone at the same address, and he will attend to debts, &c.

British Electric Automatic Machines, Ltd.—This company is winding up voluntarily, with Mr. D. Johnston, of 1, Broad Street Place, E.C. as liquidator.

Trade Announcements.—Mr. Arthur James who, until recently, was outside representative for the Record Electrical Co., Ltd., for Lancashire and Yorkshire, has now joined the board of directors of the company, and has transferred his activities to Scotland to further develop the company's business in that area.

The Fuller Electrical and Manufacturing Co. are on 29th inst. removing to Canada House, Kingsway, London, W.C. New telephone number: "Holborn 1441."

LIGHTING and POWER NOTES.

Accrington.—The electrical work for the new Palace Theatre at Accrington, which opened this week, was executed by Messrs. Simpson Bros., of Hapton.

Argentina.—The English Primitiva Gas Co. and the German Electric Light Co. are suing the municipality of the city of Buenos Ayres for long overdue lighting accounts. That of the gas company is for more than $1,000,000 (paper), and that of the electric company for something less ($880,000 m/n.).

The municipal authorities of Ramos Mejia owe $25,000 to the electric light company. It is possible that some of the lighting will be cut off.

A private company at Las Perdices (Province of Cordoba) has been granted a concession for the exploitation of the electric lighting of the town for a period of 20 years.—*Review of the River Plate.*

Australia.—The Electricity Committee of the Sydney City Council recommended that an agreement be entered into with the municipality of Lidscombe authorising the City Council to supply electricity in that municipality on the same terms as those entered into with the municipality of Ryde.—*Tenders.*

The revenue of the Sydney municipal electric light undertaking for the month of May shows the greatest net profit for any month since the inception of the scheme. The total revenue for the month was £37,118, working expenses £13,055, capital charges £11,315, net profit £12,746; compared with May, 1914, the working expenses for the month are less by £222, and the revenue is greater by £8,639. Of the total revenue £30,525 was received from the city, the remainder coming from the 22 suburbs taking electrical energy from the city undertaking.

The Sydney City Council has considered the allocation of the accumulated surpluses of the electric light undertaking for the years 1913 and 1914 amounting to £115,180. The Electric Lighting Committee recommended that £67,323 be written off the sum appearing as goodwill in the balance-sheet. The total amount shown as having been paid to companies and municipalities for goodwill was originally £140,375; up to the end of the year 1912, £55,872 had been written off, leaving a balance of £84,502. An amendment that the goodwill should be written off by instalments so that some of the profit should be available for the relief of the rates was not approved, the Council being in favour of wiping out the goodwill as soon as possible. Next year there will only be £17,000 required to write off this item completely, and the question of the relief of rates will be a simple matter.—*Sydney Daily Telegraph.*

The Sydney city electrical engineer reports that owing to the delay in ordering the 48 panels for the 5,000-volt switchgear it is not thought that it will be practicable to carry out the obligation the Council has undertaken to the northern suburbs, and it is probable that the Council will find itself compelled to pay the penalty provided for in its contract with North Sydney for late completion, and that it will be necessary to put into use temporary switchgear until the permanent plant arrives.

The Tenterfield (N.S.W.) municipality intends submitting to the ratepayers a proposal to borrow a sum of £6,200 for the installation of an electric lighting scheme for the town.—*Tenders.*

Ayr.—Annual Accounts.—The financial statement of the electricity undertaking shows that notwithstanding the high price of coal and a reduction of £600 in the revenue from public lighting the undertaking has had a satisfactory year. The total number of units sold showed an increase of 54,000, in spite of the decrease of 67,000 units in public lighting. The surplus was £1,248, as compared with £1,450 in 1914.

Basingstoke.—Mains Extension.—The T.C. has decided to extend the mains to the western end of Richmond Road, at an estimated cost of £430, there being an estimated yearly revenue of £83.

Bexhill-on-Sea.—Price Increase.—On account of the extra outlay for coal (£664 for the half-year ended March, 1915), the T.C. has decided to raise the price of electricity by 10 per cent. from the autumn quarter.

Canada.—The Dominion Government has issued an agreement under the Dominion Water Power Regulations for a scheme to develop water power on the Elbow River, near the city of Calgary, in the Province of Alberta. The scheme contemplates the utilisation of a 475-ft. working head, by the construction of a dam, 123 ft. maximum height and 565 ft. long on the crest, to span the river, forming a storage reservoir of 21,000 acre-feet capacity. From the reservoir a pressure tunnel will carry the water direct to the power station and turbine, some 4½ miles below, driving generators of a maximum capacity of 15,000 H.P. The work of construction is to be commenced at once. The agreement provides that at least 2,000 H.P. must be developed and available for use by July 15th, 1919. The taking over of the plant by the Government is also provided for, should the public interest demand such a course in the future.—*Canadian Engineer.*

Continental Notes.—Italy.—A company has lately been formed in the little town of Fenis, with the title La Società de Produzione e di Consumo di Luce Elettrica e di Forzi Motrici, to establish a small electricity generating station in the town on a co-operative basis.

Spain.—A company has lately been formed at Mondonedo (Province of Lugo), with the title La Sociedad Hidroelectrica del Tronceda, to acquire the existing plant which utilises the water-power of the Tronceda Falls near that town. The plant, which already supplies current for lighting and power purposes to a number of small towns in the district, is to be considerably extended.

Clifton.—Colliery Plant Extension.—A new power house is being built at the Clifton Collieries, and will be equipped with a 500-kw. B.T.H. mixed-pressure turbo-generator and a Mirrlees-Watson surface condenser. Current will be generated at 2 500 volts. The switchboard is being supplied by the British Westinghouse Electric and Manufacturing Co., Ltd.

Crayford.—Public Lighting.—It is reported that electricity will be utilised instead of gas for public lighting on the new estates at Barnes Cray and Northumberland Heath.

Fermoy.—E.L. Scheme.—The proposed installation of electric street lighting has been approved by the Council. The scheme will include the erection of overhead mains at the backs of houses.

Great Yarmouth.—Price Increase.—The T.C. has decided to raise the price of electricity for lighting from 5d. to 5½d. per unit.

Hale.—With reference to the request for a supply of current to this parish, the Aldershot Urban Council has decided that, under present conditions, it cannot undertake to supply outside the town. When new plant is installed, the Council will be prepared to receive applications from Hale.

Halifax.—Loan Sanction.—The Corporation has been successful in obtaining the sanction of the L.G.B. to a loan of over £20,000 for the purchase of a new turbo-generator capable of taking the whole of the load, the existing plant being only sufficient for the present demand, so that any breakdown would seriously affect factories employed on Government work.

Ilford.—Plant Extension.—The Council has applied to the L.G.B. for a loan of £858 for the provision of electricity generating plant in association with the refuse destructor.

Price Increase.—The U.D.C. has increased the price of electricity from the quarter ending September 29th by 12½ per cent.

Keighley.—Plant Extension.—As the result of negotiations with the L.G.B. the T.C. has received the Board's consent to the whole of the proposed improvements and extensions to the existing plant at the electricity works (involving an expenditure of some £20,000) being proceeded with. The Council pointed out that it would not be able to meet the demand for electricity unless the extensions were carried out, and the slightest accident to the plant might lead to a stoppage of work in those local factories and workshops which were dependent upon electrical energy for their lighting and power.

Leigh.—Annual Report.—There was a profit of £250 on the electricity undertaking for the past year, as against £1,150 in 1914.

London.—Battersea.—Linking-Up Scheme.—With further reference to the negotiations for linking up the electricity undertakings of Battersea, Fulham and Hammersmith, the Electricity Committee reports that the Hammersmith B.C. has decided not to enter into the proposed agreements until it has obtained sanction for the necessary loan. Under the circumstances, and having regard to the urgency of the matter, an agreement has been entered into between the Battersea and Fulham Borough Councils only. The agreement has been submitted to, and approved by, the B. of T. and the L.C.C. The Committee reports that, in agreement with the Fulham Council, it has accepted the tender of Messrs. W. T. Henley's for carrying out the work of connecting the two undertakings, at a cost of £5,641.

Price Increase.—In view of circumstances due to the war, and the increase in the cost of production, the Committee recommends that a charge of 10 per cent. be added to the accounts for the supply of electrical energy, as from the date of the next readings of the meters, the altered charges not to apply to cases in respect of which there are special agreements.

Shoreditch.—Annual Accounts.—The accounts of the electric supply and refuse destructor departments for the 12 months ended March 31st last show a reduction of income of the electricity department of £3,107, as compared with last year. Notwithstanding the reduced income, the gross profit is less by only £1,371. During the year £4,909 has been contributed from revenue (reserve fund) towards capital expenditure, the total contribution for the two years being £5,768. After meeting loan and interest charges and war allowances, the surplus, £1,509, plus £120 brought forward, is disposed of as follows:—Transferred to reserve fund, £1,400; to change of pressure account, £137; carried forward, £92. The net cost of the destructor is greater this year owing to the difficulty of disposing of the clinker residue and the allowance to men on active service. The electrical energy generated by the destructor amounted to 589,244 units, for which the electricity department paid £1,095, in addition to £300 for stand-by.

Lowestoft.—The T.C. has offered to supply current to the new works of Maconochie Bros. at the usual standard charges, the firm to pay 5 per cent. on the capital outlay required for the supply, and to enter into an agreement for a term of years equal to the term of repayment of any necessary loan allowed by the L.G.B. The prospective capital outlay is £2,500.

The borough accountant reports that there will be a considerable deficiency on the electric lighting undertaking for the current year. In an ordinary year the Council pays to the undertaking for public lighting £2,550. It is now suggested that the Council should pay a sum equal to the sinking fund and interest, namely, £850, and a further £1,500 towards the deficiency.

Lymington. — Street Lighting. — By arrangement with the E.L. and Power Co. the public lighting account for the past quarter (owing to restricted lighting) has been reduced from £72 to £47. None of the lamps were lit during the period named.

Newport (Mon.)—Loan Application.—Several Committees of the T.C. have notified increases in the estimates of expenditure. The largest net increase is that of £760 for street lighting. The ordinary lighting service is being maintained, and provision has to be made to meet the increased cost. The L.G.B. and the Treasury are to be approached with a view to obtaining their approval for the proposed acquisition of a site, and the raising of a loan for a sub-station for the Pillgwenlly area, where the demands for supply are constantly increasing.

Rawtenstall. — The boiler house of the electricity station has now been completed and all the new plant is running. Certain minor additions are to be made.

Sheffield. — Plant Extensions. —The L.G.B. has sanctioned the borrowing of £10,500 for the installation of electric plant. A special sub-committee has been appointed with power to take any steps that may be necessary to expedite the completion of the buildings at Neepsend and to purchase any necessary plant, so as to enable the extension to be completed without avoidable delay. Mains are to be extended, at a cost of about £15,424. Of this sum £13,000 will be spent on a new extra-high-pressure feeder from the Neepsend power house to Brightside Lane. The Electricity Supply Committee has accepted the revised schedule of prices for cables submitted by Messrs. W. T. Glover & Co., Ltd. The Finance Consultation Committee has approved a supplementary estimate of £20,000 for expenditure on mains extensions for the financial year ending March 25th last. The money is part of £75,000 for which a formal sanction of the L.G.B. was granted in September, 1914. At a recent meeting of the City Finance Committee it was reported that owing to heavy demand for power supply for war work it was necessary that additional machinery should be purchased for the electric supply department, at an estimated cost of £100,000, and that the Government had given an assurance that the Corporation would be indemnified against any loss. The Committee approved the proposed expenditure, and of the plant being ordered forthwith.

Southend-on-Sea.—Price Increase.—Arrangements are to be made for reducing the amount of electricity supplied by prepayment meters, so that the charge shall work out at the rate of 6d. per unit. The alteration will come into force on October 24th. The Electric Lighting Committee is unable to agree to the request of the contractors for the supply of coal for an increase of 4d. per ton for cartage, but is prepared to pay, during the period of the war, or during the term of the present contract (whichever may be the shorter) the sum of 2d. per ton over the contract rate. The Committee recommends the Council to authorise the electrical engineer to purchase lathes and drills for use at the works, at a total approximate cost of £388.

Street.—After several months' delay the electric lighting scheme has been completed, and the electric lighting of the streets was commenced on Friday last week.

Surbiton.—The *London Gazette* contains notice of the proposed transfer of electric lighting powers from the U.D.C. to Messrs. Callender's Cable and Construction Co., Ltd.

Swindon.—Price Increase.—The T.C. has increased the price of electricity as under, as from October 1st:—Lighting, 12½ per cent., or ½d. per unit; power, 12½ per cent.; public lighting, 10 per cent.; tramways, 10 per cent.; heating and cooking, ⅛d. per unit. To meet the demand for power for the new factory of Messrs. Gundry, a new main is to be laid, the estimated cost being £340 underground, and £231 overhead. The B. of T. is to be asked to sanction the latter.

Taunton. — Price Increase. — The Electricity Committee recently reported that it had carefully considered the terms of the agreement with the Tramways Co. for the supply of electricity, and being satisfied that they were favourable to the Corporation, saw no reason for variation. With regard to the charges for energy to other consumers, the Committee recommended that an advance of 15 per cent. be made for lighting and for electricity used for cooking, heating and motive power. The lighting increase includes a 10 per cent. advance recently made. It will produce an additional revenue of over £1,000 and save the undertaking from being worked at a loss. The Council approved the recommendations.

Tynemouth.—The Electricity Committee proposes to reduce the rent of outside lamps by 50 per cent., and a similar reduction is proposed to be made in cases where a charge is imposed for wiring which has been provided by the department. The electrical engineer has reported as to the application for a reduction in price for electricity supplied to kinema theatres, but the Committee has deferred consideration of the matter until the accounts of the past year have been submitted. Some time ago the Council agreed to a request of the Newcastle Electric Supply Co. that the bulk supply should be metered with three-phase meters. The company have since written stating that they wish to replace the existing meters by new ones, at a cost of £131, half of which would be payable by the Corporation. The electrical engineer has been empowered to arrange accordingly.

Whitstable.—Street Lighting.—Restricted lighting has led to differences between the U.D.C. and the E.L. Co. The latter, after taking counsel's opinion on the agreement, asks the Council to pay £2 10s. per lamp, so as to save the cost of arbitration. The Council, on the other hand, puts forward the opinion of Mr. McCardie that under the Defence of the Realm Act the contract is void. The Council has decided to submit to the secretary of the company a letter from Mr. McKenna, upon which Mr. McCardie bases his opinion.

York.—Loan Sanction.—The T.C. has received sanction from the Treasury and L.G.B. for the following works:—Cooling plant, £3,426; electric plant extensions, £15,936; motor omnibuses, £5,530; garage and boosters for omnibuses, £650; tramway extensions, £21,350.

TRAMWAY and RAILWAY NOTES.

Australia.—The Queensland Minister of Railways stated in the Legislative Assembly that 14 railway stations were supplied with electric light by the Tramway Co. The total cost was £2,980, but that price included the cost of energy for the Roma Street workshops, printing office, electric cranes, &c. The Commissioners' Roma Street scheme provided for an up-to-date electric plant which would not only provide the necessary motive power, but light up all the stations within a 10-mile radius of the General Post Office.—*Tenders.*

The New South Wales Government tramway returns for the year ended June 30th give the following figures:—Earnings, £1,986,060 (increase £51,896); working expenses, £1,611,286 (decrease £57,747); passengers, 289,282,845 (decrease 21,309,853); lines open, 219¾ miles (increase 7¾ miles).

Ayr.—Annual Accounts.—Owing to the lessened summer traffic the revenue of the Corporation tramways last year was £1,392 less than in 1914, and the working expenses increased by £300. There was a deficit on the year's working of £351, which has been taken from the reserve fund, which now stands at £4,648.

Continental.—Italy.—The litigation pending between the Società Varesina per Imprese Elettriche and the State Domainal Administration relating to the ownership of the Lake of Ghirla has ended, temporarily at least, against the Società. The Società works the Varese-Ghirla-Luino line by electric power generated by water drawn from the Lake, having acquired its title from a certain reputed owner named Ghisolfi. The Court of Appeal hold that the Società has not made clear its case, pending which it will have to pay the dues demanded by the Demanio. The ownership of the Lake of Ghirla, therefore, still remains unsettled, and the only resort of the Varesina Society is to carry the question before the highest Court at Rome.

The Società Roma-Nord, which works the Roma-Civitacastellana tramway and the Civitacastellana-Viterbo electric railway, has received permission from the Superior Council of Public Works to electrify the former section of its system.

Glasgow.—The receipts of the Corporation tramways for last week were over £23,000, the highest total reached in the history of the undertaking; the number of passengers carried exceeded seven millions. Over 800 women conductors are now employed on the tramcars.

Lowestoft.—The borough accountant reports that the estimated loss on the Corporation tramways for the year ending the 30th inst. is £2,700, and recommends that £1,000 of this be provided for in the borough rate. The total tramway takings amounted to £8,415, as against £10,318 for the corresponding period last year.—*Eastern Daily Press.*

Manchester.—About a dozen additional women conductors have been appointed, and it is expected that the two women conductors now working, who have previously been connected with the office staff, will be able to render useful service in helping to train the new-comers. In Salford about 70 women conductors are now employed.

Rawtenstall.—Female Labour.—The Tramways Committee of the Corporation is inviting applications from women for positions as conductors on the electric cars on the same terms and conditions as men, but for the period of the war only.

Southend-on-Sea.—The electrical engineer reports that steps have been taken to prevent, as far as possible, sparking taking place on the overhead equipment of the tramways. Authority has been given to engage women as conductors if any difficulty is experienced in obtaining suitable men for the positions. In view of the difficulty of collecting fares during the period of restricted lighting, bull's-eye lamps are to be purchased for the use of conductors, at an approximate cost of 2s. 6d. each.

Uruguay.—A project for the establishment of an electric tramway system in the town of Paysandu has been included by the Uruguayan Government in the agenda for the present special Parliamentary period.

TELEGRAPH and TELEPHONE NOTES.

Cocos Island.—The local superintendent of the Eastern Extension Co. (Mr. A. B. Skottowe) reports that the wireless station at Cocos Island, which was destroyed by the German cruiser *Emden*, is now again in full working order.

Long-Distance Telephony.—One of the special features of the Electrical Exhibition which is to be held in New York next month will be a series of demonstrations of the working of the new trans-continental telephone line between New York and San Francisco. A demonstration hall, similar to that at the Panama-Pacific Exhibition in the latter city, is to be erected in Grand Central Palace, New York, and all the 250 seats are to be provided with receivers, so that the two audiences—one in New York and one in San Francisco—may listen to greetings from each other. In considering the practicability of carrying on the demonstrations, it was discovered that the difference in time between the two places would be no hindrance to the scheme. Thus, simultaneously with the first daily demonstration in San Francisco, at 11 o'clock in the morning, the early afternoon audience will have assembled in New York, demonstrations then being held every hour afterwards up to 5.30 p.m. at the western terminus of the line, and up to 8.30 p.m. at the eastern. The commercial toll rate for three minutes' use of the trans-continental line is $22 (£4 11s. 8d.), so that the value represented by the use of the line for the ten days of the Exhibition is approximately £2,610. Both in New York and in San Francisco a lecturer will explain by the aid of moving pictures the construction and the electrical and mechanical features of the line.

Telegraph and Telephone Tariffs.—The new Budget contains important changes in the charges for telegraph and telephone services. Private telegrams will bear an addition of 3d. per telegram; the inland Press telegram tariff is raised from 1s. to 2s. 6d. per 100 words (night) or 75 words (day) for first address, and the copying fee is raised from 2d. to 8d. per 100 (or 75) words for every address after the first.

The "unlimited" telephone rate is raised from £17 to £20 per annum in London, and from £10 to £12 in the provinces (new subscribers cannot obtain the flat rate at all). Two-party lines will pay £7 10s., and four-party lines £5 per annum. The trunk service fees are raised by 33⅓ per cent. all round (except 1d. and 2d. fees, which become 2d. and 3d. respectively). Call office fees are increased from 2d. to 3d. in London, and from 1d. to 2d. in the Provinces.

The new tariffs will probably come into force on November 1st, 1915.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—October 25th. Six electrically-operated wharf capstans, for the Sydney Harbour Trust. Forms of tender from the Engineer-in-Chief, Harbour Trust Offices, Circular Quay.*

October 25th. For the Commonwealth Department of Defence (Navy Office). Supply, delivery and erection of power-station plant and equipment for the Commonwealth Naval Dockyard, Sydney.*

January 12th. N.S.W. Railway and Tramways Department. Two water-tube boilers, each 8,000 sq. ft. heating surface complete with economisers, superheaters and chimney stack, for the Zara Street power house, Newcastle. Particulars, Electrical Engineer's Office, 61, Hunter Street, Sydney.—Specification (No. 468), 20s. each.—*Tenders.*

City Council. An Australian newspaper for August 2nd stated that tenders would shortly be invited for the following:—Linemen's hand carts; 10,000-volt outdoor type line switches; contact and suspension gears; transformer kiosks; 33,000-volt outdoor transformers and switchgear; time switches.

Victoria.—December 14th. P.M.G. For delivery in all States, 18,670 common-battery wall pattern telephones, manufactured in Australia. Sched. No. 1,264.

Victorian Railways.—January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

Dundee.—September 27th. Heating and ventilating the City Hall Buildings, Dundee. Mr. Jas. Thomson, City Architect.

Exeter.—September 27th. Corporation. Three, six or twelve months' supply of steam (washed bean or pea) coal, for the Electricity Works. Mr. H. Lloyd Parry, Town Clerk.

Keighley.—September 27th. About 12,000 tons of small slack for Electricity Department. H. Webber, Borough Electrical Engineer and Tramways Manager.

Liverpool.—September 25th. Electrical sundries for three months for the Toxteth Park B. of G. Mr. H. A. James, Clerk, 15, High Park Street.

London.—H.M. Office of Works.—October 1st. Repair of incandescent electric lamps. See "Official Notices" September 17th.

L.C.C.—October 5th. Heating and ventilating installation at Charlton Tram Depôt. Specification, &c. (£1 1s.), from Superintendent Architect's Department, Aldine House, Bedford St., W.C.

Manchester.—September 30th. The Lancashire and Yorkshire Railway Co. 12 months' supply of various stores. Mr. Waring, Stores Department, Osborne Street, Manchester.

September 27th. Corporation Tramways. Two light motor-driven parcel delivery vans. Specifications, &c., from Mr. J. M. McElroy, General Manager.

New Zealand.—Dunedin.—November 3rd. City Council. Insulated and bare copper wire for a period of two years.*

November 3rd. Dunedin City Council; one 3,000-volt regulator.*

Salford.—October 4th. 20,000 pairs of carbons for the electricity department. See "Official Notices" to-day.

Shanghai.—September 29th. E.H.T. switchgear, static transformers, and underground cables for 22,000 v., for the Municipal Council. See "Official Notices" August 27th.

South Africa.—Johannesburg.—October 9th. Municipal Council. Water-purifying plant with a capacity of 75,000 gallons per 24 hours, for the generating station.*

Spain.—The municipal authorities of Villarrasa (Province of Huelva) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

Warrington.—September 28th. Twelve months' supply of earthenware conduit, for the Electricity Department. See "Official Notices" September 17th.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The following contracts have been placed :—

Victorian Railway Department.

Low-tension cables, bare : Item 1, 19/14 S.W.G., 1s. 2¾d. per lb. ; item 2, 19/12, 1s. 2¾d. per lb. ; item 3, rubber-insulated 7/16, £48 15s. per mile ; item 4, do., 19/18, £73 2s. per mile ; item 5, do., 19/16, £122 per mile ; item 6, do., 19/14, £181 per mile ; item 7, do., 37/13, £424 per mile.—W. T. Henley's Telegraph Works Co., Ltd.

Low-tension cables, bare : Item 1, 19/12 S.W.G., 1s. 2¾d. per lb. ; item 2, 37/14, 1s. 2¾d. per lb. ; item 3, 37/12, 1s. 2¾d. per lb.—British Insulated and Helsby Cables, Ltd.

Re-arrangement and relaying cables near Montague Railway Station in connection with the erection of new shipping shed, £700.—Melbourne Electric Supply Co., Ltd.—*Australian Mining Standard.*

Victorian State Coal Mine.

Resistance wire, at rates.—W. T. Henley's Telegraph Works Co., Ltd.

The Electric Lighting Committee of the Sydney Municipal Council recommends that the tender of Standard Waygood Hercules, Ltd., for 33,000-volt switchgear be accepted for all items but lightning arresters for the equipment of new sub-stations.

5,000-volt transformer panels, £97 each ; 33,000-volt do., £239 each ; 33,000-volt incoming feeder panels, £255 each ; 33,000 volt outgoing overhead feeder panels, £302 each ; 415-volt transformer panels, £221 each ; 415-volt summation panels, £67 each.

Also that the following additional lamps and compensators required for public lighting be obtained under existing contracts :—

From the British General Electric Co.—10,000 50-c.p. vacuum lamps, £713 ; 2,500 100-c.p. do., £312.

From the Australian General Electric Co.—1,000 750-watt nitro lamps, 240 v., £1,487 ; 1,000 500-watt do., £1,224 ; 500 300-watt do., £525.

1,000 750-watt nitro lamps, 45 v., £962 ; 1,000 500-watt do., £662.

350 lanterns, £1,137 ; 100 spare reflectors, £130.

200 compensators, 750-watt, 45 v., £340 ; 150 compensators, 500-watt, 45 v., £225.

The Melbourne City Council has accepted the tender of the British Westinghouse Electric and Manufacturing Co., for one 1,500-kw. rotary converter with transformer, at £4,562.—*Tenders.*

Bexhill-on-Sea.—The T.C. has accepted the tender of Myres, Rose & Co., for 1,000 tons of coal for the Electricity Works, at £1 6s. 3d. per ton.

Bury.—An offer by Messrs. Drake & Gorham, agents for Edison Accumulators, Ltd., to supply on trial an electric motor cleanser has been accepted by the Cleansing Committee, who have given instructions for a suitable body to be made at the Town's Yard.

Government Contracts.—List of new contracts for August, 1915.

War Office.

Distribution boards.—Kartret Engineering Co.

Electric cables and wire.—Callender's Cable and Construction Co , Ltd. ; General Electric Co. ; Liverpool Electric Co., Ltd.

Galvanometers.—W. G. Pye & Co. ; Walter's Electrical Manufacturing Co., Ltd.

Generators.—Phœnix Manufacturing Co., Ltd.

Electric lamps.—General Electric Co., Ltd. ; Siemens Dynamo Works, Ltd.

Motors and dynamos.—Electric Construction Co., Ltd. ; Electric Ordnance and Accessories Co. ; Mawdsleys, Ltd.

Switchboards.—Ferguson, Pailin & Co.

Rubber tape.—Ancoats Vale Rubber Co., Ltd. ; Hooper's Telegraph and India-Rubber Works, Ltd. ; J. G. Ingram & Son ; Chas. Macintosh and Co., Ltd.

Iron and steel wire.—W. Bain & Co ; Dorman, Long & Co , Ltd ; Cleveland Wire Mills ; Thos. Evans & Co., Ltd. ; Richard Johnson and Nephew, Ltd. ; Lancashire Wire Co., Ltd. ; London Electric Wire Co. and Smith's Ltd. ; Recess Screws, Ltd. ; J. Rigby & Sons, Ltd. ; Rylands Bros., Ltd. ; Shropshire Iron Co., Ltd. ; Siemens Bros. & Co., Ltd. ; D. F. Taylor & Co. ; Whitecross Co., Ltd.

Electrical work, Richmond Camp.—Cox-Walkers, Ltd.

Mechanical stokers, R.A.F., South Farnborough.—Underfeed Stoker Co., Ltd.

Crown Agents for the Colonies.

Aerial Telephone Cable.—Connolly Bros., Ltd.

India Office, Store Department.

Wireless telegraph apparatus.—Marconi Wireless Telegraph Co.

Cable.—Callender's Cable and Construction Co., Ltd. ; Shropshire Iron Co. ; Pirelli General Cable Works, Ltd. ; W. T. Glover & Co., Ltd.

Copper plates.—T. Bolton & Sons.

Fans.—Electromotors, Ltd.

Standards.—Siemens Brothers & Co.

Telephone sets.—General Electric Co.

Office of Works.

Electrically driven pumps, St. James' Park.—The Rees Roturbo Mfg. Co., Ltd.

Post Office.

Telephone apparatus.—British L. M. Ericsson Mfg. Co., Ltd. ; Phœnix Telephone and Electric Works, Ltd. ; Siemens Bros. & Co., Ltd.

Battery boxes.—British L. M. Ericsson Mfg. Co., Ltd.

Telephone Cable.—W. T. Henley's Telegraph Works, Ltd. ; Johnson and Phillips, Ltd. ; Union Cable Co.

Arc lamp carbons.—General Electric Co., Ltd.

Dry cells.—Siemens Bros. & Co., Ltd.

Leclanché cells.—Siemens Bros. & Co., Ltd.

Opal shades.—Benjamin Electric Co., Ltd.

Electric lighting, Studd Street Stores Extension.—G. E. Taylor & Co.

Great Yarmouth.—The T.C. has accepted the following tenders for the Electricity and Tramways Department :—

1,000 tons half-inch slack and 500 tons hard steam coal.—Cleaves & Co., London.

Overcoats, £1 9s. each ; inspectors' do., £2 each.—Hazel & Co.

Motor axle grease, £17, and graphite grease, £17 10s. per ton.—Stern, Sonneborn Oil Co., Ltd.

The Council has declined to entertain the request of the British Thomson-Houston Co., Ltd., for their contract price of cable to be increased from £79 to £90 per mile on account of the increased cost of labour and material.

London.—Messrs. Pope's Electric Lamp Co., Ltd., have secured orders for several thousands of lamps, both carbon and metal filament, from both the Admiralty and the War Office, and also from H.M. Office of Works.

The Metropolitan Water Board has accepted the offer of the Maxim Lamp Works, Ltd., to continue, for a further period of six months their contract for the supply of metallic filament lamps at existing prices. The offer of the British Insulated and Helsby Cables, Ltd., to continue, for a similar period, the supply of tapes at the same price for one item, and at a 5 per cent. increase on two items, has also been accepted.

The "Z" Electric Lamp Manufacturing Co., Ltd., and Reduced, has been awarded by H.M. Office of Works the contract for 12 months' supply of "Z" drawn wire metal filament lamps.

Bermondsey.—The B.C. Electricity Committee has accepted the tender of Messrs. Myers, Rose & Co., Ltd., and Messrs. A. Usher and Co., for 3,000 tons of Shipley nuts, at 21s. 11d. per ton, and 5,000 tons of Bolsover nutty slack, at 18s. 9d. per ton, respectively. The electrical engineer has been authorised to purchase for experimental purposes about 25 tons of coke breeze at 12s. 4d. per ton.

The L.C.C. has received the following tenders for installing electric light at the Winchester Street School, Finsbury :—

Napier, Kimber, Ltd. (accepted)	£104
Alpha Manufacturing Co.	146
Automobile and Electrical Equipment Co.	162
A. Hawkins & Sons	165
Tredegars, Ltd.	172
Titan Lift Co., Ltd.	181
G. Weston & Sons, Ltd.	232
T. W. Vaughan & Co. (1914) Ltd.	242

Lowestoft.—The tender of Messrs. Hadfields has been accepted for the supply of 12 rolled steel car axles, at £3 10s. each.

Sheffield.—The Tramways Committee recommends the acceptance of the tender of Messrs. C. Macintosh & Co., for the supply of 300 winter hats for women conductors, at 2s. 3½d. each.

FORTHCOMING EVENTS.

Iron and Steel Institute.—Friday, September 24th. At the Institution of Civil Engineers, London. Autumn meeting. For particulars see our "Notes," September 3rd p. 308.

Municipal Tramways Association.—Friday, September 24th. At 11 a.m. At the Surveyors' Institution, Great George Street, S.W. Annual Conference concludes.

Association of Supervising Electricians.—Tuesday, September 28th. At 8 p.m. At St. Bride's Institute, Bride's Lane, E.C. Presidential Address by Mr. A. H. Dykes.

Salford Technical and Engineering Association.—Saturday, October 2nd. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "The Wonders of Coal," by Mr. G. R. Kew.

NOTES.

Appointments Vacant.—Assistant engineer (£2 10s.), linesman jointer (£2 10s.), fitter drivers (£2 10s.), fitters (£2), wiremen (£2), engine drivers (£1 10s.), switchboard attendant (£1 5s.), district electrical and mechanical engineers (£3 5s. to £4), for War Department, Southern Command, for military hutment camps ; overhead wireman for Ramsbottom U.D.C. railless traction system ; switchboard attendant (32s. 6d.) for Plymouth Corporation ; switchboard attendant for Derby Electricity Supply Department. Particulars are given in our advertisement pages.

Poisoning in Storage Battery Making.—The results of an investigation into the five principal lead storage battery factories in America are given in a bulletin recently issued by the Bureau of Labour Statistics of the U.S.A. Department of Labour. The inquiry was carried out in order to discover the dangers of lead poisoning incurred by the workers, and disclosed the fact that about 18 per cent. of American storage battery workers suffer from lead poisoning in some form, as against only 1 per cent. in Germany and about 3 per cent. in England. The report states that the difference is due to lack of care on the part of the workmen and to neglect of factory sanitation. In addition to the details of the American industry, the bulletin gives particulars of the measures taken to safeguard workers in the storage battery industry in England, France and Germany.

The returns of the Home Office show that in the eight months ended August, 1915, there were 41 cases of lead poisoning in English electric accumulator works, as compared with 30 in the corresponding period of 1914.

Mathematical Notation.—A leaflet recently issued by the London Mathematical Society, containing a number of suggestions for notation and printing, deals with a subject of very material importance to publishers of scientific and technical literature. Those who are not closely connected with the art of printing probably have no conception of the difficulties which confront the compositor who is called upon to set up an expression such as, *e.g.*, $\epsilon^{\frac{\text{R}t}{\text{L}}}$, and they would be surprised to learn that by writing it in the form $\epsilon^{-\text{R}t/\text{L}}$, they remove nine-tenths of the difficulty, without in the least interfering with the meaning or lucidity of the expression. At the same time they greatly increase the reliability of the reproduction, for in the latter case there is far less tendency for the type to slip or draw out; mathematical composition is notoriously liable to errors in printing, not only on account of its inherent peculiarities, but also because of the mechanical difficulty in securing the type in place. We therefore heartily welcome the circular above-mentioned, in our own interests as well as those of our readers. We have long made a practice of rearranging formulæ and equations in accordance with the methods which are advocated by the Society, but we should very much prefer that authors would adopt these methods in the first instance, in order to avoid unnecessary labour and reduce the risk of error. The principal points to be borne in mind are the following:—Horizontal bars in fractions, or over a group of symbols, should be avoided; the solidus (slanting line) and parentheses should be used instead. Where, however, equations are printed in separate lines and not in the body of the text, there is less objection to the use of horizontal bars. Dots and bars over or under letters should not be used; they may follow the letters, or accents may be used, without disadvantage. There is no objection to indices, suffixes, &c. The following brief set of examples illustrates these points—which, of course, relate only to MSS. intended for composition:—

Instead of	Always write
$\sqrt{13}$, $\frac{1}{\sqrt{2}}$, $\sqrt{\frac{a}{b}}$, $\sqrt{-1}$	$\surd 13$, $1/\surd 2$ or $2^{-\frac{1}{2}}$, $\surd(a/b)$ or $(a/b)^{\frac{1}{2}}$, i
$\sqrt{ax^2+bx+c}$	$\surd(ax^2+bx+c)$ or $(ax^2+bx+c)^{\frac{1}{2}}$
$n\,.\,\overline{n+1}\,.\,\overline{n+2}$, $\underline{\lvert n+1}$, $\dot{x}$, $\dot{r}$	$n(n+1)(n+2)$, $(n+1)!$, x', r'
$\frac{a+b}{3}$, $\frac{a+b}{c}$, $\frac{p}{q}+\frac{r}{s}$	$\frac{1}{3}(a+b)$, $(a+b)/c$, $p/q+r/s$
$\frac{p+\frac{q}{2}}{\frac{r}{3}+\frac{s}{4}}$, $\frac{x}{y+\frac{z}{t}}$	$\frac{p+\frac{1}{2}q}{\frac{1}{3}r+\frac{1}{4}s}$ $\frac{x}{y+z/t}$
$e^{\frac{-nx}{l}}$, $\int_0^{\frac{\pi}{n}}$	$e^{-nx/l}$, $\int_0^{\pi/n}$

It will be noted that fractions *in common use*, such as ½, ⅓, ¾, may be used freely as here shown, but others such as 17/25 should be written with the solidus.

The Secretary of the London Mathematical Society, Dr. T. J. I'a. Bromwich, informs us that the Society is willing to supply a limited number of copies of this very welcome circular on application.

Limitation of Profits.—The following notice appeared in the *London Gazette* on Tuesday:—

MUNITIONS OF WAR ACT, 1915.

5 and 6 Geo. 5, Ch. 54.

Notice is hereby given under the Rules Publication Act, 1893, that it is proposed by the Minister of Munitions, after the expiration of at least 40 days from this date, in pursuance of the powers conferred upon him by Sec. 5, Sub-Sec. 4, of the Munitions of War Act, 1915, and every other power enabling him on that behalf, to issue Rules with respect to the limitation of Profits of a Controlled Establishment.

Draft copies of the said Rules can be obtained in the interval at the office of the Minister of Munitions.

The Electrometallurgy of Zinc.—The electrometallurgy of zinc has for many years been practised successfully at the works of Messrs. Brunner, Mond & Co., Ltd., at Winnington, where spelter guaranteed 99·95 per cent. Zn is produced by the Hoepfner process. The deterrents to the production of zinc by electrometallurgical methods have been three—namely: (1) Difficulty in obtaining a dense, coherent deposit of zinc on the cathodes; (2) large consumption of energy required for the decomposition of the zinc compounds available for commercial electrolysis, no matter whether it be the sulphate, the chloride, or an alkaline zincate; and (3) the difficulty in dissolving a fair proportion of the zinc of the ore.

The first difficulty was mastered years ago, and recent workers in this field have had no trouble in obtaining satisfactory cathode deposits. The second difficulty has limited the electrometallurgy of zinc to places where the anode reaction may be caused to serve a useful purpose, as at Winnington. The third difficulty is common to all zinc hydrometallurgical processes, and refers to the formation of zinc ferrite in the roasting of the ore, zinc ferrite being insoluble, or difficultly soluble, in most agents that are commercially available. For this reason a roasted zinc ore may give up only 60 per cent. of its zinc even to fairly strong sulphuric acid.

Recent work in zinc electrometallurgy has been done at Trail, B.C., and at Bully Hill, Cal. It is intimated that one or both of these plants is shortly going to offer electrolytic zinc in the market. The Anaconda Co. has also taken up this problem in an experimental way.—*Chemical Trade Journal.*

Swiss Electro-Metallurgy and French Connections. Early in 1914 a draft agreement was in course of negotiation between the Swiss Société Electrométallurgique Paul Girod, of Neuenburg, and the well-known French firm of Schneider & Co., of Creusot, whereby the two undertakings would have been brought into intimate association, and the capital of the former reduced from £480,000 to £96 000, and then increased to £200,000. The outbreak of war, however, prevented the conclusion of the agreement, as the financial institutions connected with the Swiss company were unwilling to proceed with the proposed issue of shares and debentures. At the ordinary meeting of the company held in June, 1915, the wish was expressed that the draft agreement should be rejected, and a resolution to this effect was adopted at a further meeting held at the beginning of September. It was pointed out that, as drafted, the agreement was no longer in the interest of the company under the change in circumstances, but that the rejection did not necessarily mean a rupture with the French company, as the Neuenburg company was still open to a fresh proposal of a more favourable nature. It was stated that the French subsidiary company, at Ugine, was exceptionally well employed on army contracts, and its working results for 1915 will presumably enable the Girod company, which has incurred large losses in the past five years, to pay off almost all its liabilities. The directors now have a free hand for taking advantage of the present more favourable situation for placing the undertaking on a firmer basis, either by securing a connection with another company or otherwise.

Charging Electric Vehicle Batteries.—The Electric Vehicle Committee has issued a leaflet of notes for the guidance of persons who wish to make arrangements for charging the batteries of electric vehicles. In the case of a small equipment for charging one or two cars, where D.C. is available at a pressure not exceeding 250 volts, it is recommended that the charging voltage be regulated by resistances, to avoid the cost of installing a motor-generator—except where the supply is on the three-wire system at 220 volts and upwards, in which case the power must be derived from the outers only, and a motor-generator is preferable. Larger equipments should be provided with motor-generators, but where the supply is at 220 volts, two-wire, a balancer is more economical than a motor-generator. With A.C. supply either a motor-generator or a mercury arc rectifier is necessary. Precautions to protect the attendant from shock from the switchgear are outlined, and the equipment recommended for the charging board is specified; three-core "cab-tire" sheathed cable is recommended for connection with the batteries.

The Budget and Business.—We suppose that in all business houses since Tuesday last a good deal of thought has been given to the various ways in which the new taxes will affect our commercial and industrial operations. The abandonment of the ½d. postage rate will probably tell somewhat heavily upon the operations of most trading firms, but in the case of publicity departments, which send out thousands, and perhaps hundreds of thousands of printed circulars and price lists in the course of a few months, it will lead to a serious re-consideration of the old question of circulars *v.* trade Press advertising. The business manager, or in cases the publicity manager, will have to bear in mind that his circulars will now cost him an additional 41s. 8d. per 1,000 for postage. The experience of all of us, whether in business or home affairs is that large numbers of ½d. circulars reach the "W. P. B." unopened—in some cases they never reach the right hands at all. "I don't want to be bothered with circulars!" When the head of the house is away from home, he wants everything sent on "except, of course, any circulars that come." If office waste-paper baskets and kitchen cupboards could talk they would a pretty tale unfold. It will be such considerations as these that will weigh with those who want to adopt the most efficient, because the most direct, and the most permanent way of reaching the eyes of buyers. Of course the same arguments really apply in the ordinary case of lists sent to foreign countries—indeed, more so, for we suppose there is not an office list of addresses that covers all the readers of a well-circulated and widely-read journal that finds its way into all corners of the globe. But just now in connection with the Budget the argument comes with particular force for home purposes. The printed advertisement appearing in a trade journal is not thrown into the waste-paper basket; on the contrary, it is often handed over to a second or a third party, and even then does not reach the flames—it is filed away for reference because, in a sense, it is an up-to-date directory as well as a literary production. The cost of producing price lists, paper, printing, &c., are like everything else higher in consequence of the war, and when one adds the new postage burden, the economy of advertising, considered both per thousand impressions and on the point of efficiency, is very substantial. Of course these are all the most obvious of truths, and they would hardly need restating now were it not essential in all business departments to-day to obviate waste wherever possible.

Russian Nickel.—A note in the *Novoie Vremya* says that a report recently issued on nickel ore deposits in Russia shows that three such deposits have long been known to exist in the Urals; but they were poor, containing but 2 to 4 per cent. of the metal, and therefore at the low prices once ruling the ore was not extracted. But when these deposits came into the hands of strong financial groups their exploitation was begun. At present, the Revdinsk factories are smelting about 600 poods of crude nickel per annum, with 65 per cent. metal content. Additional efforts are being made to discover nickel in the Urals area.

Rifle Club Shoot.—An interesting shoot was decided on Saturday last between the Ediswan Rifle Club and a team from the British Thomson-Houston. A good muster was present, and the result was as shown below :—

10 SHOTS AT 25 YARDS.

EDISWAN TEAM.	1st shoot.	2nd shoot.	Totals.	B.T.H. TEAM.	1st shoot.	2nd shoot.	Totals.
* E. Winterflood	92	98	190	* Redfern (2) ..	84	78	162
S. Smith ..	88	92	180	„ (1) ..	71	82	153
— Harrington	89	87	176	Bush	62	72	134
W. Golding ..	87	87	174	Dunton ..	67	65	132
E. Ralph ..	83	89	172	Abel	78	50	128
T. C. Black ..	78	90	168	Burton . ..	30	67	97
A. J. Corbett	85	77	162	Butcher ..	34	54	88
A. E. Davis ..	72	85	157	† Gowan.. ..	27	39	66
			1,379				960

* Winners of silver spoons presented by Edison Rifle Club.
† Winners of wooden spoons, suitably illuminated for the occasion.

Ediswan,	1,379	Average, 86·18
B.T.H.,	960	„ 60 00
	419	

Mr. Elliott (Ediswan joint sales manager) was in the chair, supported by Messrs. Child, Packenham and Cooke. Mr. Abel, on behalf of the B.T.H. Co., responded to Mr. Elliott's welcome. Messrs. Anderton (Ediswan) and Abel (B.T.H.), were captains, and the place of official scorer was filled by Mr. W. B. Clarke.

Australia on Tariffs and Trade "Capturing."—The *Sydney Morning Herald*, on July 30th, published an article stating that the tariff which was introduced in December last, but was never before the Federal Parliament for discussion, would not be considered by that body until next year. The feeling is that the time is inopportune for discussion. Toward the end of its article our contemporary says :—

"All classes of traders are greatly disappointed with the steps taken by British manufacturers to capture Germany's lost trade. In almost every instance the tariff gives preference to Great Britain, and that being the case, it is thought the British manufacturers might reasonably have been expected to make an endeavour to secure some of the orders which were previously placed with Germany. But it is complained that so far no effort in that direction has been made, and that, instead of the Empire deriving any benefit from the war, as regards new trade, the American and Japanese have stepped in, and are capturing the market for all those goods which, prior to the outbreak of war, came from Germany, Japanese exporters, in particular, are showing great activity, and are straining every nerve to secure the Australian trade. And in many cases they have succeeded."

In the next day's issue of the same paper the secretary of the Association of British Manufacturers replied to the criticism as follows :—

"You make no mention of the numerous handicaps to which British industry is subject at present. These may be summarised roughly as : (1) Shortage of labour through enlistment with the Colours ; (2) shortage of supplies of raw material ; (3) shortage of shipping tonnage ; (4) Admiralty and War Office contracts taking precedence over private orders.

"A review of the various journals published in the United Kingdom which are available here suffices to explain the position. As long as the Mother Country is engaged in a life-and-death struggle with her enemies, the capturing of enemy trade, important though it be, must be relegated to a second place. But to say that British manufacturers have made 'no effort' to capture enemy trade is unjust ; the writer of your article is apparently unaware that there has been held in London a Trade Fair organised by the Board of Trade, and that, as the result of this, satisfactory business is being done by British firms making goods which take the place of those manufactured by the enemy. Since the beginning of the war the British Trade Commissioner in Australia has succeeded in placing many Australian firms in touch with sources of supply, of which they were previously unaware, and much business formerly done with enemy countries has been diverted to the United Kingdom, notwithstanding the handicaps before mentioned."

Institution and Lecture Notes.—Association of Supervising Electricians.—This Association commences its second season on Tuesday, September 28th, at 8 p.m., at St. Bride's Institute, E.C. The presidential address will be given by Mr. A. H. Dykes, A.M.I.C.E. The following programme has been arranged for the ensuing season :—

Tuesday, September 28th, 1915.—Presidential address by Mr. A. H. Dykes.
„ November 2nd.—Paper on "Accumulators," by Mr. R. Rankin.
„ December 14th.—Paper on "Electric Lifts," by Mr. H. Marryat.
„ January 17th, 1916.—Half-yearly meeting and informal discussions.
„ February 28th.—Paper on "Illuminating Engineering," by Mr. L. Gaster.
„ April 3rd.—Paper on "A.C. Motors," by Mr. H. C. E. Jacoby.
„ May 15th.—Paper on "Notes on Electrical Work in Large Buildings," by Mr. F. C. Raphael.
„ June 26th.—Annual general meeting.

Society of Engineers.—On Monday, October 4th, at the Surveyors' Institution, Great George Street, S.W., a paper on "Law and Engineering," is to be read by Mr. S. G. Turner.

British Science Guild.—Owing to the urgent need of scientific organisation, the Guild has decided to publish a *Journal*, of which the first number has come to hand ; it contains a full report of the annual meeting, held on July 1st, at which an address was delivered by Sir William Ramsay on "The National Organisation of Science."

Nottingham Society of Engineers.—The annual meeting is to be held at the Welbeck Hotel, Nottingham, on Wednesday, October 6th, with Major W. E. Walker, the president, in the chair. A syllabus of lectures is being arranged for the 1915-16 session.

Patents and Alien Enemies.—Application has been made to the B. of T. for the avoidance or suspension of patent No. 409/13, granted to the Maschinenfabrik Augsberg-Nurnberg A.G., for cooling internal-combustion engines.

Electricity on the South African Railway System.—Mr. W. W. Hoy, general manager of the Union of South Africa Railways and Harbours, in his official report for 1914, just published, states that the Administration had in contemplation the electrification of certain sections of the railway, and a decision had been arrived at to obtain the services of an eminent consulting engineer to study the local problems and conditions on the spot, and thereafter submit a comprehensive report. "Unfortunately the condition of affairs in Europe and in South Africa has necessitated a postponement of the Administration's proposals. The matter is one, however, which should receive early attention after the cessation of hostilities."

On the subject of electric light and power, Mr. Hoy states that electric light has been installed at a number of stations throughout the system, and in the workshops extensions of electrification schemes have been put in hand. All the Administration's workshops, with the exception of those at East London, are now entirely electrically equipped, and negotiations are proceeding with the East London municipality for obtaining current at a reasonable cost. A new agreement has been concluded with the Bloemfontein municipality for the supply of current for power and lighting purposes. The developments in electrical control signalling, adds Mr. Hoy, are being carefully watched, and installations are being erected at various busy portions of the line.

As regards train lighting, the general manager reports that the electric lighting of coaches has been satisfactorily carried out during the year, and a considerable amount of work in connection with erection and charging of cells has been done. The experiment commenced in 1912 with Edison cells for block train lighting at Cape Town for suburban service having proved entirely successful, is being generally extended in the Cape suburban area. In 1912, a trial was also made with the Vickers train lighting system, six sets being fitted to main-line stock. The trial has proved fairly satisfactory, although no great improvement over other systems has been demonstrated. A further six sets have also been ordered for equipping certain coaches now being erected in England. One equipment was also purchased from Messrs. Mather & Platt, and is giving satisfaction.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—

Company Orders.—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week commencing September 27th, 1915 :—

Drills, 6.30 to 7.30 ; 7.30 to 8.30 p.m.

Monday, September 27th.—Section 1, Technical ; Section 3, Squad signalling class.

Tuesday, September 28th.—Section 2, Technical ; Section 4 Shooting.

Thursday, September 30th.—Section 3, Technical ; Section 1, Shooting.

Friday, October 1st.—Section 4, Technical ; Section 2, Squad signalling class.

Saturday, October 2nd.—Company Parade, 2.30 p.m. Route march.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, September 23rd, 1915 :—

Week-end Parades.—Saturday and Sunday.—Bridging, Bombing and Demonstrations in Field Cookery.

Saturday.—The Battalion will parade at Baker Street Station at 2.30 p.m. and proceed by train to Wembley Park.

Sunday.—7 a.m., Réveillé ; 10 a.m., Church Parade ; 10.20 a.m., Battalion Parade (Bridging, Bombing and Field Cooking Demonstration) ; 2.30 p.m., Battalion Parade ; Bridging and Bombing.

Musketry.—There will be no Shooting at Acton or Bisley on Saturday, the 25th inst., but Acton Range will be open on Tuesday, the 28th inst., and there will be Firing at both Bisley and Acton Ranges on Saturday, October 2nd.

A. G. JOINER, *Major and Adjutant*, O.B.C.

Municipal Tramways Association (Inc.).—Yesterday the annual conference of the Association was opened at the Surveyors' Institution, Great George Street. Alderman H. Linsley, J.P., chairman of the Salford Corporation Tramways Committee, delivered his presidential address, in the course of which he referred to some of the work done by the Council during the past year, and stated that the capital expended on municipal tramways in this country amounted to 56 millions sterling ; the employés numbered over 55,000, and of these over 16,000 had given their services to their country, while many of them had laid down their lives or suffered from wounds in the war. Others had left the tramway workshops to assist in producing munitions of war. The drain upon the population of industrial districts had resulted in heavy loss of income by many tramway undertakings, and the payment of allowances to men who had enlisted had involved an expenditure of £380,000 by municipal tramways, to which must be added the cost of war bonuses and other extra outlays. The scarcity of men had rendered it necessary to employ female labour, and there ware already more than 1,700 women acting as conductors on municipal tramways. Upwards of £23,500 had been subscribed by tramcar passengers to charitable funds connected with the war, A discussion was then opened by Mr. J. Dalrymple, general manager of the Glasgow tramways, on "Tramway Labour Problems as Affected by the War," and in the afternoon Mr. A. Baker, general manager of the Birmingham tramways, was to open a discussion on "Financial Problems as Affecting Tramways During War-time." To-day the Executive Council and the Managers' Section will meet, and afterwards the annual business meeting will be held.

Inquiries.—A correspondent asks for the name of an ironfounder who would undertake to supply small electrical castings. Makers of "Kingslead Drying Stoves" for photo-prints are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. Reginald A. Hayson, who served his apprenticeship at the Corporation electricity works at Swindon, has been granted a commission in the Indian Reserve of Officers, and posted to the 31st Punjabis.

The Ilford Electricity Committee proposes to grant the following increments of salary:—Mr. J. R. Wilson (first charge engineer), £170 to £175; Mr. G. E. Williamson (second charge engineer), £140 to £150 (maximum); Mr. A. Glazier (third charge engineer), £135 to £140 (maximum).

Mr. H. Hooper, senior charge engineer at the Walthamstow electricity works, has resigned his position. It is proposed to promote Mr. A. R. Manwaring, switchboard attendant, to fill the vacancy, at a salary of 40s. per week, rising by 2s. 6d. annually to 50s. In this connection the Lighting Committee has recommended the U.D.C. to fix wages of charge engineers at 45s. per week, rising to 55s. per week by annual increments of 2s. 6d., and the salaries of switchboard attendants at 35s. per week, rising to 40s. per week by annual increments of 2s. 6d.

Tramway Officials.—Sergt. M. Rathbone, formerly manager of the Oldham, Ashton and Hyde tramways, is in the trenches with the King's Royal Rifles.

General.—On September 9th the staff and employés of the Kopper's Coke-Oven and Bye-Product Co., and Coates & Co., Sheffield, engaged on the new coke-ovens at Thrislington Colliery, West Cornforth, Durham, held a smoking concert at which Mr. T. M. Craft, chief electrician, was presented with a timepiece on the occasion of his marriage. Mrs. Craft was the recipient of a gold brooch. Mr. J. A. Turner, superintending engineer, made the presentation.

Having fulfilled his engagement with the Government of Burma, Mr. Harry Nimmo is coming home, *via* Malay States, China, Japan, U.S.A., and Canada, for a holiday, after 6½ years' work in Burma's trying climate.

Mr. T. P. Brogan has been appointed chairman of the Battersea B.C. Electricity Committee.

Mr. Oscar John Sparrow, of the staff of the Marconi Co., Chelmsford, who was married on September 11th to Miss Ellen Barrow, has been presented by his colleagues with an overmantel and set of cutlery.

The many friends of Mr. Herbert H. Berry (Berry, Skinner and Co.) will be pleased to learn that he has now returned to the office, after an absence of nearly 18 months. We congratulate Mr. Berry on his recovery.

Mr. N. C. Barrett, late assistant manager of the British Prometheus Co., has been appointed to a similar position on the staff of the electrical cooking and heating department of Carron Co., Stirlingshire, with whom he has now taken up his duties.

The *Times* announces that the Minister of Munitions has appointed Sir Frederick Donaldson, K.C.B., Chief Superintendent of Ordnance Factories, to act for the time being as Technical Adviser to the Ministry. In the meantime arrangements have been made for Mr. V. L. Raven, chief mechanical engineer of the North-Eastern Railway, whose services have been temporarily placed at the disposal of the Minister of Munitions by the board of directors, to perform the duties of Acting Chief Superintendent of the Royal Ordnance Factories, Woolwich.

Roll of Honour.—Private R. Howorth, of the 7th Battalion Manchester Regiment, has been wounded in the fighting at Gallipoli. He was employed at the British Westinghouse Works, Trafford Park.

Private Albert E. Roach, formerly employed at the British Westinghouse Works, Trafford Park, who has been killed in action at the Dardanelles, where he was serving with the 8th Battalion Lancashire Fusiliers, was 28 years of age, and married.

Corporal Geo. E. Broome, of the 6th Battalion Manchester Regiment, who has been serving at the Dardanelles, has died on board ship while being invalided home. He was 20 years of age, and was formerly for five years employed in the offices of the Manchester tramways department.

Sapper Greenhalgh, of the Royal Engineers formerly in the drawing office of the Salford electricity department, is reported as missing. He went to Egypt a year ago, and had more recently been serving at the Dardanelles.

Quartermaster-Sergeant T. Brierley, 47, who has been serving with the 8th Lancashire Fusiliers at Gallipoli, has died of dysentery. He was employed for eleven years by the British Westinghouse Co.

Private Cyril Jones, of the 8th Lancashire Fusiliers, who was formerly employed at the Central Telephone Co.'s offices in Manchester, has been killed in action.

Private A. M. Doig, of the 6th Battalion Manchester Regiment, who figured in the list of soldiers awarded the D.C.M. last week, was twice wounded—the second time with fatal results. He was 25 years of age, and was an electrical engineer in the employ of the British Westinghouse Co., Trafford Park.

Private B. G. Schofield, of Oldham, who has been serving with the 10th Manchester Regiment, is officially reported missing. He is 20 years old, and was formerly employed by Messrs. J. P. Hall & Co., electrical engineers, Werneth, Oldham.

Private Walter Rimmer, of the 1st Manchester Regiment, a disabled prisoner of war from Germany, reached his home at Long Fold, Swinton, last week. Rimmer, who has lost his right foot, was formerly employed by the Chloride Electrical Co., Clifton Junction.

Private W. J. Spencer, of the 7th Battalion Lancashire Fusiliers, formerly in the telegraph department of the Lancashire and Yorkshire Railway Co., has been killed at Gallipoli.

Sergt. A. E. Irving, an employé on the Burnley Corporation Tramways, has not only been granted the D.C.M. for gallantry in Flanders, but he has received the Czar of Russia's Medal of St. George for distinguished service in the field.

Rifleman J. A. Gibbons, of the 12th Rifle Brigade, who was engaged in the West Ham electricity department, has been wounded in action in Flanders, and is in hospital at Birmingham.

Private A. Watson, of the 6th Lincs. Regiment, who was until his enlistment last August with Messrs. Cutting Bros., electrical engineers, Stamford, has been wounded at the Dardanelles.

Widespread sympathy will be felt with Sir Oliver and Lady Lodge in the loss of their youngest son who has been killed in the Dardanelles. Second Lieut. Raymond Lodge, according to the *Times*, was 26 years of age. He joined the South Lancashire Regiment shortly after the outbreak of war. He went through a course of engineering at Birmingham University, and had been associated with the firm of Lodge Bros.

Private G. S. Martlew, aged 19, formerly employed at the Atherton generating station of the South Lancashire Tramways Co., has been wounded while serving with the 5th Manchester Regiment.

Rifleman A. N. S. Knight (Rifle Brigade), whose death is reported from Flanders as having occurred on July 30th, was a shift engineer at the Burton-upon-Trent electricity works. He held the degreee of B.Sc., and was trained at the British Electric Plant Co.'s works at Alloa. Subsequently he was at Swansea, and for the last two or three years had been at the Burton-on-Trent works. One of his brothers had been killed at the Dardanelles, and another is also with the Forces.

Sapper Ernest Jackson, of the 12th Field Company, Royal Engineers, has been awarded the D.C.M. for conspicuous gallantry at Hooge. His section officer was with a bombing party some distance in front of the trench when he was severely wounded, and an N.C.O. who tried to bring him in was killed. Sapper Jackson left the trench and brought in the wounded officer, and then proceeded with the bombing party. He is 19 years old, and before he enlisted he was with the borough electrical engineer at Preston.

Lc.-Sergt. Thomas Cass, of the 6th Battalion King's Own Yorkshire Light Infantry, who has been killed in action in France, was employed in the Highways Department of the Leeds city tramways undertaking prior to enlisting last September.

Trooper Osman Karl Fowler, of the Royal Gloucestershire Hussars, has been killed in action in the Dardanelles. He was on the staff of the Gloucester Corporation electricity works, and previously at the E.L. works at Stratford-on-Avon.

Obituary.—The death has taken place, in his fifty-first year, of Mr. Wm. Thomas, late chief inspector of the West Ham Corporation tramways. When that system was opened, deceased, who came from Liverpool, drove the first electric car in the borough.

NEW COMPANIES REGISTERED.

Staines Projectile Co., Ltd. (141,584).—This company was registered on September 13th, with a capital of £5,000 in £1 shares, to take over from P. J. Mitchell the benefit and obligation of contracts secured by him from the War Office for the manufacture of shells. So long as Marconi's Wireless Telegraph Co., Ltd., or its nominees, hold 2,499 shares in the company the capital shall not be increased without the consent of that company. The subscribers (with one share each) are: P. J. Mitchell, Caxton House, Westminster, S.W., consulting engineer; H. Shaw, Caxton House, Westminster, S.W., engineer. Private company. The number of directors is not to be less than two or more than five; the first are H. Clark, H. Shaw, P. J. Mitchell, E. Cameron, and Capt. A. Simpson, R.E. (all permanent, subject to holding 500 shares). The above-mentioned company has the right to nominate two directors. Qualification of subsequent directors, 100 shares. Solicitors: Johnson, Weatherall & Sturt, 7, King's Bench Walk, E.C.

Marsh Bros. (Electricians), Ltd. (141,563).—This company was registered on September 13th, with a capital of £4,000 in £1 shares, to take over the business of electrical engineers, and contractors for and dealers in electrical apparatus and appliances carried on by H. Liller and A. Liller at Orchard Place, Sheffield, as Marsh Bros. The subscribers (with one share each) are: A. Liller, Oaklynn, Dore, near Sheffield, cashier; F. C. Young, 45, Bank Street, Sheffield, chartered accountant. Private company. The number of directors is not to be less than two or more than five; the first are not named. Qualification, £500. Solicitor: S. J. Newson, Melbourne Chambers, Cambridge Street, Sheffield. Registered by Jordan & Sons, Ltd., 116-7, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

"Cedes" Electric Traction, Ltd.—Particulars of £4,000 debentures, created August 18th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £3,000. Property charged: The company's property. No trustees.

Renew Electric Lamp Co., Ltd.—Debenture, dated September 9th, 1915, to secure £500, charged on company's undertaking and property, present and future, including uncalled capital. Holder: E. G. Fishenden, 97, Junction Road, Holloway.

Northallerton Electric Light and Power Co., Ltd. (59,301).—Capital, £6,500 in 2,900 pref. shares of £1 each and 12,000 ord. shares of 6s. each. Return dated March 10th, 1915. 1,151 pref. and 4,861 ord. shares taken up. £1 per share called up on the pref. and 6s. per share on the ord.; £2,609 6s. paid. Mortgages and charges: £5,400. Return of allotments made up to August 13th, 1915, shows further 20 ord. shares allotted for cash.

W. S. Jeal and Co., Ltd.—Particulars of £400 debentures, created September 3rd, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Drycells, Ltd.—Particulars of £2,000 debentures, created September 3rd, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Brilliant Sign Co. (1907), Ltd.—A memorandum of satisfaction in full on September 9th, 1915, of charge dated April 12th, 1912, securing moneys from time to time advanced, has been filed.

Brisbane Electric Tramways Investment Co., Ltd. (67,853).—Capital, £975,000 in £5 shares (75,000 pref.). Return dated June 9th, 1915. All shares taken up. £5 per share called up on 30,024 ord.; £150,120 paid; £824,880 considered as paid on 75,000 pref. and 89,976 ord. shares. Mortgages and charges: £450,000.

African Direct Telegraph Co., Ltd. (21,895).—Capital, £300,000 in £10 shares. Return dated June 23rd, 1915. 23,600 shares taken up. £236,000 paid. Mortgages and charges: Nil.

Babcock and Wilcox, Ltd. (65,805).—Capital, £1,960,000 in £1 shares (100,000 5 per cent. pref., 200,000 5 per cent. second pref. and 1,660,000 ord.). Return dated May 12th (filed June 24th), 1915. 100,000 6 per cent. pref., 178,356 5 per cent. second pref., and 1,660,000 ord. shares taken up £1 per share called up on 360,000 ord. and 178,356 5 per cent. second pref.; £538,356 paid; £1,400,000 considered as paid on 100,000 6 per cent. pref. and 1,300,000 ord. Mortgages and charges: Nil.

CITY NOTES.

Halifax and Bermudas Cable Co., Ltd.

At the annual meeting held on the 16th inst., at 33, Old Broad Street, E.C., the directors reported that the net result of working for the year ended June 30th, 1915, was an available balance of £10,679, as compared with £10,188 for the previous year. An interim dividend of 3 per cent., free of income tax, had already been paid, and it was now proposed to make a further equal payment, free of income tax, leaving £7,679 to be carried forward. The balance to credit of revenue account, which was last year £11,459, has been debited with £1,500 applied to dividend, and with £7,589 expended in repairs and renewals during the year, and credited with £7,679 surplus revenue of the past year, and it now stands at £10,049. During the year the company's cable has been interrupted on three occasions—by a fishing boat's anchor, by a dredger, and finally by chafing in deep water, where it was found to be in good mechanical condition. The expenditure on repairs has consequently been very heavy. The £7,589 mentioned in the previous paragraph was the cost of the first, second, and part of the third interruption. The balance of the cost of the third accident has not yet been ascertained. The shareholders were asked to approve the establishment of a pension scheme for the staff in accordance with the details of a plan submitted to the meeting.

Direct West India Cable Co., Ltd.

At the annual meeting held on September 16th, at 33, Old Broad Street, E.C., the directors reported that for the year ended June 30th, 1915, the net result was an available balance of £13,553, as compared with £7,866 for the previous year. An interim dividend of 3 per cent., free of income tax, had already been paid, and it was now proposed to make a further equal payment, free of income tax, leaving £11,753 to be carried forward. The balance to credit of revenue account, which was last year £54,989, has been debited with £900 applied to dividend, and with £2,522 expended in repairs and renewals during the year, and credited with £11,753 surplus revenue of the past year, and it now stands at £63,319. The company's cable was for a few days interrupted near Jamaica by earthquake; otherwise the cables have worked efficiently during the year. During the year the remaining debentures (£8,000) have been paid off. The shareholders were asked to approve the establishment of a pension scheme for the staff in accordance with the details submitted to the meeting.

United Electric Car Co., Ltd.

Mr. R. B. Barningham presiding recently at the annual meeting of this company said that the year had been a most trying and anxious one, the outbreak of war having caused practically cessation of their ordinary trade. Corporations were not ordering new cars, and some for which they had tendered had been hung up indefinitely. During the year they had received a fair amount of Government work, but in the face of keen competition the prices were cut very fine and the profit was very small, while in some cases there would be small losses. They had heard about Government work making fortunes, but that had not been their experience so far. Large numbers of firms, having had their normal trade held up, were only too glad to cut in low for Government work to keep their men together; for the same reason, they themselves would endeavour to get as much work as possible. Since the outbreak of war 130 employés (about 25 per cent.) had joined the Army. The result of the year's working was a net profit of £8,552, a decrease of £7,500 as compared with last year. They regretted that they were unable to pay a dividend on the ordinary shares this time, but under all the circumstances the result was a favourable one. The depreciation and general reserve was now over £27,000, an increase of £20,000 in four years. It was a marvellous tribute to the stability of English finance and commerce and the wisdom of the authorities and banking institutions of this country that after thirteen months of war there had been no panic or financial disaster, although there must have been many losses. Nobody could tell what was going to be the end of all this enormous war wastage and unremunerative expenditure. It was bound to cripple the country's trade and finance for years to come. They had sufficient work, chiefly from the Government, to keep their present staff going for the next few months, but the outlook could not be called a bright one.

The report was adopted.

Shawinigan Water and Power Co.—The directors announce a dividend of 1½ per cent. on the common stock for the quarter ending September 30th.

Globe Telegraph and Trust Co., Ltd.—The directors announce a first interim dividend of 2s. per share, free of income-tax, on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

The proposals of the Chancellor of the Exchequer in the new Budget, drastic as they are, have hardly gone to the lengths predicted by some of our pessimists; and the mere fact of their being known is a certain relief to the many who feel that suspense is a worse evil than realisation. From the Stock Exchange point of view, the additions to the income tax are an unfavourable factor, so far as gilt-edged issues are concerned. Prices of most of these securities are protected, of course, by minimum quotations, but the new taxation will add cogency to the pressure which is being brought to bear upon the Treasury for a revision, if not an entire withdrawal, of these minima. To meet the new taxes, many people will want to sell gilt-edged stocks, and that they cannot do so, because of the minimum prices established, is felt to bear very hardly upon certain cases.

None of the stocks and shares with which these pages are concerned come under the particular classes upon which minima are fixed, but there is a sympathetic influence extending from the one zone to the other. Increased taxation, especially of the direct sort, means that the investor considers himself justified in demanding a higher yield upon his securities; and if the stocks from which he is accustomed to make his choice do not provide him with sufficient scope of selection, he turns his attention to others that return more, so that the better-class stocks, unsupported by their usual buyers, have to yield ground as sellers come in, to find no buyers, except at much reduced levels.

The struggle that is going on between advocates of the voluntary and compulsory systems has had an unexpected effect upon Home Railway prices. Substantial shrinkages have occurred upon the speeches of Mr. J. H. Thomas, and his warnings that the railwaymen for whom he speaks not only want more money, but are prepared to go to extreme lengths if conscription is to be introduced. On this, people started selling their Home Railway stocks, and all the strength which animated the market two or three weeks ago went out of it for the time being.

Electric issues have given way with those of the Steam companies. The public will not look at any of them; and although prices are still above the general range touched a month or two ago, they are sorely disappointing to those who looked for continuance of the forward movement that lifted the prices out of their then slough of despond. Metropolitans at 23½ are a point down, and, as a matter of curiosity, it may be pointed out that the stock now stands at much the same level as South-Eastern deferred and South-Western deferred.

The respective dividends for 1914 were 1¼, 1, and 1⅝ per cent. As the South-Western line will shortly deserve to be included in the list of semi-electric companies, we may remark that the yield at the present price is 7 per cent. on the money, while on Metropolitan Consolidated it is about 5¼ per cent. The last calculation, however, is worked out on the basis of the 1914 dividends, but the declaration for the first half of 1915—namely, 1 per cent.—went against 1½ per cent. in the previous year. Underground Electric Incomes have managed to maintain their price with the loss of a point only.

There are some who argue that, with taxation so heavily increased and living more expensive, the ordinarily cautious investor will be tempted to depart from his usual path and to seek for high-yielding stocks to mix with more steady-going investments, in order to average a better return than he is accustomed to look for in normal days. If this tendency should materialise, it would mean better prices for such stocks as Underground Incomes, and shares in markets for rubber, mining and oil shares.

The Telegraph market keeps very steady in consequence of the dividends which are being declared. The Globe Telegraph and Trust will pay its usual 2s. per share, free of tax, at the end of the month. The Eastern has declared the regular dividend of 1¼ per cent. on the ordinary stock, free of tax, payable on the 15th proximo, and the Eastern Extension usual dividend is to be paid on the same day. The Direct West India Cable Co., in its report for the year ended June last, shows an available balance of £13,500—an increase of £6,700 over that of 1913-14. The company proposes to repeat the interim dividend of 3 per cent., free of tax, and £11,700 will be carried forward. The Direct Spanish dividend of 2s. per share, tax free, and payable on October 1st, is the same as that of a year ago. These are decidedly satisfactory announcements; and that the money should be paid free of tax must be a cause of special gratification to shareholders, who feel the advantage of this to a much greater extent nowadays than they have ever done before. New York Telephone bonds further advanced to 98¾, but lost part of the improvement. Eastern Extension shares are better; Eastern ordinary is firm at 115. Both the Anglo-American Telegraph stocks have hardened.

Marconi shares have been unaffected by an important arrangement notified last Saturday, to the effect that the company is about to absorb one of its principal competitors—the the Poulsen system. It may be recalled that at the time of the Marconi scandal, the Poulsen system, which was run by the Universal Radio Syndicate, had decided claims to consideration. A syndicate representing the Marconi Co. is said to have made an offer which has been accepted; the *Daily Chronicle* is responsible for the statement. Under present Treasury regulations, it is not likely that anything will be done in the way of raising fresh capital for some time to come. American Marconis are a little better at 16s. 3d., and Canadas braced up to 6s. The recent excitement in connection with the American rate of exchange has somewhat died down, displaced for the time being by the interest taken in the Budget.

Various electricity debenture stocks can now be bought to pay 5 per cent. on the money. There is, for example, a small amount of County of London 4½ per cent. first debenture which can be obtained at 90, thus giving the round 5 per cent. yield; and several others of similar class are available to the buyer. So far as the share list is concerned, prices are dull. County preference are ¼ up, the remainder show no quotable change. Every now and then a small transaction takes place, but it is by no means easy to realise even the best-class shares just now.

Brazil Tractions at 47½ are the fraction higher on the week, although the rate of exchange has latterly shown a tendency to droop. In Mexicans, there is practically nothing doing; the deadlock at which affairs seem to have arrived shows no immediate signs of relaxation, although it is said in some quarters that ceaseless efforts are being made to discover some way out of the extraordinary *impasse*. Canadian industrials are decidedly strong; and any company which is concerned, directly or not, with the making of munitions is enjoying a good market in the Stock Exchange. Private advices from British Columbia report that motor competition has recently been set up in Vancouver against the British Columbia Electric Railway Co., which concern, of course, has for some time past enjoyed a virtual monopoly of street transport.

The manufacturing group is quiet. Henleys eased off to 13½, but British Insulated keep firm at 10⅝. The armament division is a little better, prices being helped by an unexpectedly good dividend and bonus—the latter in shares—from the Birmingham Small Arms Co. Nothing of importance is doing in rubber shares; prices keep hard on the whole, and there is a fair amount of trade going on. On the other hand, the copper group is depressed and weak, owing principally to fresh heaviness in the price of the metal.

RUSSIA.—The Russian Siemens & Halske Electrical Works made a profit of 785,627 roubles in its seventeenth working year (1914). A dividend of 6 per cent. will be paid.

The Russian Tudor Accumulator Co. made a profit of 319,690 roubles in its seventeenth working year (1914). A dividend of 9 per cent. will be paid.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Sept. 21, 1915.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.				
Brompton Ordinary	10	7½	—	£6 13 4
do. 7 per cent. Pref.	7	7¼	—	4 16 7
Charing Cross Ordinary	5	3¾	—	6 13 4
do. do. do. 4½ Pref.	4½	3¾	—	6 0 0
do. do. City Pref.	4½	3¾	—	6 0 0
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4¼	—	5 17 8
do. 4½ Deb.	4½	88	—	4 17 10
City of London	9	12½	—	7 7 0
do. do. 6 per cent. Pref.	6	10¾	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10¼	—	6 16 7
do. do. 6 per cent. Pref.	6	10½	+ ¼	5 14 8
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6¼	—	7 4 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4¾	—	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	3½	2½	—	7 0 0
do. 4½ per cent. Pref.	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6¾	—	7 8 2
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6¾	—	6 13 4
do. 4½ Pref.	4½	4¼	—	5 9 0
TELEGRAPHS AND TELEPHONES.				
Anglo-Am. Tel. Pref.	6	98½	+ ½	6 2 0
do. Def.	1½	22	+ ¼	6 16 4
Chile Telephone	8	6½	—	6 3 0
Cuba Sub. Ord.	5	8¼	—	6 1 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11⅞	+ ⅛	*6 15 0
do. 4 Deb.	4	80	+1	5 0 0
Eastern Tel. Ord.	7	115	—	*6 18 0
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	9¾	—	*7 0 8
do. Pref.	6	9¾	—	6 3 0
Gt. Northern Tel.	22	33	—	6 13 4
Indo-European	10	60	—	6 10 0
Marconi	10	1⅞	— 1/32	5 6 8
New York Tel. 4½	4½	98½	+ ¼	4 11 8
Oriental Telephone Ord.	10	1 15/16	—	5 3 1
do. Pref.	6	1⅛	—	5 6 8
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5½	—	*8 6 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	11¾	—	*6 17 0
do. 4 Deb.	4	81	—	4 16 5
HOME RAILS.				
Central London, Ord. Assented	4	70	−1	5 14 4
Metropolitan	1½	23½	−1	6 6 5
do. District	Nil	14¼	− ¼	Nil
Underground Electric Ordinary	Nil	1½	—	Nil
do. do. "A"	Nil	5/9	—	Nil
do. do. Income	6	71	−1	*9 11 8
FOREIGN TRAMS, &c.				
Anglo-Arg. Trams, First Pref.	5½	3¾	—	7 6 8
do. 2nd Pref.	5½	3¼	—	8 9 2
do. 4 Deb.	4	73	—	5 9 7
do. 4½ Deb.	4½	72	—	6 5 0
do. 5 Deb.	5	74	—	6 15 2
Brazil Tractions	3½	47½	+ ½	7 7 4
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds	—	40	—	Nil
do. 6 per cent. Bonds	—	35	—	Nil
Mexican Light Common	Nil	25	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	40	—	—
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	98	—	5 2 0
MANUFACTURING COMPANIES.				
Babcock & Wilcox	14	2 3/16	—	6 8 5
British Aluminium Ord.	5	1 1/16	—	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	10⅝	—	7 1 2
do. Pref.	6	5⅞	—	5 2 2
British Westinghouse Pref.	7½	32/6	—	9 7 6
do. 4 Deb.	4	68	—	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref.	5	4½	—	5 11 8
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	8¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	58	—	6 18 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/-	—	7 7 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	13½	− ½	*8 9 8
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	8¾	—	5 14 8
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

Eastern Telegraph Co., Ltd.—The directors announce a dividend at the rate of 3½ per cent. per annum, less income-tax, on the preference stock for the quarter ending September 30th, and the second quarterly interim dividend of 1¼ per cent on the ordinary stock, free of income-tax.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1915.

The August returns of electrical exports business show a reduction of £25,000 as compared with the month of July, and an increase of £107,600 on the total for August, 1914, which stood at £238,621.

The decrease in the exports appears to have affected principally the wires and cables and machinery sections, the latter of these being some £22,000 less than the July total.

The imports and re-exports also show a slight falling off in value as compared with the previous month, the totals of the former being £212,414 for July, as against £202,490, and for the latter £15,097 for July, as against £10,676.

For August, 1914, the imports and re-exports were £87,031 and £10,001 respectively.

The Scandinavian countries and India were our best customers during the month, while New South Wales, New Zealand and Argentina were also large purchasers.

The electrical imports from the U.S.A. show a falling-off of £17,000, whilst those from Holland, France and Switzerland have increased.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	4,372	8,719	1,991	67	3,348	2,205	7,632	1,803	98	155	17,560	1,886	49,836
German West Africa	...	...	...	...	...	...	...	...	...	...	25	...	25
Netherlands, Java and Dutch Indies ...	157	5,539	684	...	...	...	103	347	51	...	1,107	...	7,988
Belgium	...	...	...	...	...	...	...	...	...	...	...	...	...
France	1,055	470	1,224	47	21	21	3,783	3,105	468	...	1,426	4,414	16,034
Portugal	45	1,788	...	71	...	122	49	22	...	...	928	3,597	6,622
Spain, Canary Isles and Spanish N. Africa...	227	269	86	56	...	263	2,372	38	25	3	66	3,932	7,337
Switzerland, Italy and Austria-Hungary ...	411	...	13	...	...	...	4,761	228	...	...	1	35	5,449
Greece, Roumania, Turkey and Bulgaria ...	555	...	33	12	...	...	427	...	...	...	13	219	1,259
Channel Isles, Gibraltar, Malta and Cyprus...	78	196	31	16	...	181	...	...	17	...	...	4,175	4,694
U.S.A., Philippines and Cuba	352	...	62	65	...	48	5,743	15	19	...	35	1,370	7,709
Canada and Newfoundland	71	...	72	150	...	1,126	3,341	18	1,443	24	...	13,183	19,428
British West Indies and British Guiana ...	65	30	55	19	...	...	...	...	10	20	15	15	229
Mexico and Central America	6	...	12	18	...	...	...	...	...	...	...	962	998
Peru and Uruguay	...	47	71	79	...	...	10	...	...	...	22	289	518
Chile	13	247	4	36	...	...	148	...	82	25	...	68	623
Brazil	388	350	73	202	...	28	444	206	17	2	64	15,670	17,444
Argentina	1,138	4,872	1,232	1,622	457	1,786	3,845	6,031	438	127	2,856	2,353	26,757
Colombia, Venezuela, Ecuador and Bolivia...	...	85	80	372	...	61	155	...	34	10	...	19	816
Egypt, Tunis and Morocco	174	1,565	433	221	192	...	704	...	505	114	47	146	4,101
British West Africa	50	28	116	73	...	...	37	...	88	...	86	749	1,227
Rhodesia, O.R.C. and Transvaal	1,008	1,387	1,852	1,893	...	450	1,059	154	1,294	...	305	5	9,407
Cape of Good Hope	423	855	552	656	...	257	865	63	1,521	29	66	65	5,352
Natal	402	4,042	466	309	...	65	5,641	150	433	48	3,075	...	14,631
Zanzibar, Brit. E. Africa, Mauritius & Aden	309	15	158	306	...	18	186	21	27	...	82	268	1,390
Azores, Madeira and Portuguese Africa ...	33	227	...	33	...	188	764	...	...	...	57	292	1,594
French African Colonies and Madagascar...	19	...	10	57	...	...	45	217	...	...	...	42	390
China and Siam	442	427	1,176	...	...	118	468	88	245	4	...	945	3,913
Japan and Korea	367	...	50	26	1,825	221	464	1,210	761	...	...	...	4,924
India	2,988	8,744	5,170	2,202	128	2,014	8,706	2,614	5,751	86	597	170	39,170
Ceylon	186	34	129	21	...	28	29	...	141	...	16	...	584
Straits Settlements, Fed. Malay States and Sarawak	274	537	293	195	...	...	298	199	186	...	358	147	2,487
Hong Kong	78	247	62	10	...	363	185	...	143	38	30	...	1,156
West Australia	225	1,168	349	791	...	574	5,390	...	26	...	107	19	8,549
South Australia	139	300	159	61	...	208	544	4	14	...	5,758	...	7,187
Victoria	1,068	3,919	1,730	806	...	188	2,668	...	2,998	25	3,687	111	17,200
New South Wales	250	4,458	1,928	2,279	160	1,163	4,328	972	1,787	239	2,801	1,729	22,094
Queensland	20	1,394	209	311	...	32	910	...	101	28	1,564	...	4,569
Tasmania	...	...	136	...	...	...	579	...	...	...	...	98	813
New Zealand and Fiji Islands	887	809	1,913	666	...	337	7,011	537	653	23	8,961	17	21,814
Total, £	18,275	52,768	22,614	13,748	6,131	12,065	73,594	18,042	19,376	1,000	51,715	56,990	346,318

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Norway, Sweden and Denmark ...	230	868	135	276	173	...	3,698	97	1,815	408	4,174		11,874
Germany	...	...	...	...	...	...	...	...	...	...	...		...
Holland...	...	3,115	...	7,414	...	...	489	...	690	...	...		11,708
Belgium	...	...	...	...	...	...	...	...	...	...	...		...
France	190	2,390	598	2,977	1,419	585	371	...	6,705	3,907	310		19,452
Switzerland	1,588	6,275	296	39	334	251	1,640	...	62	2,808	...		13,293
Italy	26	2,158	...	...	...	...	945	790	...	110	1,212		5,241
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...		...
United States	8,806	2,310	3,066	1,305	4,421	90	39,296	49,331	6,675	13,289	4,961		133,550
Total, £	10,840	17,116	4,095	12,011	6,347	926	46,439	50,218	15,947	20,522	10,657		195,118

Additional imports.—Spain, goods, £18; electrically driven machinery, £75; carbons, £3,088. Canada, goods, £89; wires, £1,489; magnets, £272; machinery, £1,317; carbons, £903; telegraph and telephone apparatus, £171.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above... ...	3,491	98	...	500	...	399	1,215	...	498	262	4,213		10,676

Total Exports: £346,318 Total Re-Exports: £10,676 Total Imports: £202,490

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE BRITISH ASSOCIATION—III.

Friday, September 10th.

On the Friday, Prof. Miles Walker read a paper to Section G on "A Self-adjusting Commutating Device" (of which an abstract appears on p. 414).

Mr. Gerald Stoney, F.R.S., expressed the belief that the device might lead to important developments in improvements of commutation of continuous-current machines, which had been one of the bugbears of electrical engineers. His own experience had been more particularly with turbo-generators, and the difficulties of commutation there had been very great indeed. He asked if Mr. Walker had considered the application of this device to turbo-generators.

Prof. Walker replied that the matter had been considered, but the device had not been applied to the turbo-generator.

In the course of the discussion on Prof. Wilson's paper on "Exposure Tests on some Metals and Alloys," Prof. Howe spoke of the importance of the experiments. When they had to put wires out in the open they very often put them up not knowing whether they were going to last or not; it was simply trial and error. He thought it would be a good thing if similar experiments to those just referred to could be made in different parts of the country; wires being placed simultaneously in cities, seaside towns, and country districts to see how they withstood exposure to the different atmospheres. He thought every new alloy put on the market ought to be put with the others, so that it could be ascertained as soon as possible how it withstood exposure to the atmosphere.

Another speaker suggested that the wires exposed should be of different diameters; and it was also stated in the discussion that the establishment of new chemical works in a district would affect the matter, and that things like that would have to be watched.

Prof. Wilson agreed with the views expressed.

The Mathematical Section discussed "Thermionic Emission"—a hot subject on a hot day, said one speaker—and Prof. O. W. Richardson, F.R.S., who opened, said the conclusions at which he had arrived were that the effects attributed to thermionic emission were certainly physical in some cases, probably physical in most, and possibly chemical in a few.

In the same Section Prof. Pierre Weiss gave a highly technical paper on "New Views of Magnetism"; and Prof. W. B. Bragg, F.R.S., and Mr. W. L. Bragg dealt in interesting fashion with "X-Rays and Crystal Structure."

Saturday, September 11th.

The most unfortunate part of the concluding session in Section G was the fact that, owing to the shortness of time, the authors of the papers were not able to do justice to their subjects. It is a common fault of congresses that timed programmes are never adhered to, and it is difficult to see how a better state of affairs can be secured. Speakers naturally follow most particularly those subjects that interest them, and the preparation of a timed programme is largely a task of speculative character—the times being allocated according to the interest of the papers as roughly judged in the minds of those having the arrangement in hand. The system invariably works out in favour of the earlier speakers, and the last on the bill are, indeed, unfortunately circumstanced. The Section should have closed its proceedings by 12.30, but it was after one o'clock before the closure was applied—and then one paper, "An Investigation of the Thermal Conductivity of Thin Air Films between Parallel and Metal Plates" (Mr. A. A. Griffith), was left out, in the absence of the author.

Prof. E. G. Coker submitted the report of the committee on "Stress Distributions in Engineering Materials."

The committee has been re-appointed and is to continue its work. Prof. Coker said there was no reason why it should not become a permanent committee, because he did not think they would ever get to the end of the subject. Referring to a sample of steel which Mr. Mason produced, showing fracture parallel to the axis, Prof. Coker remarked that these cracks, and other similar evidence, were serious matters, which went to show that the material they had got was, perhaps, not ideal in regard to its condition throughout. They would have to be very careful in future to try to get the material absolutely identical in all respects, so that all the members of the committee would have identical material to deal with.

Prof. Miles Walker, whose paper on "Some Experiments to determine whether there exists Mutual Induction between Masses" came last, good-humouredly remarked that whereas the previous paper (on "Torsion Stresses in Framed Structures") concerned matters represented by thousands and millions of pounds, and was of practical and immense value to those whose interests were involved in the expenditure, his own paper was one of those that were of no use whatever. Nevertheless, it represented one of the inquiries sometimes worth making, and somebody had to do the useless work sometimes.

The President said that although Prof. Walker had got a negative result he was in much good company, and although a negative result was in some ways disheartening it contributed to science.

Prof. Schuster said he thought the paper ought to have been given to Section A as well as Section G; those attending the Mathematical and Physical Science Section would have appreciated its importance. On the question of negative results, he agreed with the President. The pity was that there were so few people who had the courage to undertake research where ultimately they risked having negative results after a good deal of labour, and he was afraid many of those who tried—and he included himself—did not afterwards take the trouble to record the fact that they had had a negative result. One was really doing very great service to the scientific world by recording negative results.

Dr. Hele-Shaw, in closing the proceedings of Section G, addressed himself particularly to Prof. Schuster (the Association President), and informed him that, from the engineering point of view, the opinion was that the Association had been justified in holding its meeting as usual. The matter contributed to the practical science of engineering had been well worth the while, and had not been one whit inferior to that gained in previous years, when there was, of course, an absence of such difficulties as had faced them this time.

Sir William Mather, in a paper read before the Educational Science Section on Saturday on "Education and Industry," said the relationship of the two was as close as that of soul to body. After a brief retrospective view of the subject, Sir William said we were still far below the standard our industries required if we were to compete successfully with those of other countries. No provision had yet been made to continue the education begun in the elementary schools through the years of adolescence; neither had any definite system of continuation schools for the manual worker yet been established. Dealing with the relations of employer and employed, he remarked that a more thorough and enlightened system of education would, in the course of years, render these relations free from the troubles they had had under present conditions. Trade unions and employers' federations existed more for organised defence and resistance than for peaceful progress, and there was as little cause for capital and labour to be divided as for a household to be divided against itself. The outstanding menace which imperilled our very existence as an industrial nation was the chronic separation of capital and labour into opposing camps. Until the necessity of perfect unity of interest, of motive, and of purpose was recognised and established we were building our industrial edifice on sand; and it was eminently unscientific to build on sand when rock was at hand.

Principal Garnett, of the Manchester School of Technology, spoke of the place of the technical school in this matter.

Prof. Schuster referred to workers and evening classes, and remarked that it was only the most vigorous of working men who could take advantage of these classes. A large number of men who had been in the workshops all day were not, in the evening, in a physical condition to benefit from attendance at evening schools. He did not agree that there were insufficient trained men in this country, and thought the tendency was rather to overtrain the mind.

Mr. James Graham, of Leeds, said that the only rational and effective way to train the rising generation of skilled workmen after leaving the elementary schools was to have half-time in the workshops and half-time in the technical schools between the ages of 14 and 18 years.

General.

As regards the meeting in general, the weather conditions in Manchester were ideal the whole time. There was no rain, an abundance of sunshine, and visitors to the city who expected to find what is commonly spoken of as "typical Manchester weather" were very agreeably surprised. While learned scientists were discussing the smoke question, its effect on the atmosphere, and, generally, painting wholly in black the city of Manchester, a warm and powerful sun was shining outside, and Oxford Street was a thoroughfare of white dresses and straw hats.

There were no excursions this year, and the President (Prof. Schuster), in his thanks to the city for its hospitality, mentioned that the hope had been expressed that the example set by Manchester in the matter of the absence of "side shows" would be followed in other places.

Visits to Works.

But while there were no organised excursions or social functions on the grand scale there were innumerable invitations to members to visit works and warehouses of all kinds. Members were able to visit the electricity stations at Stuart Street and at Frederick Road, Salford; the testing and standardising department of the Manchester Electricity Department at Ardwick; the British Westinghouse works at Trafford Park; the works of Messrs. W. T. Glover & Co., Ltd., Trafford Park; Electromotors, Ltd., Openshaw; the Lancashire Dynamo & Motor Co., Ltd., Trafford Park; Messrs. Mather & Platt, Ltd., Newton Heath; and numerous engineering works; while of the visits to textile factories reference may be made to the spinning and weaving shown at the Brunswick Mill of the Bannerman Mills Co., Ltd., which is now driven by electricity supplied by the Manchester Corporation, instead of, as formerly, by steam.

Altogether the proceedings were educative and enjoyable, and the 1,400 or 1,500 members who attended—the number was well above the early estimates—will long retain pleasant recollections of the Manchester meeting.

It may be added that Sir Arthur J. Evans has been appointed president for next year's meeting of the Association at Newcastle-on-Tyne, and Prof. W. A. Bone, Mr. H. N. Dickson, Sir Daniel Morris, and Dr. A. Smith Woodward have been appointed members of the Council. The 1917 meeting is to be held at Bournemouth.

Industrial Harmony.

(Concluded from page 361.)

Mr. Will Thorne, M.P. (a representative of the Trade Union Congress), said he was prepared to agree to the submission of disputes to the Industrial Council, or, better still, to a smaller committee or committees appointed by it. He was opposed to compulsory arbitration, and he advocated the idea of compelling masters and men to meet and discuss disputes before proceeding to the strike and lock-out. He would like to see more conciliation boards set up. Much of the industrial unrest at present was due at bottom to the sharp rise in the price of commodities, in many cases without justification, and if the Government had dealt with the coalfields as they had dealt with the railways there would have been no trouble in that sphere. Under the present system of production he could not see how they could harmonise the opposing forces of employers and employed. They would not have the harmony they desired until there was a better distribution of wealth. The workers were convinced that they were not getting what they were entitled to.

Sir Hugh Bell, the well-known ironmaster, said he thought the previous speaker under-estimated the participation of the working classes in the gross income of the country. In the steel industry, for example, from 70 to 75 per cent. of the cost of steel was labour, and an advance of 10 per cent. on wages would wipe out the whole of the present profit. Improvements in methods of manufacture would produce more profit on a smaller labour bill, and wages might be increased by giving to the workman his share of the increased profit. Unfortunately, the introduction of labour-saving devices often meant temporary disadvantage to the workers, and on that account it was resented, though its ultimate effects were beneficial to the workers. He commended "compulsory conciliation" as a means of helping both sides in a dispute to see where their true interests lay. He and Mr. Thorne, he added, were at one in this, that they both desired to see labour getting its full share of remuneration, provided it gave in return full share of effort.

Mr. Albert Evans, of the Papermakers' Union, spoke of the employment of women, and said there was a suspicion on the part of labour that when the war ended the employing class would take advantage of the chaos to filch from the workers advantages they had fought for for years. They were very anxious about the employment of women to do men's work at lower wages.

Prof. Schuster (President of the British Association) remarked that to say that labour and capital were working for the same end was merely to evade difficulties. They should not minimise the differences that existed.

At the afternoon session on the same day, Mr. Snell read a paper by Mr. G. P. Holden on "Ruskin's Law. Government and Co-operation are in all things the laws of life; anarchy and competition the laws of death."

Prof. Hobhouse said he understood industrial harmony to mean not merely a system in which people rubbed on without strikes and lock-outs, but he looked upon it as essentially one of co-operation in which each individual member of the community, in putting forth his best energies and developing his distinguishing capacities, served the common life. To apply that involved considerations of value and ends, and if they were going to undertake a systematic investigation into this question they must understand that they were dealing with the sphere not of pure fact alone, but with the sphere in which fact and ideal came into contact. In many respects, as stated by previous speakers, the interests of all parties to the industrial bargain coincided. It was in the interest of all parties, for example, that production should be increased and that better processes should be introduced. But he did not think they must take too smooth a view as to the sphere of identity of interest in every case between the parties to the industrial bargain. He thought Sir Hugh Bell took somewhat too easy a view. It did not so much matter to whom the increment of wealth at any given point went, provided that it was saved and that it was devoted to the development of industry; and it was conceivable that if it went into the pockets of the workpeople or the State, for instance, it might as well be devoted to the production as when it went to the employer.

Mr. James Johnston (Manchester) spoke of the influence of the co-operative movement in producing industrial harmony, and gave details of the operations of the Co-operative Wholesale Society.

The Rev. P. H. Wicksteed (Oxford) spoke of the importance of getting at the hard ultimate facts. It would be an enormous help if there could be established anything like approximate agreement as to the fundamental facts underlying the industrial order. The reason why there were plenty of rumours of wars, but no really deadly wars, in the cotton industry, was that the cotton operative knew too much to have a really serious strike. A lot of cotton operatives had themselves an interest in some concern, and there were all sorts of means of knowing what was going on, and there, where they had the facts, they realised the position. But they did not fight; they recognised that the utmost they wanted was not worth fighting for. We were living in an intellectual chaos complicated by moral twists——twists of vision, and the one and only salvation was to get at the underlying facts by experience, by organisation, and by hard thought.

Mr. G. E. Toogood devoted himself to the question of trade union discipline. The trade unions, he said, had rules which made it clear that they recognised the duties of citizenship, the duties towards the employers, and the duties towards each other; and yet in practice those rules were not generally enforced. If a man absented himself from work without good reason, and by his action affected the earning power of other subsidiary workers, according to the rules of most trade unions he was liable to come under disciplinary treatment; but to enforce that rule would mean the creation of a large number of blackleg workers, and the trade union organiser naturally would hesitate before taking steps which would weaken his own power of bargaining. He suggested that industrial agreements should receive public sanction and be enforced by the whole power of public opinion expressed through the law of the land.

Prof. Unwin (Professor of Economic History, Manchester) said the real practical point of difference between the cotton trade and the engineering trade lay in the fact that in the cotton trade the workers had secured a fairly complete control of the division of profits with the employers. There would be a possibility of increased production in engineering by different methods of management. If the same degree of co-operation and control could be secured in that trade as was already secured in the cotton trade, a very large increase might be made in both wages and profits on a harmonious basis. The cotton industry, however, was on much more routine lines than the engineering trades, and improvement in production in the engineering trades would depend far more upon the improved efficiency of individual workers under scientific management. It was possible for people in the cotton trade to watch profits and to secure their share, and that was not at present the case in the engineering trades.

Mr. B. Ellinger (Manchester) expressed agreement with Sir Hugh Bell that for hope of settlement of the problem they must look to the idea of the benefit of both classes coming from the increased production of wealth.

Mr. W. Smalley (Castleton) spoke of the growth of trade unionism, and said that whereas there were now three million workers organised in trade unions, there were not more than a million five or six years ago. Where working people were unorganised there would low wages be found.

The President of the Section then summed up. He pointed in a general way to some effects of the present war—notably the scarcity of food tending to rising prices, and making living more difficult through the lowering of real wages, the demands for war bonuses, and so forth—all tending towards industrial friction, and remarked that we might bear the inconvenience better if we were sure that it was a temporary thing for the war period. But the war had lasted sufficiently long to put a great deal of our industry on a war basis, and when we went back to peace then the converse change had to be made, and the probability was that the friction would be intensified. Upon the general question under consideration he would like to ask them to take a wide general view, because he thought it was only in taking broad views—at the same time, not neglecting any essential details—that they would be enabled to advance this question. What particularly interested him, personally, and what he thought was very fruitful in the debate that day, was that they had heard speakers who quite candidly ranged themselves on one side as employers, or on another side as representatives of organised labour, make a partial admission that there was a tendency towards a large measure of identity of interest between the two. That was extremely hopeful. The ultimate real earnings of labour were its efficiency earnings; but they found among the rank and file of employers and of labour quite a different point of view. They had the employer who thought cheap labour was best for him: on the other side they had the workman who confined his activity in endeavouring, as he said, to get as much out of the employer as he could. The difficulty was that in both those cases the question of efficiency earnings had been thrown overboard completely. One could not produce a panacea to deal with the matter. The best he could do was to suggest certain lines of action which he thought would conduce towards levelling up the laggards on both sides to the standard of the more intelligent and far-seeing. First of all, it might do no harm if both of them had a little more acquaintance with economic principles. In the second place, one could not help being immensely struck with what had been said about the avoidance of disputes in the great cotton trade, and the reason assigned for that; and he thought, taking that as a model, there would be an immense advantage if in other trades there were the same mutual knowledge of the conditions of the trade, both on the side of the employer and on that of the employed. Such knowledge would enable each to know something more about the difficulties of the other. He believed if the employer knew something intimately about how his people lived, and if, on the other side, the people employed knew something of the fight the employer often had to win so as to protect his own living and the living of those he employed, it would introduce the element that once was common in British industry, but was now becoming scarcer and scarcer—namely, a sympathetic appreciation of the prospects and the character of the work amongst those who co-operated in the work. This brought him to his third point, which, at the moment, might seem a little bit ideal. One would like to see both employers and employed taking pride in the work done. The spirit of co-operation and the pulling together and recognising that everybody had a share in the work achieved, would conduce to sympathy and, to a large extent, to the avoidance of friction. After remarking that the principles of co-operation and of profit-sharing, valuable, perhaps, in their own special sphere, would not alone lead to industrial harmony—they had their limits—the President observed that we had only just begun to see the benefit of conciliation, and there, again, we came to a point where there was a considerable amount of agreement between employers and employed—an agreement which found its echo in the striking phrase of Mr. Will Thorne, "compulsory conciliation." It was quite easy to see what Mr. Will Thorne meant, and he (Prof. Scott) would like to draw special attention to the point that the really serious danger that he saw was not conflict between what was called Labour and Capital, but a much more serious possible one of a conflict between different kinds of labour, and he was taking labour in the wide sense—every kind of worker that produced anything productive or rendered any economical service. Any internecine contest of that kind between labour might produce very serious effects in our social structure. The nation as a whole had sufficient resources to deal with any attempt of that kind, and he thought he was right in saying that it was almost impossible for any lock-out or any strike to succeed if public opinion was definitely against it. Now, public opinion really had never had a chance of fully making itself felt. Public opinion must have knowledge, and it was through well-informed public opinion that useful influence could be brought to bear towards effecting a solution by the full discussion of the various points at issue. If that opinion was brought to bear as an ultimate court of appeal in a labour dispute, and if that court of appeal sided definitely in favour of one side, a very little experience would show it was not much good that side striking or attempting a lock-out, as the case might be. Not one of these things alone would do, but those he had outlined and others might conduce very materially towards the prevention, or, at least, the modification, of economic friction.

War Credit and Finance.

A valuable report on "The Effects of War on Credit, Currency and Finance" was presented and discussed on Friday, September 10th, at the proceedings of Section F (Economic Science and Statistics). For the purpose of its investigation the "Conference" divided the whole inquiry into four heads, namely:—(1) The direct effects of the war on credit; (2) Public borrowing as affecting credit; (3) War measures and currency; (4) War and the mechanism of foreign exchanges. The members of the "Conference" felt strongly that the time was not ripe for the presentation of a final report. The present is only an interim report and, necessarily, incomplete, but it has the advantage of attempting to present a picture of momentous events drawn whilst most of them were fresh in the minds of those who had special opportunities for observation. It aimed at focusing a body of reasoned opinion upon the causes and proximate effects of credit movements during the first year of the war. "However much present judgments may be shown by subsequent events to have been in error, in the opinion of the Conference it was essential that they should be recorded." With the report in detail we need not deal here, but it is so useful a document, and on a subject which concerns us all, that we may indicate the nature of its contents.

The more important emergency measures made during the year 1914 are summarised, as are also the direct effects of the war upon credit. The next section has sub-sections dealing with the following matters:—(*a*) Effect of assistance by the Government to banks and financial houses in August, 1914; (*b*) Was their hoarding owing to the war?; (*c*) Emergency measures to meet the need for currency; (*d*) The extent to which these measures were effective, necessary, or desirable; (*e*) Effect of increased paper currency on prices. The reference to public borrowing for the war as affecting credit is divided up thus:—(1) General effects of public borrowing on credit; (2) Effect of the regulations as to the issue of new capital; (3) Extent to which capital is withdrawn from enterprise; (4) Effect of borrowing in Great Britain by Allied Governments. War taxation, and the war and the foreign exchanges, are the remaining sections, and an appendix discusses the "Third War Loan." The report in its concluding sentences says that economy should be enforced as well as preached, and "the lesson should be the easier in that Germany has already set an example to the whole world. But when all these palliatives and remedies have been adopted there is little doubt that there will remain a great deal to be done, and our weapon for this purpose must be the raising of credits abroad." "No one doubts that the British Government could raise money in the United States on favourable terms."

In the discussion that followed, Dr. Yves Guyot said that on the morrow of the war an enormous mass of fixed capital would have to be reconstituted, railways, houses, and working plant to be reconstructed. The needs would be great, the purchasing power small, and the cost would be increased by the high rate of interest, the difficulties of procuring working plant and instruments, the scarcity of labour, and fiscal surcharges. The only means of repairing losses and increasing the economic power of a nation was to intensify production.

Prof. Scott (the Chairman) observed that he had come to the conclusion that if the country "put its back into the war" and if the cost did not exceed one thousand millions a year we could finance the war indefinitely.

Mr. Drummond Fraser urged the need of a simpler form of Government investment; and Prof. Boyd Dawkins was in favour of taxing war profits. Why, he asked, should not all profits made above a defined level go to the Government? He did not see the slightest difficulty in carrying out the principle which had already been applied by the Government to the railways. He also favoured the taxation of incomes below £160, and declared that on this proposal the working man was ready to do his bit financially in this great war.

In the Economic Section on Saturday, September 11th, the Ven. Archdeacon Cunningham spoke of "Economic Problems after the War." An abstract of his remarks follows:—

Economic Problems after the War.

By W. CUNNINGHAM, F.B.A.

(*Abstract.*)

There can be no accurate forecast of the conditions after the war; but as we have borrowed largely and spent the money unproductively, there is sure to be a heavy burden to fall on some one, though we cannot foresee exactly how it will be borne. We can only indicate hopes and fears as to the possibilities of the future.

During the war there has been an immense outburst of the sense of national duty; we may hope that men will continue to view the affairs of the country with public spirit, and that the *laissez faire* school which identifies national prosperity with the pursuit of private interests is dead.

There has been a great increase of governmental activity, and the experiments made in regard to the nationalisation of railways and the fixing of prices and profits and wages by the State are remarkable. They make an increased sense of the nation as a unit, and indicate that cosmopolitanism has received a check. It is probable that each nation will be on the guard against the risk of being exploited by countries which are more advanced industrially. Great Britain was enabled by the age of invention to use her industrial superiority so as to control the resources of other countries; and though Great Britain has now left her Colonies free to pursue their own development, German organisation and her careful application of science to industry have given her the opportunity of pursuing the same policy.

It is of the highest importance that the problems of the increased burden caused by the war should be clearly stated; and there may be some misgiving lest the habit of mind which has been recently cultivated by English economists is the best for dealing with broad issues. Both consumption and production are necessary parts of the economic process, but the war has shown once more the importance of production—the production of munitions and the organisation of employment; the new school of economists, which gives an exaggerated importance to consumption and leaves production in the background, is not well fitted to deal with the questions. Many economists before the war took a short-sighted view of British interests, and helped to create the impression in Germany that Great Britain was so committed to neutrality that she would present no objection to the invasion of Belgium. By exaggerating the importance of consumption the same school of economists has given an apparently scientific basis to the claims of those who are taking advantage of the war to stand out for higher wages. In so far as the struggle at the Dardanelles has been due to political rather than military considerations they have laid undue stress on the possibility of importing corn from the Black Sea, and have raised the question as to whether cheapness to the consumer may not be obtained at too great a cost in lives.

Manchester Electricity Supply Undertaking.

In Section G, on Thursday morning, Mr. S. L. Pearce, City Electrical Engineer, read a paper on the Manchester electrical undertaking, with special reference to the projected Barton Power Station. The latter was fully described in our issue of January 8th, 1915, with illustrations. The paper was followed by a discussion, opened by the President of the Section.

Dr. Hele-Shaw, remarking upon the storage capacity for two months' supply of coal, said that in these days, when it was necessary to think of the possible total stoppage of coal supplies, the provision of storage for so far ahead was a good thing. He could not see that it would have hurt the Ship Canal Co. at all to have made an arrangement with the Corporation Electricity Department respecting the supply of water for condensing, but, as it turned out, to have to use the sewage effluent at the electricity station was actually going to prove of distinct advantage to the sewage disposal department.

Mr. J. G. Newbigging (Chief Engineer, Manchester Gas Department) said he understood Mr. Pearce to say that he made his calculations of cost on coal at 9s. per ton. Did he think that price would ever be reached? As users of about half a million tons of coal per annum, the Gas Department never hoped to get it as cheaply as that. He thought the charge would be 50 per cent. higher than that for many years to come.

Mr. Gerald Stoney, F.R.S., said he had heard a good deal about the Barton power station, and he thought the lay-out was most complete; he did not see how it could be improved upon. The sizes of turbines Mr. Pearce had selected—15,000 kw. and 25,000 kw.—were very suitable; 15,000-kw. turbines at 1,500 r.p.m. were very suitable at the present time, and about the maximum that was economical for that speed. But the sizes of turbines were going up so rapidly that doubtless by the time Mr. Pearce required his 25,000-kw. turbines, manufacturers would be in a position to give them. Up to the present no turbine had been constructed at more than 750 r.p.m. of this size, although in America they had been made of 30,000 kw. at 1,500 r.p.m. With regard to measuring instruments, it was most important in a power station to measure everything accurately; by that means alone could economy be obtained. Every stage in the process of producing electricity should be absolutely measured and curves made, and then the matter could be watched and economies effected. Touching on the use of sewage effluent, Mr. Stoney asked if there would be any trouble wth the choking of the condenser tubes and getting a skin on them which would reduce the vacuum. Vacuum was everything in such a station for high economy in turbine work, and the turbines Mr. Pearce had chosen were going to be made, he believed, for the highest vacuum possible—somewhere about 29 in. He would also like to know whether there would be trouble about corrosion of the tubes due to sewage effluent. Another point was whether Mr. Pearce had made any provision for getting easily heavy parts of machinery into his engine room. He had allowed for removal from his engine room to his workshop, but was there any connection between that and the main lines of the country so that heavy machinery could be got direct into the engine room without serious handling? That was an important point in modern electric power stations, and one, he was sorry to say, in which many electric power stations were deficient. They ought to be able to lift straight off the truck to the place where they wanted the machinery to be.

Mr. Pearce, in reply, said that he did not expect to be able to buy coal at 9s. a ton, but that was the figure prepared in connection with the Parliamentary inquiry, and at that time there was certainly a reasonable prospect of getting coal at 9s. a ton at Barton. He did not think there was a prospect of their being able to buy coal at 9s.per ton unless they were prepared to accept coal of very inferior quality, and that he doubted. The table he had shown, in which the price of 9s. was mentioned, was to indicate the difference between the conditions at Barton and at the Stuart Street Station, and if they had to pay 50 per cent. more for coal it would apply equally to Barton and to Stuart Street. The dearer the coal, the more Barton would score over the other one. With regard to Mr. Stoney's observations, he was glad to have the endorsement of the correctness of proceeding with turbines of such output as had been mentioned at such high speeds. No one was more competent to pass opinion on that than Mr. Stoney. No portion of the Barton scheme had been considered more carefully than the question of condensing water, and very elaborate arrangements would be made at Davyhulme (where the sewage works were situated) to give the electricity department a purified effluent. "We have it on the highest authority," added Mr. Pearce, "that the effluent as we shall receive it will be better than the Ship Canal." As regarded the condenser, they had had before them the possibility of having trouble with the water, and special designs had been introduced into the condenser to eliminate any of the possible dangers mentioned by Mr. Stoney, and also to facilitate matters. Corrosion they did not fear at all. With regard to getting heavy machinery into the engine room, arrangements were being made for a railway line to be brought in for that purpose.

The Manchester Corporation Gas Undertaking.

In the course of a collection of notes on this subject, read in Section G by Mr. J. G. Newbigging, the author stated that the gas works, established in 1817 by the Commissioners of Police, became the property of the Corporation in 1843, and were valued at £3,335,019; the debt outstanding had been reduced to about one million sterling, and nearly 3¼ millions of net profits had been applied to corporation purposes, while the price of gas was less than 2s. per 1,000 cubic feet. Enormous new works had been designed, including an electrical installation for generating the power required in the manufacturing processes, and for the handling of the huge quantities of coal and coke, but owing to the war their construction had been deferred.

After describing the important assistance rendered by the gas works to the State and to industry in general by the development of suitable methods of reclaiming by-products, the author stated that it could not be expected that the success of the department could be maintained unless it were relieved of the burden of contributing large sums annually in relief of rates, at the expense of the gas consumers. Practically the only direction in which town gas could make material progress was in the replacement of smoky solid fuel with gaseous fuel, as the advent of the practical application of electricity had taken away the monopoly previously enjoyed by gas, and it was becoming more and more evident that each of these commodities had to a very great extent its own distinct sphere of usefulness. During the period 1909-13, the increase in the use of electricity for power purposes was no less than 155.2 per cent., and the use of gas for cooking 30.18 per cent., these being the directions in which the respective commodities had made the greatest progress. For private lighting, gas was practically stationary, showing an increase of only 0.2 per cent., while electricity increased 7.5 per cent. During the last decade the use of gas for cooking, heating, and industrial use had made good progress in Manchester, but a much lower price was necessary to encourage its more general adoption.

In the case of a municipality controlling both gas and electricity supplies, Mr. Newbigging held that there was no reason why the former department should not eventually become the gaseous fuel supplier, and the latter the light supplier. The fuel question was of great importance to the nation, and the gas industry had a better opportunity than any other of solving it, and with it the smoke problem, besides economising our coal resources and encouraging the growth of a variety of minor industries.

A Self-Adjusting Commutating Device.

By Prof. Miles Walker.

(*Section G.—Abstract.*)

It is well known that a continuous current generator fitted with commutating poles will not commutate very heavy overloads, owing to the magnetic saturation which occurs in the iron of the inter-pole. When the excitation becomes very great the saturation of the iron interferes with the proportionality that should exist between the current to be commutated and the commutating flux.

The rating of a frame, regarded from the commutating point of view, may be very much increased if for all loads the excitation of the interpole can be automatically varied so as to give for all loads the right commutating field.

The paper describes a device tried at the Manchester School of Technology which automatically produces the right amount of commutating flux over very wide ranges of load. So effective is the correcting influence, even where the diverter in parallel with the commutating-pole winding is deliberately put out of adjustment, that, whether it be short-circuited or given a resistance equal to five times the proper resistance, the flux will be preserved at approximately the correct value.

Each brush (say, the positive brush) consists of two parts, one part, A, fig. 1, being slightly in advance of the other on the commutator, and lightly insulated from it. The winding on the commutating pole has twice as many turns as one would ordinarily have, and the cross-section of the copper conductor is only sufficient to carry one-half of the armature current continuously. Thus the weight of copper on the commutating pole is the same as on machines as at present constructed. The part of the brush B may be connected through a diverter D, having the same resistance as the winding W, or the diverter may be dispensed with altogether. The direction of rotation of the machine is such that a point on the commutator passes first under B, then under A.

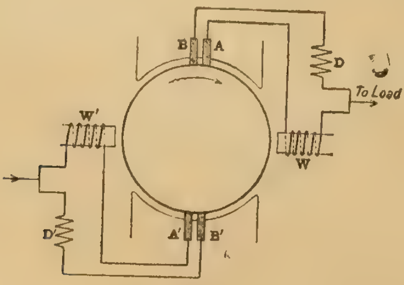


Fig. 1.

Assuming that the number of turns on the commutating pole is such as to give the right commutating flux when half current is passing through them, then it will be found that the current will divide evenly between brushes A and B, because the correct excitation of the commutating pole gives an even distribution of current over the face of the compound brush A B. If, however, the number of turns in W is too great, there is a tendency to over-commutation; that is to say, the current in B becomes greater and the current in A less. This has the effect of automatically weakening the commutating pole, and the pole remains of just such a strength as to bring about the required distribution of current between A and B.

It will be found on machines of ordinary rating, and more particularly on machines of very large rating, that the "correcting" voltage between A and B necessary to bring about a suitable division of current between the two brushes is normally very small, being of the order of .5 volt, whereas the voltage which can be generated between A and B by a pole being too weak or too strong may easily amount to 5 volts or more. Thus a very little disturbance in the equality of loading on brushes A and B is sufficient to yield the desired "correcting" voltage.

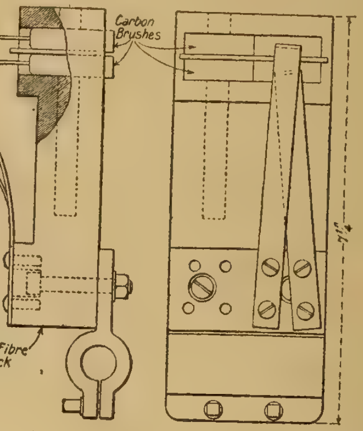


Fig. 2.—Type of Brush Holder for Double Brushes.

If for any reason the commutating pole tends to become too weak, owing, let us say, to the saturation of the iron of the pole, the induction of the armature coils carries the current forward to brush A, and tends to increase automatically the excitation of the commutating pole.

We can imagine an extreme case, though it would be difficult to attain in practice, in which the whole of the current would be carried forward to brush A. This would give an excitation on the commutating pole equal to double the excitation that would be obtained with the same load on an ordinary machine. We see that right up to this extreme case we would obtain good commutation—that is to say, up to the point at which the saturation of the pole required a doubling of the ratio between commutating pole ampere-turns and armature current.

The other brush (say the negative brush) may be either a simple one or it may be divided into brush A' and B'. In this case half the commutating poles would be in series with A and the other half in series with A'. A number of experiments were carried out by Mr. H. G. Bell on a 125-kw. 220-volt continuous-current generator in order to determine the amount of "correcting" voltage that could be obtained between brushes A and B. The brush-holder employed is shown in fig. 2 and the result of the experiments in fig. 3. The plan adopted was to change the resistance of the diverter D. The change of the resistance was not accompanied by a corresponding change in the current flowing through the diverter, there being only comparatively small change in the value of the current taken by A and B, and this small change affected the excitation of the commutating pole to such an extent as to generate between A and B a "correcting" voltage, and this voltage forced the current through the higher resistance of the diverter.

In fig. 3 are plotted the values of the "correcting" voltages at different loads for the different resistances of the diverter marked on the curves. Suppose that a current passing through W brings about a commutating pole strength which tends to divide the current so as to give I_B amperes to B and I_A amperes to A. Let the resistance of the diverter by R_D and the resistance of W be R_W. Then, if $I_B R_D = I_A R_W$, there will be no "correcting" voltage. If the value R_D be less than necessary for this equation, we will have what is called a "negative" correcting voltage, and if it be greater we will have a "positive" correcting voltage.

It will be seen that if there were no saturation of the commutating pole the value of R_D, which would require no "correcting" voltage, would be a constant. As soon as saturation occurs this ideal value of R_D is increased, as can be seen from the way in which the positive curves in fig. 3 turn over with increase of load.

A number of oscillograms were taken by Mr. Bell showing the behaviour of a generator provided with the correcting device described in this paper, and without the correcting device. It was found that with the correcting device the machine would take nine times full-load current without sparking, whereas with a normal adjustment of the diverter the machine sparked badly at a lower load.

A 500-kw. 500-volt rotary converter, built by the British Westinghouse Co., was fitted with the double-brush gear arranged as in fig. 1, and was found to give most excellent results. The machine was loaded by circulating the power through a 1,000-kw. converter provided with an alternating-current booster. It was found that with 3,000 amperes flowing (the largest current which could be circulated through rotaries and transformers with the existing arrangement) the commutation was sparkless. The device is being at present installed on a 1,500-kw. rotary converter, on which the commutating conditions would otherwise be rather difficult.

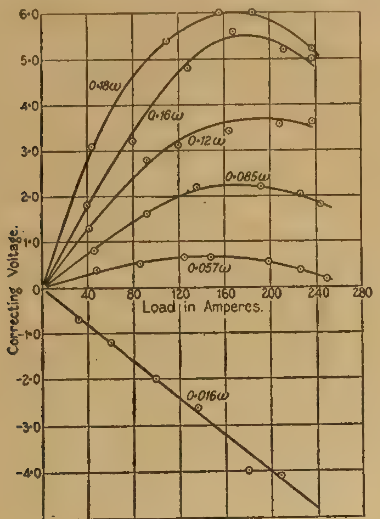


Fig. 3.

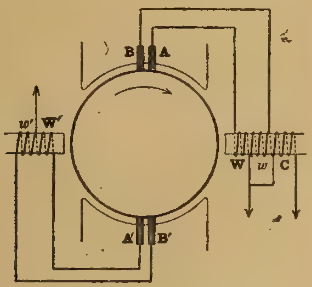


Fig. 4.

An alternative arrangement is shown in fig. 4. Here the current coming from B passes round the coil *w*, so as to give some opposing ampere-turns on the interpole. If the W turns are sufficiently great to wipe out the *w* turns and give the required excitation, then the arrangement works as described in connection with fig. 1. If it is desired to keep W and *w* the same, then the extra turns C can be added as shown in fig. 4. It is found in practice that the simple arrangement shown in fig. 1 is quite sufficiently effective in practice.

The Control of Fuel Consumption.

In the Chemistry Section, on Wednesday, September 8th, Prof. W. A. Bone, presiding in the absence in Flanders of Prof. H. B. Baker, discussed the great national importance of a more scientific control of fuel consumption and the utilisation of coal generally, with special reference to the situation created by the European conflict. He said that notwithstanding the fact that we were raising annually in the United Kingdom some 287 million tons of coal, of which 189 million tons were consumed at home, more or less wastefully, it was surprising how little had been done by the scientific community to impress upon the Government and the public the importance of establishing some systematic control or investigation of fuel consumption in all large industrial areas.

The contending armies depended upon certain distillation products of coal for their supplies of high explosives, and there was little doubt in his mind that Germany's violation of the neutrality of Belgium, and her subsequent seizure of that country and of a large tract of Northern France, had more than a purely political or strategic significance. She doubtless wanted also to seize for herself, and at the same time to deprive her enemies of, coalfields lying just beyond her own borders which were capable of furnishing abundant supplies of coal admirably adapted for yielding the raw materials for the manufacture of high explosives.

Fuel economy and the proper utilisation of coal, whether in connection with manufacturing operations or domestic heating, would become one of the most important national questions during the trying years that would follow hard upon this war, because of all directions in which national economy could be most healthfully and advantageously exercised, this was perhaps the most obvious and prolific. It was tolerably certain that, with an efficient and systematic public supervision of fuel consumption, we ought to be able, even with existing appliances, to save many millions of pounds of our annual coal bill, and with improved appliances still more millions, a saving which would in the long run redeem a considerable amount of the War Loan, which had been much more easily raised than it would be repaid.

He feared that not only were chemists for the most part lamentably ignorant of the nature of coal, and of modern technology, but they had been for many years past so indifferent about such questions that they had been content to leave them almost entirely to engineers, who, as a body, were notoriously deficient in chemical sense and experience. Nearly all that the modern student of chemistry was taught in our academies about combustion was known to Lavoisier, and he questioned whether in the majority of our University laboratories any investigation upon coal or combustion was ever undertaken. And yet the subject was full of the most fascinating and fundamental theoretical problems, for the most part unsolved, and the nation consumed every week as much coal as could be exchanged for the whole quantity of aniline dyes used by its textile industries in a year. Moreover, such advances as had been made in recent years, and they were by no means inconsiderable, had nearly all been in the direction of the wider application of gaseous fuels, yet in how many of our University laboratories was even gas analysis taught, or how many of our schools of chemistry provided systematic courses in the chemistry and manipulation of gases, without which no professional training of industrial chemists, however much research work it might include, ought to be considered satisfactory?

Alluding to the carbonisation of coal, he suggested that public interest would justify the Government in fixing by law a reasonable time limit beyond which no beehive coke oven installations would be allowed to remain in operation, except by express sanction of the State, and then only on special circumstances being proved. There was also much need of a better and more systematic chemical control, in the public interest, of by-product coking plants. He suggested that the Government be memorialised with a view to the establishment of a central organisation for the supervision of fuel consumption and the utilisation of coal, somewhat on the lines of the existing alkali works inspection, which had been so beneficial to the chemical industry. In connection with such an organisation there might be undertaken a much-needed systematic chemical survey of British coalfields, as well as experimental trial of new inventions for fuel economics.

(We are indebted to the *Yorkshire Post* for the foregoing report.)

A Note on "Earth Resistance."

By Prof. E. W. Marchant, D.Sc.

(*Section G.—Abstract.*)

In connection with the wireless station at Liverpool, some experiments have been made recently on the resistance to earth of three different types of earth plate. The earth most used was the water-pipe system of the building; in addition to this, an earth was formed by 14 2-in. cast-iron pipes, pointed and driven about 1 ft. into the ground, which, in Liverpool, is a good yellow sandstone; a third earth was formed by a copper plate 1 ft. 6 in. wide and 4 ft. 6 in. long, buried vertically at a depth at the lower edge of 6 ft. below ground, to which were riveted two copper strips, laid at a depth of 6 ft., each 1 in. wide and 40 ft. long. In both cases described the earth was made by burying the plates direct in the wet sandstone, without a surrounding volume of coke such as is usually recommended.

The specific resistance of the sandstone, when excavated from the soil and firmly pressed into a wooden box with copper plates at opposite faces, was 375 ohms per foot cube, the percentage moisture in the sand being 10 per cent. By measuring between these earths in succession the resistance of each of the three can be estimated. The following results were obtained :—

Earth resistance of copper plate and strip	6.1 ohms.
Earth resistance of iron pipes	42 ,,
Earth resistance of water pipes	3 ,,

After a very dry spell of weather the earth resistance was found to be about 6 per cent. greater than it was after the usual rainy conditions had prevailed for some weeks.

LEGAL.

Contract Difficulty with Interned Patentee.

In the Patents Court on Thursday last week, Messrs. J. Warner and Sons, Ltd., of the Spitalfields Bell Foundry, applied for power to manufacture an appliance for ringing church bells by electricity, under patents 27,457 of 1907 and 19,199 of 1910, in the name of Carl Herrde, of 33, Great Queen Street, Holborn, who is interned in a concentration camp.

For the applicants Mr. Ernest de Pass, chartered accountant, appeared, and Mr. A. Helbing watched the proceedings for the patentee.

Under the patent, the hammer is suspended within the bell, requiring no counterweight or spring to balance it, and the entire weight is available to ensure a powerful stroke. Prior to this patent the difficulty with electrically-actuated bells had been that, when the hammer struck, contact for the next cycle was made too soon, so that the armature exerted a retarding action on the hammer, which weakened the stroke and diminished the power of lifting the tongue. The patent interposes between the hammer and the armature means to prevent the circuit being closed prematurely, and contact for the next stroke is made at such a time that the effect of the electromagnet is not to diminish the impact of the hammer. A spindle carries one slow wheel and one fast wheel, the former actuating a contact device, and the whole operated by the swing of the hammer. The switch arrangement consists of a fulcrumed bar operating a swinging contact piece, and actuated by a rod, receiving motion from the armature. A keyboard may be fitted, with which tunes can be played electrically on any number of bells; the keyboard, by reason of its electrical operation, may be placed in any part of a church or building away from the belfry. The regulator patent is a dial, with attachments, by which, on placing a pointer at any number, the number of blows, from 3 to 80 per minute, may be struck upon a bell.

Applicants' licence was handed to the Controller of Patents, Mr. Temple Franks, by Mr. de Pass, who stated that while holding exclusive licence from the patentee they were not certain that their contract gave them power to manufacture. Under a certain clause Mr. Herrde had hitherto supplied all the electric fittings. Further, they were troubled as to whether any question could be raised of trading with the enemy. The applicants asked the Patents Court and the Board of Trade for power themselves to manufacture. They were prevented from fulfilling orders they had in hand.

The Controller said it looked as though the patentee granted the company power to sell, use and exercise the patent rights of the invention, and there was a further clause which referred to "manufacturing, selling and disposing of bells." This seemed to indicate that the right to manufacture was given in terms, but a later clause bound Messrs. Warner & Sons to place with the patentee orders for electric fittings to the amount of a certain sum per annum. That was wholly inconsistent with the right which seemed already to have been given to manufacture. The licensees were to be entitled to the sole right to manufacture in the event of the death, retirement, or bankruptcy of the patentee, or in default of his keeping the patents and inventions in full force and effect.

Mr. de Pass observed that the licensees had paid patent renewal fees in the patentee's default, and they said that he had broken his agreement.

The Controller said he must take the view that under the contract the applicants had power to manufacture.

Mr. de Pass said another question was raised. They could do nothing without the tools, drawings and patents for electric fittings, which were at Herrde's office, and these the landlord had seized for rent. He also said he had made advances to the patentee in respect of working.

Mr. Robert Warner, managing director of the applicant firm, stated that they had sold a considerable number of the apparatus, and desired now to manufacture for themselves.

The Controller, delivering judgment, said: As far as the agreement is concerned, I think you may commence to manufacture to-morrow, but you cannot manufacture without tools. The landlord may have a lien on them, and you must take legal opinion on your position there. It is possible after what you have said, and what you have paid, that you may have a prior lien. No question of trading with the enemy arises. As to agreements with alien enemies, generally speaking, the operations are suspended during the war. You cannot receive anything from him or pay him money. There is no need to ask the Board of Trade to annul the existing licence and to give you a new one in different terms.

Metropolitan Munitions Case.

On Monday, at Caxton Hall, at a local Court of the Metropolitan Munitions Tribunal, complaints were brought by a telephone manufacturing company, which is engaged upon war work, against eight of its employés, alleging that on a certain night they took their meals at the wrong hours and absented themselves from important work without leave. The matter is reported in Tuesday's *Times*.

Mr. Burney, the managing director of the company, said that new hours and regulations were put in force as the result of a more complete night-shift. A deputation waited on the firm to protest against the new hours. The men on Friday, September 10th, ignored the rules, got their money, and did not come back. They were still out.

Mr. Swales, a representative from the men's Union, said they were not objecting to long hours, but to the alteration of hours for meals. The proper method in the case of a dispute was for the Board of Trade to be acquainted with the facts, or, in a controlled establishment, the men should have due notice of any change and an opportunity of discussing the matter.

Mr. Burney said that the matter had been taken to the Board of Trade, but the men had held a pistol at the employers' heads.

The President said the Court was satisfied that the rules became known to the men early in the controversy. It was a pity they took that high-handed action. It was a serious offence, and seven of the men would be fined £1 each. The eighth man, who had since returned to work, would be reprimanded.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

12,730. "Bipolar electrode electrolyzers." G. G. Hepburn. September 6th.

12,747. "Protective devices for electric systems." British Thomson-Houston Co., Ltd. September 6th. (General Electric Co., United States.)

12,748. "Dynamo-electric machines." H. Chitty. September 6th.

12,772. "Electrical switches." A. C. Wynne. September 7th. (Complete.)

12,781. "Electric lighting of vehicles." P. F. Smith & V. S. Robinson. September 7th.

12,792. "Electric lamps." British Thomson-Houston Co., Ltd. September 7th. (General Electric Co., United States.)

12,798. "Multiple-filament electric lamps." L. Simonotti & E. Simonotti. September 7th. (Complete.)

12,810. "Controllers for electric motors." H. E. Dey. September 7th. (Convention date, September 29th, 1914, United States.) (Complete.)

12,834. "Method of generating high-frequency electric currents." T. F. Wall. September 8th.

12,848. "Trolley heads." G. R. Taylor. September 8th.

12,868. "Electric motor control systems." British Thomson-Houston Co., Ltd. September 8th. (General Electric Co., United States.)

12,869. "Microphonic detectors." Western Electric Co., Ltd., & G. H. Nash. September 8th.

12,876. "Method of and means for the electrolytic production of gaseous fuel for internal-combustion engines and other purposes." T. R. Cowling. September 8th. (N L. Cowling, British Expeditionary Force.)

12,882. "Production of continuous electrical oscillations." Marconi's Wireless Telegraph Co., Ltd., & G. M. Wright. September 8th.

12,883. "Electro-mechanical locks for the gates or doors of electric lifts and the like." M. D. Scott. September 8th.

12,924. "Electric heating apparatus." G. Pate & A. R. Wood. September 9th. (Complete.)

12,936. "Apparatus for use in connection with secondary storage batteries." O. Oldham. September 9th.

12,951. "Electro-magnetically-controlled valves for use in connection with the electro-pneumatic actions of organs and like musical instruments." H. Willis, Jun. September 9th. (Complete.)

12,974. "Electrical heat-diffusing apparatus for medical and other purposes." I. Gaunt. September 10th.

12,984. "Electrical cooking apparatus and switchgear therefor." F. S. Grogan & E. W. B. Burder. September 10th. (Complete.)

12,994. "Electric lamps." G. M. J. Mackay. September 10th. (Convention date, September 12th, 1914, United States.) (Complete.)

12,995. "Electric lamps." J. A. Orange. September 10th. (Convention date, September 12th, 1914, United States.) (Complete.)

13,033. "Means for transmitting signals electrically." G. B. Reeve. September 11th.

PUBLISHED SPECIFICATIONS.

1914.

7,821. Enclosed Electric Motors for Driving Machines under Water Signal Ges. March 27th. (March 29th, 1913.)

12,673. Electric Jacquards, Card-punching Machines, or the like. Oesterreichische Siemens Schuckertwerke & Regal Patente Ges. May 22nd. (May 30th, 1913.)

17,246. Transmission of Electrical Impulses over Telephone and Telegraph Circuits of High Electrostatic Capacity. G. Musso. July 21st.

17,328. Means for Controlling the Heating Effect of Electric Heating Apparatus. A. F. Berry. July 21st.

17,329. Electrical Heating Apparatus. A. F. Berry. July 21st.

18,971. Electric Distribution Systems. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). August 22nd.

19,121. Electrical Continuity of Electrical Conduits and other Tubes. R. W. Perry. August 27th.

19,238. Electro-magnetic Track Brakes. D. Storjohann. August 29th.

19,290. Electric Switches. T. G. Nyborg. September 1st.

19,316. Insulators for Aerial Strainers or the like, and the Manufacture thereof. T. Sloper September 1st.

19,483. Electric Telegraphy. W. Judd, Davies & Eastern Telegraph Co., Ltd. September 5th.

19,942. Electric Heating for Metal Working. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). September 18th.

21,157. Points, Switches and the like, of Tracks for Electrically-driven Vehicles. R. Cumming. October 19th.

21,825. Cooling of Dynamo-electric Machines. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). October 31st.

22,744. Grinders for Commutators or Distributors of Ford or other Motor-car Engines. W. L. Ross. November 19th.

23,182. Electric Accumulators. G. Fuller, L. Fuller & G. J. A. Fuller. November 27th.

23,628. Magnetos and other Electric Generators. A. Keller-Dorian. December 5th. (December 6th, 1913. Addition to 8,931/14.)

24,428. Sparking Plug Tester. G. W. King. December 21st.

1915.

58. Means for the Electrical Transmission and Distant Control of Movements, specially applicable to Systems for Signalling Orders and the like. E. A. Graham & W. J. Rickets. January 1st. (Addition to 6,214/14.)

450. Process of and Means for Manufacturing Carbons for Arc Lamps Compagnie des Charbons Fabius Henrion. January 11th. (January 13th, 1914.)

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Vol. LXXVII.] CONTENTS: October 1, 1915. [No. 1,975.

Page
Labour after the War ... 417
The Copper in German Electricity Works ... 418
Lead ... 418
Ought we to Grumble? ... 419
The Tramway Labour Problem ... 419
The Municipal Tramways Association ... 420
The British Association.—IV. ... 422
  Labour after the War ... 422
  Industrial Fatigue ... 423
  The Heating of Iron when Magnetised at very High Frequencies (*illus.*) ... 423
  Transformer Core Loss as affected by Triple Harmonics (*illus.*) ... 424
  Radiotelegraphic Investigations ... 425
  The Capacity of Aerials of the Umbrella Type ... 426
  Gaseous Explosions ... 426
  Exposure Tests of Light Aluminium Alloys ... 426
  The Cadmium-Vapour Arc-Lamp ... 426
New Electrical Devices, Fittings and Plant (*illus.*) ... 426
Legal ... 427
Correspondence—
  Pocket Dry Batteries ... 427
  Telegraph and Telephone Tariffs ... 427
  The A.E.G. Meeting ... 428
Business Notes ... 428
London and South-Western Railway Electrification (*illus.*) ... 431
The Supply of Electricity at Stowmarket (*illus.*) ... 433
Notes ... 437
City Notes ... 440
Stocks and Shares ... 441
Share List of Electrical Companies ... 442
Market Quotations ... 442
The Problem of the "Point-Five" Tariff (*illus.*) ... 443
Preferential Rates for Exports, by F. Broadbent ... 444
Trade Statistics of South Africa ... 445
Arc Phenomena, by A. G. Collis (*illus.*) ... 446
War Items ... 447
New Patents Applied for, 1915 ... 448
Abstracts of Published Specifications ... 448
Contractors' Column ... Advertisement page xx

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LABOUR AFTER THE WAR.

WHILE the nation is still engaged in discussing what are the best measures to adopt in order to draw men away from their ordinary callings to "do their bit" for the Allied cause, either with the fighting forces or in the factory ranks, it may seem to be premature to enter at all deeply into the probable position of Labour after peace is proclaimed and the clearing-up stage of this colossal holocaust has been reached. Yet the problem is one of such vast importance and of such enormous proportions that it is unwise for its consideration to be long deferred. True it is that we have never had to face such a situation before, and, having little experience to guide us, shall have to shape and reshape our policies with the change of events, but the movements that are taking place in our midst must be closely watched by the most capable minds that can be brought to bear upon the subject. Already we have organisations dealing with the situation, and doubtless our Allies and our enemies are also occupied with it; only a week or two ago we recorded that Germans who were permanently disabled were being taught elementary mechanics. All the leading nations of Europe, and especially the manufacturing ones, will have to deal with the same problem, though in different countries it will take on different aspects. Though our own calls to the fighting line have been numerically less than those of our great Allies, we shall have a large and delicate series of operations to go through before we can return to anything approximating to the industrial state of things that prevailed in July, 1914. Our own problem is quite sufficient to absorb our thought; each nation will have its own particular difficulties. So far as we are concerned, not only has the industry of our Empire been disorganised in order to remedy defects in national organisation, workers having changed from one trade to another and from one locality to another, but the whole citadel of labour principles has been stormed as the result of the attack of Prussianism upon our supposedly sacrosanct individual Liberty. Already disabled soldiers have returned by the hundred thousand; large numbers of them will be permanently unfit for the colliery, the factory, and the works; their experience will, we fear, be multiplied perhaps many times as our brave fellows continue to make their gallant stand; large numbers will probably choose a freer life in the Colonies instead of returning to accustomed industries; hundreds of thousands of others will have made the great sacrifice on our behalf and be free from all the trammels of civilised industry. In these ways the ranks of the industrial workers will be thinned in comparison with pre-war times. But while the position in Europe continues as it is at present, we cannot see far ahead in regard to these matters. We must go on enlisting and training more men and yet more men, and we must further disarrange ordinary industry in order to increase the output of munitions, leaving it to those who are unable to help in either capacity to bring any special experience or knowledge that they may possess to bear upon the probable or possible effects of present happenings on the course of employment affairs in the years that are to follow. Therefore, it was a wise decision on the part of the British Association to appoint a conference to investigate the "Outlets for Labour after the War." This conference presented an interim report to the Economic Section at the Manchester meeting. The terms of reference were as follows:—

1. To investigate into the replacement of men by women in industries during the war.
2. The permanent effects of this after the war.
3. The character of re-employment with respect to changes of tastes and physique amongst those who have served with the Forces and are disbanded.
4. Suggest means by which consequent unemployment may be counteracted or minimised.
5. Possibility of employing disbanded men on the land.

It was decided that the best method of dealing with the first two terms of this reference would be to investigate those industries in which the extra employment of women since the war had been most marked, as well as those industries in which there were possibilities of an extension of women's work, with special reference to trades localised in the London, Manchester, Leeds, and Birmingham districts.

The last three terms of the reference were left to be dealt with by papers and discussions. The report was, therefore, confined to the replacement of men by women in industries as a result of the war, and the possible permanent effects of this displacement.

We publish a summary of some of the contents of the report elsewhere, and commend the whole subject, of which the employment of women is but a part, to the very careful attention of all our readers.

The Copper in German Electricity Works. It was recently stated in this journal, on the basis of German calculations, that the Teutons claimed to be in possession of an adequate supply of copper for a number of years in the form of copper and copper alloys, which have been consumed in the country for industrial and other purposes, including electric lighting and power stations and tramway equipment, during the course of many years past. It may now be assumed as a definite fact that numerous manufactures of copper and its alloys have already been appropriated for the use of the munition works, and that with the exception of copper equipment in industrial works acting as auxiliaries of war and the electricity works and tramways, very little of this metal remains available for the use of the army authorities; but the time seems to be approaching when recourse will necessarily have to be had, even to the works which have hitherto been exempt from official levies on materials. If this were not the case we should not find, as was reported from Zurich on September 21st, an important quotation from the well-known *Elektrotechnische Zeitschrift*, of Berlin. This journal, it is stated, has raised a protest against the prospective eventuality of the authorities laying hands on the electricity works owing to the scarcity of copper. It is suggested that the Government should, in the first place, take possession of the roofs of the churches and castles and melt all the bells containing a good alloy of copper, and that other metals should be substituted for the copper tubes of locomotive boilers. It is calculated by the journal in question, that by making the latter alteration 150,000 tons of copper would be realised. The statement made by the Berlin journal is a welcome announcement to this country, as it indicates the difficulties with which the Germans are now becoming confronted in connection with the continuation of the war. But we no longer hear anything of the reported discovery of a substitute for copper, as was announced several months ago at a meeting of a well-known iron and steel association in Germany. The Teutons, it was claimed, did not require any copper, as they had found a substitute; but now the Berlin electrical journal discloses the fact that copper is becoming scarce, and is in urgent request.

Lead. A distinct and rather sharp upward movement has been seen within the past week or so in the lead market, which has drifted into a rather dull position with less business doing both for home and export. The buying movement, which was responsible for the improved appearance, seems to have been based upon a heavy demand for September shipments to Russia. Dealers here had held a good deal of metal for dispatch to Archangel by vessels leaving British ports during the current month, and it became necessary to provide material in connection with the contracts entered into; some repurchases were necessary also, because metal which had been expected to arrive in time had been delayed. A result of the inquiries thus coming upon the market already poorly supplied with near metal, was to encourage holders to assume a much more resolute attitude, and with prices advancing, speculators who had gone short of the metal were also induced to come forward. For a day or two, the advancing prices in early shipment lead had hardly any effect upon the tendency of forward positions, but even these have now commenced to feel the effects of the more encouraging sentiment, although they still stand at a very substantial discount compared with prompt contracts. The upward turn in the market has come as a complete surprise, for in its early stages it synchronised with a much more accommodating attitude on the part of American holders, who, it is believed, were feeling the weight of the quantities held across the Atlantic, and were desirous of making sales for export. They booked up a number of orders for South America and some other markets, and they also sold about 1,000 tons or a little more for shipment to the United Kingdom, but since the market began to take an upward turn, they have once more withdrawn, although no doubt they are waiting for what they would be disposed to regard as a favourable opportunity of supplying the demands. Additional business could have been done for shipment from America had sellers only been able to secure the necessary amount of freight room, but in this effort they appear to have been unsuccessful. The position generally is one of complexity. Production seems to be pretty ample, in spite of the difficulties in Mexico, but there are recurring periods of vigorous buying, mainly on Russian account, which for the time being are upset by calculations based upon what is believed to be the actual condition of the market.

Ought we to Grumble?

We are quite prepared to make due allowance for His Majesty's Stationery and Printing Department, and the printing firms working in co-operation with it, in these days, and we are in agreement with the Committee which has advocated the introduction of more economical, and, may we say, more efficient preparation and circulation of the thousands of documents that the said department has to produce. But the receipt in this month of September, 1915, of a number of Consular reports for the year 1913 tempts us to be more or less critical in our attitude and to ask of what practical value it is to learn that the supplies of ice from Norway to the United Kingdom fell off very materially because of our cold and wet summer in those dim and distant days before the war, or to receive the interesting information that such and such an electrical undertaking "will be completed during 1914," or to be told that the supplies of eggs exported from Denmark in 1913 amounted to nearly 4,000,000 score more than in 1912? It looks almost as though the Government, which with one hand gave excellent assistance with its material for the capturing of enemy trade, had had to withhold with the other its usual Consular reports, thereby lending some weight to the criticism of traders that after all Consular reports do not matter. We are treated to more up-to-date information respecting the trade of Swatow, in China, for therein we read of what happened in 1914, but when we find that in the interior robbery, piracy, clan fighting and secret society activity produce a feeling of insecurity among the trading classes, we are not enamoured of the trading opportunity, and may be allowed to wonder why Swatow is selected for such expeditious publication, while countries nearer home must wait before their tale is told. From Ichang, in China, too, we are favoured with the 1914 report, but the Consul himself vouchsafes the information that with one single exception "there is nothing of interest to report as regards the trade." What a lot of things there are that, when we really examine into them, "do not matter"! But it were neither kind nor generous to be querulous when the Board of Trade has shown a more real interest in trade affairs, and it were unfair to allot to it blame which is really not its due; the congestion in the Stationery Department, and other difficulties consequent upon the war, doubtless being the actual causes. Perhaps, however, we may be allowed to say that this is one of the things that will want serious looking into "after the war." If we are to have official and complete, and often very useful and interesting, reports prepared by Government representatives for consumption by those engaged in "live" trading operations at home, then it is "up to" those responsible to see that those statements are not hung up so long as to be of, comparatively speaking, little value by the time they appear in print. It looks as though there will require to be a good deal of "speeding up" in these matters when we have finished off our shell and bayonet operations and resumed the battle with the methods of trade competition. Either Board of Trade and Foreign Office reorganisation, long understood to be in hand, or else a Minister of Commerce, seems inevitable unless we are to remain inefficiently served in the matter in question.

The Tramway Labour Problem.

The dominant note of the Municipal Tramways Conference—held last week in London—was undoubtedly the labour difficulty, brought about by the present war. Last year, it may be remembered, the annual Conference, which usually takes place in September, was abandoned in consequence of the outbreak of hostilities, and it is possible that a similar course would have been followed this year, had it not been felt that there were some tramway questions arising out of the war which might be discussed with considerable advantage.

We have now had a year's experience of tramway operation under war conditions, and, generally speaking, the position throughout the country is much more satisfactory than might have been anticipated. Traffic returns are, in many instances, higher than ever previously, due, no doubt, to the increased spending power of a very large section of the working classes as a result of well-known causes; difficulties have also arisen, and, no doubt, will continue to arise, but, so far, they have not proved insurmountable. Principal amongst these are increased cost and difficulty of obtaining labour, increased cost of materials, and increased taxation, and it is to be feared that these will, in too many cases, entirely swallow usual profit margins.

The discussion arising from Mr. Dalrymple's remarks on the tramway labour problem showed that the enforced experiment of employing female labour on our tramways has proved very successful so far; but it is somewhat early to make a definite pronouncement on the subject, as the women have yet to show their physical fitness to meet the exposure of the winter and the continuous muscular strain of ascending and descending to and from the top deck, which falls to the lot of the men, but has so far been largely avoided in the case of the women by allowing fares to be taken on the platforms.

Probably few will doubt the mental capability or nimbleness of the average woman of, say, 30, but her ability to withstand physical strain and exposure, year in and year out, may well be questioned. So far the women have received the same wages as the male conductors (27s. a week at Glasgow), this being a stipulation on the part of the men, who naturally wished to discourage cheaper labour.

But if the experiment succeeds during the coming winter—which is not certain—and if, as at Glasgow, a woman is found capable of looking after a car on the road after only eight days' training, it will be impossible to avoid the reflection that this branch of the tramway service has been even more excessively overpaid in the past than has been generally assumed. Moreover, such inflated rates of pay for the women are unfair to other employers and to the ratepayers generally, since the supply of female labour is greatly in excess of the demand; in Glasgow 800 women have been engaged and 12,000 applications were received, and a similar state of affairs exists in other cities.

It is understood, of course, that the "tramway woman" is a temporary innovation, since the men's jobs are being kept open for them, and so far the woman driver has not made her appearance, although the front platform appears to be sadly in need of recruits, and a woman, if physically fitted, could doubtless be trained for this work as for motor-car driving,

But another matter, which it seems to us is equally as important as this question of female labour and largely bound up with it, is the future rate of pay for tramway work. Many people are firmly convinced that the higher rates of pay introduced since the war will become permanent; some hint that the Budget will result in a further application for an increase in wages owing to the increased cost of living. We have no doubt as to the normal attitude of the labour organisations in the matter, but we believe that economic considerations will override all others; the privileged treatment of any particular section of the population with regard to the financial burdens of the war is surely a thing of the past, and it needs a considerable share of optimism to believe that labour will be as scarce and employment as brisk after the war as they are under the present exceptional circumstances, a creed which those who believe in the continuance of high wages must subscribe to.

We have not here referred specifically to the discussion initiated by Mr. Baker, on tramway finance, and it is only necessary to say that we entirely agree with the common-sense action of both Birmingham and Leicester in increasing their tramway fares sufficiently to meet the estimated financial requirements of the next year or two; we take it that those tramway managers who express disapproval of such a course are satisfied that the profit margin in their particular undertakings is ample enough to meet the strain of the very uncertain period ahead. The only alternative seems to be a call on the rates, which can only be defended in the last resort.

THE MUNICIPAL TRAMWAYS ASSOCIATION.

At the annual Conference of the above Association, which took place on Thursday and Friday, last week, at the Surveyors' Institution, Great George Street, S.W., the Presidential Address, to which we referred briefly last week, was delivered by Alderman H. Linsley, Chairman of the Salford Corporation Tramways Committee, who has filled the presidential office for two years in succession.

Owing to the exceptional circumstances of last autumn, the annual Conference was not held, and this year, instead of holding the meeting at Salford, as would have been the case in the ordinary way, it was decided to meet in London, and restrict the business to discussion of certain tramway questions arising from the war, and to the ordinary business meeting necessary under the Articles of Association.

Of the subjects for discussion, the first, "Tramway Labour Problems as Affected by the War," was introduced by Mr. Jas. Dalrymple, of Glasgow.

Mr. Dalrymple pointed out that there would, no doubt, be very varying conditions in the different tramway undertakings, and that no general experience could be given.

So far as the general staff of tradesmen and labourers was concerned, the war had not in a general way affected the Glasgow tramways. In the car-sheds 129 out of about 512 men had enlisted, and there were 119 fewer men employed now than 14 months ago. Much Government work was being done, and new work was quite stopped; it was impossible to get more tradesmen.

The men had either received increased wages or a war bonus of 2s. per week. Of those engaged in building work, 119 had gone; in the matter of car cleaning, the staff of 635 in August last year was reduced to 472.

The uniformed traffic staff of 3,249 at the same date was reduced to 3,123, and this total included 818 women as conductors. The efforts to engage men unfit for military service had been unsuccessful, and for some time past the staff had had to work seven days a week, and the car services were curtailed. Since March they had got very few men, and therefore relied chiefly on women, but the difficulty was the shortage of motormen.

The working week for the whole staff was 51 hours, and both men and women conductors were paid 27s. per week, but the men received a bonus in addition. About 12,000 women had applied for situations; those selected were from 25 to 35 years of age, about 300 being married women and 55 widows. They had found female conductors very satisfactory, as they were quick, and the passengers were pleased; the latter were encouraged to pay their fares on the platform before going up to the top deck, in order to lessen the work of the women, who had been helped by the men as far as possible. The women had the same conditions of service as the men, but were not asked to work seven days a week; they were employed on all routes, even the roughest ones.

He closed by reminding them that he said nothing of the effect of this work on the health of the women, or of the future; but the women were now doing the same work as the men, and last week they carried more passengers and drew more revenue than ever previously.

Mr. C. W. Mallins (Liverpool) doubted whether female conductors could be safely used on hilly routes, and this was a drawback; they could be used as car cleaners, but the difficulty was what would happen when the men returned. In Liverpool there was plenty of male labour above military age, and his outside staff was composed of men. A question much more important at the moment than female labour, was the utilisation of the resources of the tramways for munition work, and he appealed to the President to utilise the organisation of the Association to this end.

[Both the President and the Hon. Secretary reassured Mr. Mallins on this matter.]

Ald. Dunsford (Southampton) said that in his town, the female conductors who had been put on temporarily had proved a success, but boy labour, which had also been tried, was a failure.

Mr. Wm Murray (Walthamstow) strongly urged the necessity of employing female labour on the tramways in the metropolitan area, where, however, the police had up to now refused to consider the matter. Tramway services had had to be curtailed, and serious overcrowding took place owing to the shortage of men, yet the police authorities stood in the way of employing women. He hoped the Association would take this matter up in connection with the London area.

Ald. Sir J. W. Courtis (Cardiff) said their experience with 50 or 60 women on the cars had been satisfactory, but he disagreed with the employment of too young women or youths. Objections had been raised by the male staff at Cardiff, but they would not have been able to keep going without employing women; these were taking a full share of the duties and receiving 5d. an hour.

Mr. Theo. Prestige (vice-chairman, L.C.C. Highways Committee) suggested that the Association should enlist the aid of the chief recruiting officer in favour of employing women on the tramways of the metropolis, and pass a resolution on the matter.

Mr. T. B. Goodyer (Croydon) said he understood that there was now some hope of the metropolitan police altering their attitude towards female labour on the tramways.

Ald. Brown (Leeds) urged that at the present time serious attention should be given to the question of reducing both labour and working expenses. Although the employment of women had been criticised, he believed they had come to stay, but a difficulty which would have to be faced was the high wages paid; he did not think it right that the woman conductor should receive, to commence with, the same pay as a man, as this might affect all other employers of female labour.

Mr. A. L. C. Fell (L.C.C. tramways) said it was only right to mention that the Metropolitan Commissioner of Police had met them in their efforts to maintain the tramway services, by allowing overloading of the cars. He thought that in any case it would be scandalous to employ women on these crowded cars, but that they should be allowed on outlying routes and in special cases.

Ald. F. Smith (Liverpool) agreed that it was quite time the Association took up the question of tramway labour in London.

Mr. A. R. Fearnley (Sheffield) said there were now 300 women conductors on the Sheffield cars, and more were being taken on; their work was quite satisfactory. Great care was exercised in selecting the women, of whom far too many applied; they were paid at the same rate as the men (6d. an hour), and worked the same hours, and the men offered every assistance. He thought Mr. Mallins was quite wrong in doubting the ability of the woman conductor; in Sheffield they were employed on the hilly routes. In fact, the question was not: could women do the work? but, rather, could they not do it better than it had ever been done before? The women had certain little failings, but the remedy was to employ women inspectors; it had also been found advisable to run staff cars to bring them to work and take them back to the suburbs late at night. In Sheffield they were dealing with a 25 per cent. increase in traffic over last year, and the women conductors were doing this. The shed and repair shop, however, was much depleted owing to munitions work.

Ald. Banton (Leicester) was strongly opposed to employing female labour with an idea of reducing expenses; it would not make for efficiency.

In the end, Mr. Theo. Prestige (L.C.C.) moved a resolution that the meeting should request the executive of the Association to approach the Home Secretary, with the object of removing the present restrictions as to the employment of women as tramway conductors in the metropolitan area.

This was seconded by Mr. L. E. Harvey (Ilford), and carried unanimously.

Mr. Peter Fisher (Dundee), in response to a request by the President, mentioned that in his area female labour was scarce and none was employed on the cars. A third of their employés had enlisted, and others were engaged on Government work, so they took on men over military age, but 60 per cent. of them failed, being unable to accustom themselves to the regular routine. He had come to the conclusion that there was not the necessary male labour to carry on ordinary tramway work.

The President, in closing the discussion, said that at Salford female conductors had given every satisfaction.

In the afternoon Mr. Alfred Baker, Birmingham, introduced a discussion on "Financial Problems as Affecting Tramways During the War."

Mr. Baker said that things had gone well for a number of years with municipal tramways; in many cases large profits were earned and depreciation was provided for, and the position was a sound one. In the early days when the tramways were taken over, tramway committees had dealt generously with the travelling public fares were greatly reduced and other concessions given; but during the past three or four years expenses had gone up materially, and many of them had begun to look at the financial situation even before war broke out, and the position was much worse now. Very large payments were being made to the dependents of of men who had joined the Forces. The cost of stores and materials had gone up all round by at least 27 per cent. as compared with 1912-13, while the traffic and permanent-way staff wages showed an increase of 10 per cent., and those of the skilled trades, of 7½ to 12½ per cent. Local rates (at Birmingham) had more than doubled in three years, due to revaluations of the undertaking; and the income-tax, in view of the Budget proposals, might in 1915-16 be £10,000 in excess of that of 1912-13. The net result was a great decrease in the surplus, as shown by the following figures:—

Year.		Receipts.	Expenses, interest and sinking fund.	Depreciation.	Relief of rates.
1912-13	...	£581,566	£485,794	£45,000	£62,248
1913-14	...	635,470	567,788	31,000	45,168
1914-15	...	647,014	604,844	17,596	30,130

It would be noted that although £30,000 had gone to the rates, this should really have gone to depreciation. The financial position at Birmingham was becoming so acute that steps had to be taken to meet it, and it was decided to raise the "selling price." It had been suggested that they should decrease costs, but economies in repairs, &c., only resulted in storing up liabilities. A new schedule of increased fares was, therefore, adopted, and, despite the doubts of some critics, had been quite successful, the receipts per car-mile being for August, 1914, 10·17d., and for August, 1915, 13·18d., an increase of 3·01d.; for June, 1915, the receipts were 11·69d., showing between then and August that there was an increased revenue of nearly 1½d. per car-mile, which amounted to £1,666 per week. It might be suggested that the fares would need to be reduced after the war, but he thought expenses would remain at a high level after the war. They had raised the price when there was plenty of money about, as there might be a slump after the war; they expected to be from 70 to 80 thousand pounds better off on the year as a result.

Mr. C. W. Mallins (Liverpool) and **Mr. Arthur Ellis** (Cardiff) both agreed with the policy adopted at Birmingham, but the latter thought it strange that the rates should have received £30,000 before securing the right amount for depreciation. He thought expenses would not go down after the war, and that the fares should be kept up, if they were put up.

Ald. Smithson (Leeds) said it was no use taking a too pessimistic view of the future, there might be a surplus of labour and a slump in wages after the war.

Bailie Alston (Glasgow) agreed with the last speaker; he condemned the subsidising of the rates until indebtedness to the public was wiped out, and expressed astonishment that the Birmingham Finance Committee should interfere with tramways finance.

Ald. Smith (Liverpool) upheld the principle of rate aid, as he considered that the ratepayers who had taken the risks were entitled to some contribution from the tramways.

Mr. McElroy (Manchester) said that from the start operating costs had been going up, and earnings per head of population going down, and he thought they should be careful before agreeing that the correct policy was to increase fares. The tendency had been rather to increase the number of rides.

Mr. C. J. Spencer (Bradford) thought this was the first example of a large undertaking increasing fares as a policy, and it appeared to have resulted successfully. They had had a number of problems before them, and they might only be temporary ones; the tramways were in an extraordinarily successful position, and the future of wages rested on economic considerations.

Mr. Hy. Mozley (Burnley) said his Committee believed in handing over 3½ per cent. to the Finance Committee, which they could apply as they wished; at present depreciation contributions were suspended and the money went to the rates. He did not agree that expenses would necessarily remain at a high level after the war, and suggested that they should take a less pessimistic view of affairs.

Ald. Sir J. W. Courtis (Cardiff) asked what the effect of the present Budget taxation would be. It was possible that they would have an application from the men for a further increase of wages.

Mr. J. B. Hamilton (Leeds) entirely disagreed with the tenour of Mr. Baker's remarks; it would require a great amount of deliberation in Leeds to charge higher fares, if they could get along on the old basis. The revenues of nearly all large tramway undertakings showed considerable increases, and he was not sure that at Birmingham the increase could be solely attributed to the raising of the fares.

Mr. Robson (Southampton) said it was probable that the improved revenue was due to the inflated earnings in the Birmingham district, and that when the Budget effect was felt, travelling would fall off.

Ald. Flint (Leicester) said he thought it was better to make provision now for the future. Despite the upward tendency of receipts, expenses were going up even more, and at Leicester it was considered that 40 or 50 thousand pounds more would be required next year to meet expenses, so they had decided to follow Birmingham's example and raise fares.

Mr. Baker briefly replied to the discussion, pointing out that unless they had been charging passengers much more than they ought all these years, they must raise the fares now.

On Friday morning the annual business meeting was held, when the report of the Council was adopted, and subsequently Mr. Peter Fisher, general manager of the Dundee tramways, was elected president of the Association for the coming year, and Mr. Henry Mozley, of Burnley, was elected vice-president.

The report of the Executive Council, submitted at the annual general meeting, contains the following comparative summary of the members for the past four years:—

	1911-12.	1912-13.	1913-14.	1914-15.
Honorary members ...	1	1	1	1
Local authorities	72	75	75	76
Managers and assistants ...	105	109	111	111

The Executive Council has been approached by the Electric Vehicle Committee, which has been founded under the auspices of the I.M.E.A., and which is affiliated with the Electric Vehicle Association of America, to co-operate with them by nominating a representative to sit upon the Committee, whose main object is to encourage the development of the electric vehicle.

The Council thought it desireable that it should be represented on the Electric Vehicle Committee, and appointed Mr. A. R. Fearnley, of the Sheffield Corporation Tramways, as its representative on this Committee.

The Joint Committee, representing the Municipal Tramways Association, and the Tramways and Light Railways Association, completed its investigations of the question of tramway controllers and their connections so far as they concern magnetic brakes, and submitted a report thereon to the Association.

Mr. A. L. C. Fell, L.C.C. tramways, has been experimenting with a modified arrangement of the controller connections, with a view to overcoming faults existing on the early Dick, Kerr type of controller, used on the L.C.C. tramways, and the following is an abstract of the communication sent to the members as a supplement to the above-mentioned report:—

"As these modifications to a very large extent overcome the faults especially referred to under Group I of the Committee's report, the method adopted may be of interest to your Association.

"Fault.	"Alterations Made.
"(*a*) The terminal boards are fitted in the lower part of the controller with terminals very close together, making it difficult to avoid overlapping of the cables leading thereto, and thus introducing a potential defect in the form of abrasion of the cable insulation.	"The terminals on the finger boards have been removed and special terminals fitted to the finger bases.
"(*c*) The cutting out of one motor from any cause whatever, whether voluntary or otherwise, renders the electric brake entirely inoperative.	"This fault occurs where the motors are connected in cascade for braking, and are therefore inter-dependent on one another. The controller wiring has been rearranged in such a manner that the motors are connected in parallel and equalised, braking with one motor thereby being rendered possible.
"(*d*) Difficulty is experienced in maintaining part of the brake-circuit in a state of efficiency, as magnetic braking was not arranged for in the original design, and certain fingers and segments have had to be added for this purpose in spaces not sufficiently large to ensure the best possible insulation.	"Ample space for the additional fingers and segments required has been obtained by the removal of the terminals referred to under.

"Incidentally, it might be noted that the removal of the terminals eliminates a considerable amount of the controller back wiring and joints, and in addition to the improved braking obtained, a very material reduction in the number of armature and field coil failures is anticipated with the altered controllers."

The Caledonian Railway Co. sought Parliamentary powers to run omnibuses and road vehicles.

The Corporations of Glasgow, Dundee, Edinburgh and Aberdeen, petitioned against the Bill, and the Association undertook to give every possible assistance, and notification was subsequently received that the railway company had decided not to proceed with the clauses relating to motor road vehicles.

The Sub-Committee appointed to deal with motor omnibus traffic, road maintenance, &c., in consultation with the Association's London agents, was informed that the terms of reference of the proposed Committee, composed of members of both Houses, to investigate the question of motor omnibus traffic and road maintenance, were as under:—"That it is desirable that a Joint Committee of both Houses be appointed to inquire into and report as to the present law relating to the running of motor omnibuses and trolley vehicles under statutory powers and otherwise, whether any amendment is necessary with respect to the control to be exercised by local authorities: and what contributions, if any, should be payable towards the cost of road maintenance by the proprietors of such vehicles."

The Sub-Committee decided to communicate with the Association of Municipal Corporations with a view to discussing certain broad principles, and a preliminary Conference has taken place between representatives of the two Associations. A report will be submitted later.

In view of the complaints which have been made as to the alleged excessive damage caused to roads by certain classes of heavy motors and locomotives, the President of the L.G.B. appointed a small Expert Committee to inquire into the sufficiency of the existing requirements with respect to the construction of these vehicles, including weights on wheels, widths of tires, diameters of wheels, &c.

The question whether a special contribution should be paid towards road maintenance by heavy motor users was outside the scope of the Expert Committee.

The Income-Tax Sub-Committee has had under consideration the question of the proper allowances for depreciation of motor omnibuses. It was felt both in the interests of the Board of Inland Revenue and the Associations concerned, that a uniform method of determining depreciation allowances for income-tax purposes to govern the practice for the future should be arrived at, as in the case of tramways. A Special Committee was appointed to investigate this matter, and certain recommendations were adopted which will be placed before the Inland Revenue Authorities in due course.

At the time of writing, 16,630 men, or 30 per cent. of the employés on municipal tramway undertakings, have joined His Majesty's Forces.

In addition to enlistments, a further drain has taken place in the ranks of skilled artisans engaged upon the repair of tramcar equipments, and it was deemed necessary to draw the attention of the Minister of Munitions to the fact that the efficiency of tramway undertakings was being seriously affected, and point out that it was necessary for a certain number of specially skilled men to be retained if the tramways of the country were to be kept in a safe and efficient running condition, and that in many towns munitions were being manufactured, and any interference with the tramway service would have a very serious reactionary effect upon the output.

With this point of view the Minister of Munitions agreed, and, he is considering, in consultation with the War Office, whether it is possible to protect tramways against the loss of any of the irreducible minimum of skilled workmen, required for the proper working of the tramway service, by means of the issue of badges under Sec. 8 of the Munitions of War Act, 1915.

The Minister states that he is addressing a further communication upon this matter, as it appears somewhat doubtful whether work in connection with tramways can be strictly regarded as being work for war purposes, within the meaning of the Section of the Act above referred to.

The Sub-Committee of the Engineering Standards Committee on Tramway Rails has had under consideration (1) the revision of the Standard Tramway Rail Sections; (2) the revision of the Standard Specification for Tramway rails; and (3) a Report on British Standard Special Trackwork for Tramways.

The Sub-Committee proposes to recommend that the existing Standard Sections be replaced by three sections, with their corresponding curved sections, having a uniform width of head of 2⅛ in.

It also proposes to recommend the adoption of a dwarf rail for inter-urban tramways. This rail is primarily intended for use with sleeper construction, has a 2⅛ in. width of head, and weighs about 88 lb. per yard.

A Panel Committee has been at work preparing recommendations for the revised analysis and mechanical tests for tramway rails. It has presented its report to the Sub-Committee and the revision of the Standard Specification is being proceeded with.

A report has been prepared on British Standard Special Trackwork for Tramways, dealing with the standard nomenclature of the different classes of special trackwork used in actual practice, and standard dimensions for crossings, switches and turn-outs.

The Engineering Standards (Panel Committee) on Tramway Tires and Axles has drawn up standard specifications for tramway tires and axles. In the case of tramway axles the same course has been taken as was adopted in the railway rolling stock specifications, two specifications being drafted, one with and one without a chemical analysis, in order that those who do not desire to specify an analysis may have a standard specification available.

Pending the confirmation of contain cold bend tests for axles, the specifications are ready for presentation to the Sub-Committee on Tires, Axles and Springs.

In order that the undertaking of experiments and the general investigation of the rail corrugation phenomena might proceed continuously, the General Committee decided to appoint two Sub-Committees, one comprising the members in the North and the other those in the South, to undertake this work.

THE BRITISH ASSOCIATION.—IV.

Labour after the War.

We refer to the report in this matter in our leading columns. The report summarises the position that women's employment has taken during the year, August, 1914, to August, 1915. At the end of this section the following reference is made to the "present effects of war on industry":—

The women who have entered industry since the war seem for the most part comparatively young. Billeting money and fairly liberal separation allowances have in the majority of cases been sufficient to prevent any large number of married women from returning to their trades.

One of the tendencies of the war is clearly to transfer a more than normal proportion of the nation's business to large concerns. Though this has its drawbacks, the balance on account is probably to the advantage of the women who have entered, as far as the safeguarding of their standard of life is concerned, and consequently of that of the men who will return.

It is clear that the year has seen an enormous upheaval in industry; factories have been adapted to meet new demands and to facilitate women's employment; trade union and Home Office restrictions have been relaxed; women are replacing men; experiments are being made and knowledge gained which may well revolutionise many branches of industry. The one great factor upon which industry as a whole now depends is the volume of Government contracts. At the end of the war these will substantially decline and industry will begin to resume its normal course. But every transference of labour, every youth put into a man's place, every woman who has received training, because of the war, adds something to the bewildering chaos of those industrial problems which will have to be grappled with when peace is declared.

Section II considers the general position and indicates the main features arising out of the new conditions of women's employment during the past year. Three features of the labour market that stand out in special prominence are:—

1. The serious shortage of skilled workpeople.
2. The considerable extension of women's employment.
3. The limited extent to which women have replaced men, in the sense that women are now doing work previously done by men.

The first of these is not only due to enlistment but also to what in the past thirty years has, unfortunately, been a growing feature of industry—the small proportion of skilled to unskilled industrial workers. This disproportion is exceptionally large amongst women. The shortage of skilled labour is the cardinal feature of the industrial position with which the nation is now faced. The situation cannot be solved during the present time of war. In a great many industries women are working on processes previously wholly or partially done by men, but the extent to which this has occurred is inconsiderable. The margin of difference, however, between actual fact and possibility is yet to be discovered, but that is largely a matter for the future—in a small measure for the year immediately in front of us, but chiefly for the years of construction and renewed effort which will follow the war. The report later considers the important question of the training of skilled labour, and discusses the relative functions of the technical school and the workshop in the training of the artisan. In the metal working trades, and in some others, the whole of the highly skilled workers are men. The women employed in these trades are either semi-skilled or unskilled. The question arises whether women are capable of becoming highly skilled workers, and, if so, whether they would in normal times be preferred to men. This depends on a variety of circumstances, physical, psychological, economic, and social. Some engineering employers express a doubt as to whether women could be trained to the same degree of skill as has been attained by highly skilled men, maintaining that women lack, as a rule, the necessary qualities of judgment and initiative, and dislike shouldering responsibility. The question of the possible limitations to the industrial employability of women is gone into at some length, and such matters as wages are also discussed, but the space at our disposal prevents us from entering fully into the rest of the report, though we have no doubt that as a whole it will be perused with interest by employers, social economists, and other students of the times and tendencies. Particular professions, callings and trades have been made the subject of full inquiry, and from the material contained in the remainder of the pamphlet (more than 80 pages) we reproduce merely the section bearing on "electrical apparatus," the investigation in regard to which was made by Miss M. E. Bulkeley, Miss M. Cross, and Miss Moses:—

	1901			1911		
	Total	Men	Women	Total	Men	Women
Electric cable manufacture	—	—	—	5,813	4,858	955
„ lamps	49,518	47,028	2,490	5,627	1,425	4,202
Other electric apparatus and electric fitters ...	—	—	—	54,746	50,558	4,118
				66,186	56,841	9,275

[The men's figures for 1901 include also electricians (undefined) who in 1911 equalled 27,905.]*

Women are to some slight extent doing work which before the war was done by men, in certain departments such as:—

Small lathe work.
Screw machines.
Cable making.
Winding of transformers for armatures.

This last may be regarded as an extension of work previously done by women rather than as an entirely new process; for example, where they now wind two coils on to a transformer they previously only did one.

Before the war, women were definitely employed in all branches of light work in electrical apparatus work, but not at all in the electrical supply trade. Although the above displacement is classed as owing to the war, there is evidence that before August, 1914, the policy of many firms had been to extend the employment of women into new branches. That women have to some extent been replacing men, or, at any rate, entering new branches, may also be inferred from the fact that, though the electric lamp branch of the trade has been depressed owing to the war, there has been a total increase in the employment of women in the electrical trade of nearly 18 per cent. Part of this increase is due to a temporary increase of production in branches of the trade in which women were previously employed, but as the enlistment of men from this trade has been on a considerable scale, it is reasonably clear that women are to some extent taking their place during the emergency. In most cases readjustment to meet the introduction of women has been simple, or no alterations at all have been necessary, as they have only been put on to the lighter machine work. One firm has actually made the machines more mechanical and employs an extra mechanic as supervisor.

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* The table is reproduced as it stands in the original; apparently the 1901 figures are the totals.—Eds.

The introduction of women into new processes often necessitates the provision of another workshop, as in the majority of cases it is not considered desirable for men and women to work together.

The main objections to the employment of women are:—

1. Want of technical skill and general experience.
2. Want of physical strength, making it impossible to employ women on the heavier processes.
3. The strong objection on the part of many employers to have men and women working side by side in this trade.
4. In some cases the men's objection to the introduction of women.

In regard to the question of physical strength, one firm employing women in lathe making found the women's output slightly less than that of men, owing mainly to exhaustion during the last hour of work. Nevertheless, it is clear that as a general rule women's output is considerably less than that of men, since both on time and piece rates their wages are generally 50 per cent. below those of men.

The main advantages are:—

1. Their greater dexterity in certain processes where small fingers are an advantage. This has been a considerable factor in the employment of women in such processes as assembly work in the electric lamp trade.
2. Cheapness of their labour.
3. The larger supply of unskilled workers to draw upon.

The Future of the Trade.—In those processes which are suitable to women, the possibilities of extending their employment are great. In the more skilled processes, however, where a longer training is necessary, it depends how far women choose to utilise the present opportunity of becoming highly efficient workers. Hitherto women have been employed almost entirely in unskilled processes, and the trade has been essentially one for young persons, the majority of the girls leaving the trade soon after the age of 19. It is difficult to foretell the state of trade after the war, but in view of the accumulation of private work which cannot be done at present, employers rely on its being good for at least a year or two, and they, therefore, expect to absorb the men returning from the Front as well as the new women that have been taken on. Two firms stated that after the war it was much more likely to be a case of taking on new men in addition, than of dismissing the new women.

On the whole, there is little definite evidence up to the present of the actual displacement of men by women owing to the war, and the increase in the number of women is mainly due to a temporary increase of production. The trade unions, however, state that of recent years there has been an increasing tendency to bring women into the trade, and in view of the fact that women are unorganised, they are pessimistic with regard to the future, fearing that the increase of female labour will lead to a fall in the standard of wages, and to male unemployment after the war. Much will depend upon the attitude of the women themselves.

Industrial Fatigue.

The report of the Committee on Industrial Fatigue was also received by the Economic Section.

In the course of the discussion on the report, Prof. Kirkaldy, who was in the chair, referred to Mr. Lloyd George's speech at the Trade Union Congress, in which regrettable incidents on the part of the workers were mentioned. Prof. Kirkaldy said it seemed to him that some of the unrest and some of the diminution of output was due to the fact that our Labour force was improperly organised. He was certain we should not get the best results from our munition workers until the subject of fatigue had been properly considered, and the workers' time and energies so organised that they got proper leisure and proper recreation.

Dr. T. M. Legge (Medical Inspector of Factories under the Home Office) said he had been struck by the wonderful spirit of the workers, and in his opinion it was that that sustained them in their additional work. His experience was that where there was no fast-running machinery there were no obvious signs of fatigue.

A rather pithy sentence from the speech of Prof. B. Moore ran something as follows: Over-working of men might have been excused when we thought we were in for a hundred yards' race in this war; but we now found it was a four-miles' race, and must organise the workers accordingly. We ought to organise on the lines of putting more men on the work. Far more work was done in three eight-hour shifts than in two 12-hour shifts.

The Heating of Iron when Magnetised at very High Frequencies.

By N. W. McLachlan, B.Sc., A.M.I.E.E.

(*Section G.—Abstract.*)

The present paper is the outcome of tests made by the author to ascertain the magnetic behaviour of Stalloy and Lohys at very high frequencies, using a Poulsen arc generator. Tests have been carried out at frequencies between 3×10^5, and 5×10^6 periods per second. Although the "apparent" maximum flux density is small, owing to the screening effect of eddy currents, the rate of rise of temperature of the iron is very large on account of the high frequency of the magnetising current producing correspondingly large hysteresis and eddy-current losses.

Theoretically the eddy-current loss (which is the larger of the two at such high frequencies) for a given thickness of plate and number of turns per centimetre length, is proportional to the square root of the frequency, specific resistance and permeability, and to the square of the magnetising current. Moreover, since the frequency of the oscillations in the shunt circuit of the generator increases with the current* (for a given value of the capacity), and the loss increases as the square root of the frequency and the square of the current, it was essential, in order to obtain a large heating effect, that the current should be large.

The Poulsen arc generator circuit is arranged as shown in fig. 1. The field-magnet coils producing the magnetic blast are in series with the copper-carbon arc, which burns in an atmosphere of coal gas. The air gap between the poles of the magnet is 19 mm., and the electrodes are each 15 mm. in diameter.

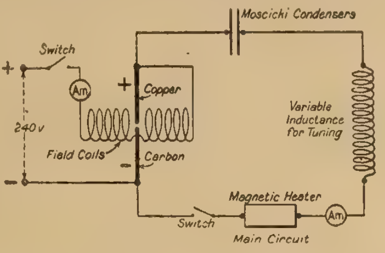

Fig. 1.—Arrangement of Poulsen Generator Circuit.

The oscillatory or shunt circuit is connected across the arc and consists of one or more Moscicki condensers and a plate-glass condenser, a variable inductance for tuning to the desired frequency, a magnetic heater (to which reference is made hereafter) or other apparatus for demonstration purposes, and an ammeter to read the current.

In order to ascertain the frequency a loose coupling is made between the variable inductance and the coil of a Lorentz wave-meter. The wave-length is then determined by adjusting the variable condenser of the wave-meter until resonance is obtained.

By using various wave-meter coils, it is possible to analyse the current in the shunt circuit. If the coil constants are known, the relative magnitudes of the fundamental and the various harmonics can be determined. The most prominent harmonics are the second and third. Since there is an even harmonic, the positive and negative half waves are not similar. However, by adjusting the arc length so that the current through the arc is as large as possible for steady burning, the harmonics may be reduced.

The heater, fig. 2, consists of a glass tube 1½ in. in diameter on which is wound 20 turns of 22 s.w.g. The tube contains a bundle of iron strips or wires and also a quantity of water. The ends of the tube are plugged by means of rubber corks.

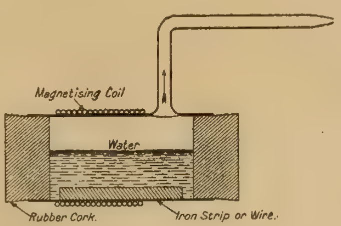

Fig. 2.—Magnetic Heater.

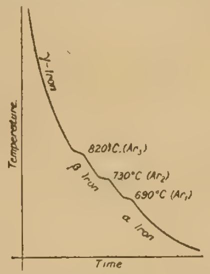

Fig. 3.—Cooling Curve for Mild Steel.

In order to demonstrate the losses in the iron, one of the heaters is inserted in the shunt circuit (fig. 1). A short time after the current in that circuit is switched on, the water begins to boil. Thus the iron strips when magnetised act in a somewhat similar manner to the fire tubes in a locomotive boiler.

Another form of heater, by means of which water can be boiled, consists of a coil of wire wound on an iron tube.

The sizes of the heaters are limited by the power available from the Poulsen generator.

At such high frequencies, viz., 3×10^6 periods per second and over, the accurate determination of the losses in the iron is a very difficult matter. It can be shown experimentally that, for values of the "apparent" magnetising force from 2 up to 6 c.g.s. units, no serious error is involved in taking the watts lost as the product of total current through the circuit and voltage due to the iron alone. Several coils, some having cores of Stalloy and others of Lohys, have been constructed in such a manner that the effect of the non-ferric portion of the core and the IR pressure-drop is negligible, and the watts lost per kilogram obtained in this way.

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* When the inductance in the shunt circuit decreases the current and frequency increase, and *vice versa*.

By using a modified 3-voltmeter method of measuring power and assuming the voltage to be sinusoidal, it may be demonstrated that the power factor for the coil is nearly unity. Thus the energy current is practically equal to the total current, while the true magnetising current is a fraction of the latter.

The losses in the iron might also be estimated by lagging the heater well to minimise radiation, and passing a quantity of water through in a certain time, maintaining the inlet and outlet temperatures constant. Provided the difference of temperature was fairly large, say, 30 deg. C., the watts lost per kilogram ought to be obtained fairly accurately. This procedure could only be adopted in cases where a sufficient rise in temperature was obtainable.

The Recalescence Point Ar_1.

When iron is heated above a temperature of about 700 deg. C., *i.e.*, above the point Ac_1*, it passes from the alpha-state to the beta-state. The former is magnetic while the latter is non-magnetic. Just before reaching the point Ac_1, the permeability, provided the magnetising force is weak, say, 0.4 C.G.S. unit, increases very rapidly for a comparatively small increase in temperature, attains a maximum value somewhat after the nature of a resonance curve, and then suddenly drops to unity when the iron reaches the non-magnetic state. This is illustrated in fig. 4. For stronger fields, say, 4.0 C.G.S. units, the increase in permeability is comparatively small. This case is illustrated in fig. 5.

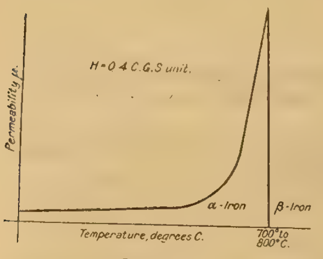

Fig. 4.

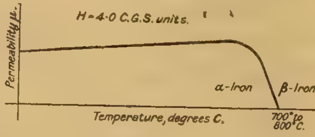

Fig. 5.

Permeability-Temperature Curves.

The following experiment illustrates the increase in permeability up to a certain temperature and the decrease at higher temperatures :—

A ring of Lohys, of 4 in. external diameter, 3¼ in. internal diameter and 0.36 mm. thick, is covered on both sides with asbestos rings and wound with copper wire. In order to prevent short-circuiting on the iron, the wire is wound lightly and the whole ring squeezed up in a vice, thereby diminishing the thickness. This procedure also lessens the area of the non-ferric portion of the ring, which must be as small as possible if quantitative results are to be secured, owing to the small apparent permeability of the iron at such very high frequencies. The ring is connected up in the oscillatory circuit of the Poulsen generator with a voltmeter across its terminals.

When the current is switched on in the shunt circuit it attains a certain value. At the same time the voltmeter records the value of the voltage across the coil. The temperature of the iron increases rapidly until a point is reached,† when the current falls steadily and the voltage rises until both become stationary. On the attainment of a still higher temperature the current rises until it reaches a definite higher value. When the current increases, the voltage decreases until it attains a steady value.

The first decrease of current, with its corresponding increase in voltage, is due to augmentation in the apparent permeability caused by rise in temperature. The subsequent rise in current, with its corresponding decrease in voltage, is due to diminution in the apparent permeability caused by a still further increase in temperature.

The approximate figures given below will enable the changes to be followed more easily :—

$B_{max.}$ apparent.	$H_{max,}$ apparent.	μa apparent.	Watts per kilogram.‡	Frequency per second.
3,500	21	170	48,000	$1{\cdot}9 \times 10^5$
4,300	17	250	44,000	$1{\cdot}7 \times 10^5$
3,200	25	130	57,000	$2{\cdot}1 \times 10^5$

B_{max} calculated on the assumption that the magnetism is uniformly distributed across the section gives an "apparent" value, while H_{max} calculated from the total current is not the true magnetising force, since the true magnetising current is a fraction of the total current.

In calculating the above quantities the wave forms of the current through the coil and the voltage across its terminals have been assumed to be sinusoidal. If the current wave was sinusoidal, the E.M.F. wave would be peaked, and the form factor greater than 1.11. This would mean a reduction in the apparent values of B_{max} as given in the table.

An inspection of the table shows that the apparent permeability increases 30 per cent. with rise in temperature up to a certain point, the watts lost per kilogram decreasing 9 per cent. For a further rise in temperature the apparent permeability decreases 50 per cent., its value being lower than that at normal atmospheric temperatures, while the watts lost per kilogram increase 30 per cent.

Transformer Core Loss as affected by Triple Harmonics.

By H. M. Lacey, B.Sc., and C. H. Stubbings, B.Sc.

(*Section G.—Abstract.*)

This paper described experiments conducted in the Siemens Electrical Engineering Laboratory, King's College, London. The object of these experiments was to investigate the effect of triple harmonics upon the core losses in transformers.

An alternator giving approximately a sine wave was three-phase star connected to a three-phase choking coil. The star centres were also connected through a switch. Current-measuring resistances were inserted in the neutral and one of the outer leads. Voltmeters and ammeters were also inserted as required. Two experiments were made :—

(1) With the switch in the neutral wire open.
(2) With the switch in the neutral wire closed.

In each case the wave forms of phase amperes, phase volts, and in the second case amperes in the neutral wire, were taken by means of a Kelvin quadrant electrometer and a contact-maker.

The curves thus obtained were remarkable in many ways. In a balanced three-phase star system, the algebraic sum at any instant of the currents in the three arms will equal three times the value at that instant of the third harmonic in one of the arms, neglecting higher harmonics. It is thus obvious that in the first case, where the centre of the star is insulated, the presence of third harmonics would be a direct contravention of Kirchhoff's First Rule. The accuracy of this conclusion is clearly verified by the experimental results, for an analysis of a mean curve drawn to exclude the ripples or higher harmonics gave (Case I) the following :—

Volts :

3rd harmonic, 48.9 per cent. ; 5th harmonic, 4.12 per cent.

Amperes :

3rd harmonic, 3.6 per cent. ; 5th harmonic, 21.1 per cent.

Thus we see that while the triple harmonic in the current curve is (within the limits of accuracy) completely suppressed, it is very pronounced in the volt curve.

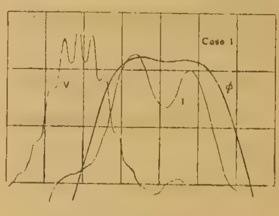

Fig. 1.

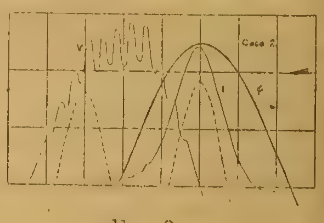

Fig. 2.

Taking the second case in which any third harmonic in the current is allowed to escape along the neutral wire, we obtain (Case II) the following results from an analysis of the curves :—

Volts :

3rd harmonic, 5.07 per cent. ; 5th harmonic, 2.88 per cent.

Amperes :

3rd harmonic, 48.2 per cent. ; 5th harmonic, 13.94 per cent.

Also the wave of current in the neutral wire was practically a pure sine wave of triple frequency, thus amply justifying the statement that the triple harmonic escapes along the neutral wire. Its amplitude was also found to be approximately three times that of the third harmonic in the current curve. It is very significant also that the percentage triple harmonic in the volt curve in Case I is practically the same as that in the current curve in Case II. It would, therefore, appear that the triple harmonic is inevitable, and if suppressed in the current curve is forced into the volt curve.

Fig. 1 shows the wave-forms obtained when the centres of the stars were insulated. The volt and current curves are marked V and I respectively, and the induction curve was obtained by integration of the volts, copper drop being negligible. The presence of the third and fifth harmonics in the volt and current curves respectively can be clearly seen from the diagram, the third harmonic causing the volt curve o descend below the zero line at one point. Fig. 2 gives the vave forms obtained with the switch in the neutral wire losed. The third harmonic is very pronounced in the current urve, and the current in the neutral wire is represented by he dotted line.

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*Ac_1 is that point on the heating curve of iron corresponding to the recalescence point Ar_1 on the cooling curve. Fig. 3 shows the nature of the cooling curve for mild steel containing 0.02 per cent. carbon. In this case there are three recalescence points or points of arrest, viz., Ar_3, Ar_2, Ar_1.

† The iron being red-hot.

‡ The author has not ascertained if the foregoing method of estimating the losses, viz., product of volts on coil and amperes through it, holds for frequencies lower than 3×10^5 periods per second, and apparent magnetising forces greater than 6 C.G.S. units. Moreover, in adopting this procedure in the present instance the losses may be too large.

The question now arises as to what effect this will have ipon the hysteresis and eddy-current loop for the iron cores f the choking coils.

Fig. 3 shows the loops obtained from the curves; these are ot in B and H units, but they are both drawn to the same cale. The extraordinary shape of the loop for Case I is rgely due to the triple harmonic in the volt curve.

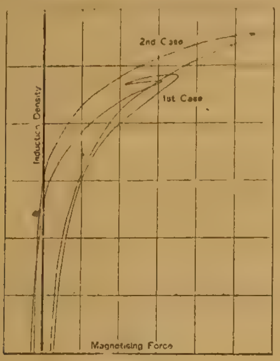


Fig. 3.

The following readings were taken :—

Case I.—Line volts, 185.5; magnetising current per phase, .9 amperes.

Case II.—Line volts, 186.6; magnetising current per phase, .88 amperes.

Value of B_{max} in Case II is 1.144 times the value in Case I.

In order to compare the core losses in both cases, the areas f these loops were found, and are in the following ratio :—

$$\text{Area of loop } 1 = 0.775 \times \text{area of loop } 2.$$

It will thus be seen that a saving of 22.5 per cent. in the core ss is effected by insulating the neutral point. The actual alue of B for this percentage saving was not actually deterined, but the shape of the loops obtained indicates a value of $_{max}$ for Case II of approximately 15,000.

Each reading on the volt curve was multiplied by the corresonding reading for the current, and the average watts thus und for each case. These watts are dissipated in core loss, opper loss being negligible, and they were found to be as llows :—

Case I, 54.2 watts.   Case II, 71.5 watts.

The ratio of the losses thus obtained gives the value 0.757, hich is sufficiently near the figure obtained by the other ethod to justify the supposition that this is correct.

The experiments thus show that the losses in a transformer re considerably reduced by employing an insulated neutral oint. Also, they may be made to give the same voltage with smaller value for the induction density.

Radiotelegraphic Investigations.

(*Section A.—Abstract.*)

The report of the Committee shows that the war has had very direct effect on radiotelegraphic investigations. About e beginning of August, 1914, private wireless telegraph ations throughout the Empire nearly all stopped collecting atistics, while naval and other Government stations stopped l merely scientific observing. A few stations in India, Ausalia, Canada, the West Indies, and the United States are, owever, still at work.

The fact that the Committee's programme for the collecon of statistics three days a week in all parts of the Englisheaking world, and in a few other countries, has been interupted after only three months of work diminishes greatly e scientific value of such statistics as have been collected. also implies considerable financial loss. The extensive heme of special observations projected for the occasion of e solar eclipse failed almost completely in the countries in hich the eclipse was visible.

The day-by-day statistics collected in the period April to uly have been partially analysed. The conclusions drawn om these observations yield information which will guide e Committee, when the time comes, to further attacks on e problems concerned.

Analysis of Records of Strays.—The principal and most niversal fact is that the strays heard in the dark hours are uch more numerous and louder than those heard during aylight. If curves be drawn showing the amount of disturbnce to telegraphic work from hour to hour, the lowest point sually falls a little after mid-day, and the highest point of e convex part of the curve occurs a little after midnight, nearly all stations north of the Equator. Unless local eather conditions are producing great disturbance, the ange from night to day conditions and *vice versa* in stations orth of the Equator lags behind the sunrise and the sunset. At some stations south of the Equator, *e.g.*, Cocos Island, the opposite rule seems to be usual.

Periods of Excessive Disturbance.—Occasionally the radiotelegraphic work at a station is rendered almost or quite impossible for a period, by strays of vigour and number greatly exceeding the average. These occurrences are for brevity called "X storms," the term "X" being an alternative designation for "stray" or "atmospheric." An analysis of the records has shown that X storms occur within the same two or three days over very wide areas. Occasionally X storms are reported almost simultaneously at places several hundred miles apart, but more usually the X storms occurring at such distances are separated by several hours. Periods of severe strays coincide with periods of low barometer, high wind velocity, rapid change of temperature, great rainfall, and, especially, rapid barometer fluctuations. These meteorological conditions are precisely those that accompany or precede thunder storms and line squalls; and, in fact, the records of the Meteorological Offices, and of the observers reporting to the Committee, all lead to the conclusion that X storms are often associated with thunder storms at places not very far distant. Sometimes all the symptoms of thunder weather except thunder and lightning may be present in a locality and a heavy X storm be recorded.

It is well known that the unstable atmospheric conditions bringing thunder weather sometimes move at a relatively slow rate from place to place, and may have their movements traced by ordinary methods of meteorology. The analysis of the radiotelegraphic records shows that such convective weather can be anticipated several days in advance.

A report received from the wireless-telegraph station of the Government of Australia situated at Esperance states that during the day-time rain is preceded in at least 80 per cent. of cases by intermittent disturbances. Strays of varying strengths may be heard from 6 a.m. to sunset for one or more consecutive days prior to rain.

This conclusion is borne out in other ways by some of the records forwarded to the Committee. There is evidence that north-west winds on our Atlantic coasts, especially in the winter, are associated with strong strays at Irish stations and at sea. The atmospheric convection produced by the land may be sufficient to account for this. Mr. R. Ricci, of the Marconi Co., who has made reports on two trips round the world, during which he made especially careful daily observations, states that in mid-ocean strays are, as a rule, very few and feeble both in the day and in the night; but that when the edge of a mountainous continent is approached strong, and even continuous, strays are normal. In this something must depend on the direction of the prevailing wind relative to the land—a matter that will be inquired into later.

The months of the greatest X storms in the Mediterranean are shown by the records to be September and October, the months of cyclonic weather.

As a whole the statistics show that there appear to be two kinds of X storm occurring in the day-time: (1) Those produced by convective conditions in the atmosphere within, perhaps, a hundred miles of the station, which may be termed local X storms; (2) those originating at a distance. Regarding the first class, in general, we may conclude that the observation of strays in the day-time constitutes a method of feeling the fringe of a region of convective weather, and so anticipating thunder and rain a day or two in advance. This ability to prophesy the advent of thunder weather is well known and is as old as wireless telegraphy itself; but hitherto it has been thought that the electric discharges at a great distance were responsible for the strays heard at the station attempting to prophesy. The present analysis indicates, rather, that at any rate in the day-time the strays are frequently due to very local discharges, often too weak to give noticeable lightning or thunder, but definitely indicative of an approaching period of instability in the atmosphere.

The second kind of X storm is not of strictly local origin, but is sometimes traceable in the stray observations made hourly at the Malta station of the Eastern Telegraph Co., and the Sierra Leone station of the African Direct Telegraph Co. There is evidence that on certain occasions the same cause is affecting both stations though they are separated by 2,500 miles, mostly across mountain and desert.

As regards disturbances observed at night-time, these are also frequently very local and due to convective weather, but there is probably a greater proportion of non-local storms than appears in the day records. In this connection may be noted a report from Australian stations that the worst and most continuous type of disturbance (apart from local thunder storms) occurs on calm nights when the sky is blue and starry.

As a contrast to the prevalence of strays during convective weather may be instanced the fact, reported by Lieut. E. R. Macpherson from Sierra Leone, that a very dry wind which blows periodically for several days on the West Coast of Africa causes an almost complete cessation of strays immediately it starts and allows of their resumption immediately it stops. On the other hand, the monsoon period on the same coast is one marked by great X storms.

Graphic Records.—Many observers have made for the Committee precise observations of individual strays by making, on lines graduated to represent time, marks corresponding to each stray as heard in the telephones, the zero of time being fixed by aid of radiotelegraphic time signals within range of the observer. Comparison of the records made in the British Isles has shown that on an average night many of the strong strays are heard by all the observers, and on days free from X storms the same remark applies. Coincidences have also been noticed between pairs of American stations not too widely separated. The analysis for very distant stations has not yet been carried out except for a very few in Europe. For example, in the month of June, 1914, coincidences have been traced in the strays heard at Southampton and Dresden, Gibraltar and Dresden, Guildford and Malta. A proper investigation of the meteorological conditions accompanying or determining the periods when strays are heard simultaneously at places very wide apart has not yet been made.

Auroral Displays and Magnetic Variations.—Reports from officers in the wireless telegraph stations of Alaska show that the appearance or disappearance of auroræ caused no unusual disturbances. No trace of the 27-day period of magnetic variations or of any nearly equal period has as yet been found.

The Capacity of Aerials of the Umbrella Type.

By Prof. G. W. O. Howe, D.Sc.

(Section G.—Abstract.)

In a paper read before the British Association at Sydney last year the author developed a method of calculating the capacity of radio-telegraphic antennæ. In addition to describing the method in general, curves and formulæ were given so that the capacity of aerials of standard types could be determined in a few minutes. The umbrella type, however, was not specially considered, and it has since been suggested to the author that the usefulness of the paper would be considerably increased if curves and formulæ could be given for aerials of this type. The method is briefly as follows:—The whole aerial is assumed to have a uniformly distributed charge, and the average potential of the whole aerial under this fictitious condition is then calculated. It is assumed that if the total charge, while remaining unchanged in quantity, be allowed to have its own natural distribution, it will assume a uniform potential approximately equal to this fictitious average potential. The proximity of the earth is taken into account by the method of images. Tables and curves are given for aerials with from two to six ribs and for various angles between the ribs and the vertical. With these curves and those given in the original paper, each of the nine component potentials of any given aerial of the umbrella type can be read off and the resultant average potential determined. The method is then applied to two practical examples, one a simple aerial with six single-wire ribs and the other a more complicated case in which each of the five ribs consists of a four-wire cage, the size of the wire being different from that used for the central vertical wire.

Tests on actual aerials have shown that the values of the capacity as calculated by the author's method agree with the measured values within the errors of observation and of estimation as to the allowance to be made for connecting wires, etc.

Committee on Gaseous Explosions.

Owing to the war, the completion of the equipment of the new laboratories of the Imperial College of Science and Technology has been seriously delayed, and the investigation of many problems of importance has had to be postponed. Also, many of the members have been engaged on work for the Government, so that researches on questions under consideration have been either prevented or interrupted. The committee, therefore, is not in a position to present a report to the Association this year. The general work of the Committee, however, has gone on; and during the session three meetings were held at the City and Guilds (Engineering) College.

Exposure Tests of Light Aluminium Alloys.

By Prof. Ernest Wilson.

(Section G.—Abstract.)

The physical properties of certain light aluminium alloys have formed the subject of reports during the last fourteen years. In order to investigate the influence of exposure to London's atmosphere, a specimen of each alloy has been placed on the roof of King's College, London. All the specimens are in the form of wire 0.126 in. (3.2 mm.) diameter.

Commercial Aluminium.—A specimen has steadily increased its electrical resistance by 17.2 per cent. in 13 years.

Copper.—It has already been pointed out that the electrical resistance of the copper series in a given time increases with the percentage of copper. One specimen containing 2.61 per cent. of copper had so far corroded in 1911 that it broke quite easily. Another specimen containing 1.86 per cent. of copper has now so far corroded as to become practically useless as an electrical conductor. The tests emphasise the opinion already expressed that alloying commercial aluminium with copper except in small quantity is not to be recommended.

Copper-Manganese.—Three alloys containing from 0.02 to 0.09 Cu and 0.05 to 1.78 Mn have steadily increased their electrical resistance by about 10 per cent. in 14 years. The specimen with the highest percentage has a breaking load of 35,000 lb., and is apparently in good condition.

Copper-Nickel.—A specimen containing 1.08 per cent. Cu and 1.29 per cent. Ni has somewhat diminished its electrical resistance—the percentage being now 12.4, as against 19.4 in 1908. Its breaking load was 45,900 lb. before exposure.

Copper-Zinc-Nickel.—One specimen containing 0.11 Cu, 1.77 Zn, 2.01 Ni, has varied its electrical resistance as shown by the following figures:—

Year	1901	1903	1904	1908	1911	1913	1915
	962	995	1013	1285	1125	1102	1102

Copper-Manganese-Magnesium.—The alloy known as "Duralumin" is stated to contain about 0.5 Mg, 3.5 to 5.5 Cu, 0.5 to 0.8 Mn. A breaking load as high as 90,000 lb. can be obtained according to treatment. The specimen exposed has steadily increased its resistance by 9.6 per cent. in four years. It is, however, so brittle that a small loop cannot be bent without fracture.

The author was unfortunately unable to report on the copper specimen, as it had been stolen from the roof.

The Cadmium-Vapour Arc-lamp.

By Dr. H. J. S. Sand.

(Section B:—Abstract.)

The cadmium-vapour arc-lamp exhibited, the use of which was recommended for polarimetric and other purposes, is comparable in general principle with the well-known mercury-vapour lamp. The lamp is constructed of quartz-glass, and the cadmium is freed from oxide and dissolved gas by a process of filtration while at the pump. It is hindered from adhering to the glass by the presence of a small amount of a loose powder (zirconia) in the lamp. The metal is melted by external heating before starting, and maintains itself in the molten condition by the heat of the current. Once started the lamp may be kept burning for an indefinite time.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Portable X-Ray Apparatus.

The constantly extending employment of the X-rays has promoted a demand for portable sets of apparatus, and this has been met by the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., with their "Dubilier" outfits, of which one is illustrated in fig. 1. These are complete sets suitable for all classes of X-ray work, and operate on either D.C. or A.C. circuits between 55 and 250 volts, connection being made to a lampholder or wall socket, so that they can be used almost anywhere, and taken to the patient instead of the patient being taken to the apparatus. The current consumed is small, and the outfit is suitable for both fluoroscopy and radiography. Two patterns are made, one for general work, and the other, as illustrated, more particularly for dentistry, the latter also having an adjustable spark-gap for high-frequency treatment, and an attachment for cautery.

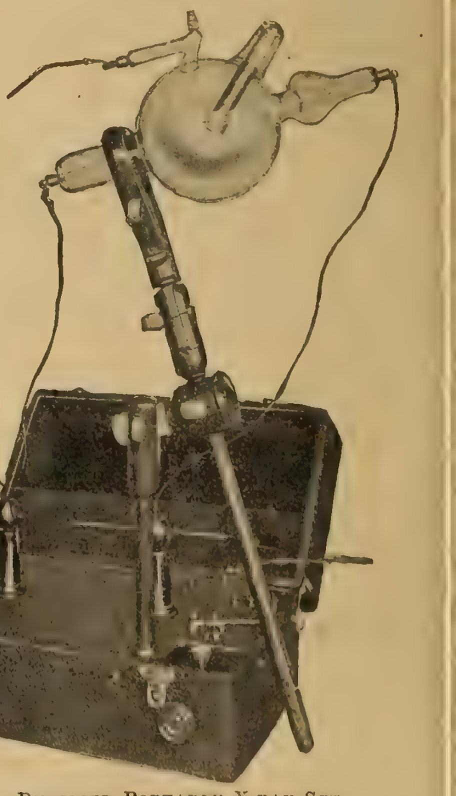


Fig. 1.—Dubilier Portable X-ray Set.

"Quead" Electric Fires.

In our issue of July 9th we illustrated the new type of heating element that has been introduced by Messrs. Ikin & Eads, Ltd., of 47-57, Marylebone Lane, Oxford Street, W.; we are now able to reproduce photographs of some of the various patterns of electric fires which they have developed, and in which these elements are used. The elements are standardised at one kilowatt each, and are guaranteed for three years; they work at red heat, and therefore should satisfy those who are attached to the coal fire, while a further advantage which they share with the latter is the facility for keeping food warm on the top of the "fire." Fig. 2 shows a fixed pattern of fire, for a moderate-sized room, with a detachable shelf for utensils; each heating bar is controlled by a separate switch. Fig. 3 shows a portable model. Many other patterns are made to suit different requirements, from the "handy fire" for bathrooms, &c., taking one kilowatt, to the heavy pattern taking 4 kw. When there are three elements, as in fig. 3, two of them are controlled by two switches, and the third is controlled by the main switch, so that three degrees of heat are obtained.

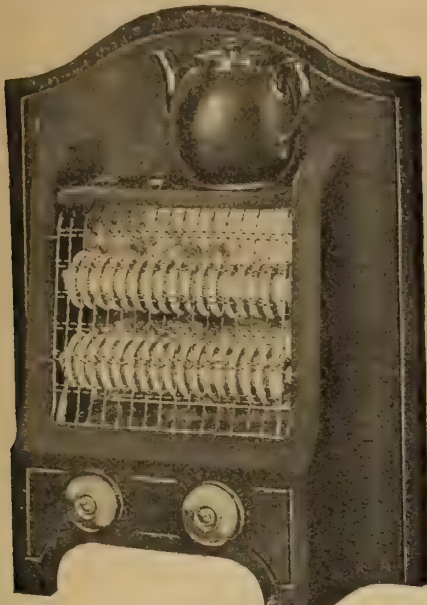


Fig. 2.—"Quead" Fire, Pattern Q 10

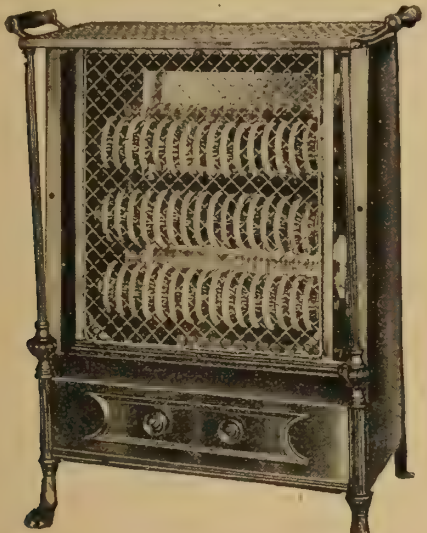


Fig. 3.—Portable Fire, Q 4.

LEGAL.

Munitions Court Cases.

At the Oldham Munitions Court last week, Messrs. Ferranti, Ltd., electrical engineers, of Hollinwood, complained under Sec. 4, Sub-Sec. 5, that Henry Tate, a transformer coil winder, had not worked diligently during the ordinary working hours, and had refused or neglected to obey the lawful orders of a person having authority over him. It appeared that he had been employed in the winding shop on transformer work, and his charge hand had to remove him to another part of the winding shop where he could be under the actual observation of the foreman. He behaved fairly well until September 14th, and then asked to be paid up. He was told to get on with his work and settle down to it. He did little work that day, and next morning he was in the works at seven o'clock, but did no work. Those over him reasoned with him and used every endeavour to get him to work, but failed. On September 14th, said Mr. Riley, foreman, Tate only wound nine coils, whereas he should have done 19 or so. On the following day Tate said he did not intend to work. Tate told the Court his ambition was to get on armature winding instead of the work he was put on. The Court held that Messrs. Ferranti had fully made out their case and fined Tate 10s.

At the same Munitions Court, last week, Richard Hollins, iron turner, employed in the Oldham Corporation tramway department, complained that his discharge certificate had been unreasonably withheld.

Mr. Dugdale, general manager of the tramways, said that if the man left the department they would have no one left to attend to the bearings of the cars. Mr. Dugdale had been in communication with the Ministry of Munitions, and the man Hollins had received a communication from the Ministry stating that the national interest could best be served by his remaining at present in the employment in which he was now engaged.

Hollins told the Court that he desired to leave to better himself financially.

The seriousness of the position, if Hollins left, was pointed out by Mr. Dugdale, who also pointed to the number of fitters and skilled men who had left the department for munitions work. Mr. Dugdale suggested that as his department was conveying workmen to and from work on munitions, it came under the clause "an establishment employed on, or in connection with, munitions work." The Chairman said that was much too wide.

Eventually Hollins was given a certificate to the effect that no discharge certificate was required by him, but the Chairman said that the Court would be very glad if he would go back to his work in the tramway department.

Broken Lamp Standard.

A question of dual responsibility was raised in an action heard by his Honour Sir W. Lucius Selfe, in the West London County Court, on Tuesday. The Fulham Borough Council claimed £19 1s. from Messrs. Wm. Whiteley, Ltd., and B. H. Winteringham, of Battersea. Counsel for the plaintiffs stated that at 8 p.m. on January 1st, 1915, one of the defendants' vans was proceeding along New King's Road, Chelsea, and collided with a motor-car belonging to the other defendant, and the two vehicles fell against an electric standard, which was knocked down, and damage done to the amount claimed. Both parties were written to as to paying the repairs. Whiteleys said the car-driver was at fault, and the car-driver cast the blame on Whiteleys. After evidence as to the facts, from which it appeared, that as Whiteley's driver was crossing the road, the car came up, and, "skidding," ran into the van, which toppled over, followed by the car, and felled the lamp and standard, his Honour found that Whiteleys were to blame, and gave judgment for the Council against them, with costs.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Pocket Dry Batteries.

I noticed in the last issue of your paper, of which I am a regular reader, "Howard Berry" comments on the remarks made by "Dry Battery Manufacturer" on the voltage of dry pocket batteries.

I may mention that, like "Howard Berry," I have for a good number of years experimented with the making of dry cells as a hobby, and can also obtain at will voltages from 1·2 to 2·2 with a single cell of overall dimensions 2⅛ in. high by ¾ in. diameter. But the point is this: he does not state how long they will remain in that condition when not in use, which is, I believe, the principal factor. I may also mention that I have at the present time pocket lamp batteries that have been in use since January 1st; of course they have been used only when necessary.

Robert Porrill.

London, N.E., *September 24th.*

Telegraph and Telephone Tariffs.

Although, generally speaking, the increase in taxes and rates causes no consternation, it is a matter for surprise that the technical Press has not in this instance pointed out that one way to make money is not to lose it.

The National Telephone Co. in 1911 paid the Government over £353,000 in royalties, and 6 per cent. on a greater part of its capital; soon after the system passes into the hands of the Government the surplus on the year's working is less than the amount received in Royalties from the National Telephone Co., therefore the rates are to be increased.

Rather than sink this huge sum annually in inefficient methods, do you not think it reasonable to suggest that an independent board of business men, skilled in this kind of work, should be given control, or better still, resell the plant to the old management?

Economy with Efficiency.

[We pointed this out long ago, while there was still time to prevent the loss, and urged that, if the transfer must take place, a board of business men should be given the control of the undertaking. But it was of no avail; *quem Deus vult perdere, prius dementat.* Parliament will not listen to reason.—Eds. Elec. Rev.]

The A.E.G. Meeting.

I heartily concur with "Inquisition's" letter in your last issue. The Electrical Co. shorn of its British title is the A E.G. Co., of Berlin. Yet to the disgrace and shame of the Tungsten Lamp Convention, the A.E.G. name is still retained on their lists, and this company in England is selling or, rather, offering the lamps manufactured by members of the Convention.

It is a matter for regret that there should still be Englishmen who associate themselves in the continuance of this concern.

Impatient.

September 21*st*, 1915.

The questions raised by "Inquisition" in the last issue of your paper, with regard to the Electrical Co., Ltd., should not be allowed to drop until they are definitely cleared up, at least as regards the names of the manufacturers supplying the goods, and any contractors who are drawing their supplies from this quarter.

After the war we shall have to meet the keenest possible competition from German electrical manufacturers, who will make their utmost endeavours to recapture trade, and any manufacturer supplying goods to this company, and thereby enabling it to maintain even the nucleus of a selling organisation, or to retain its connection, is doing a sorry service to the trade, and to himself also, because his business will be immediately cut off as soon as it has served its purpose and he is no longer needed.

I trust, Sir, that you will continue to move in this matter until the trade presents a united front on this question.

Unitas.

September 22*nd*, 1915.

Writing as a private individual, happily so placed as to be free from danger of financial hardship due to German competition, I have always regarded with complete astonishment the attitude of the electrical trade since the war towards the A.E.G. Co. When I read the speech of Dr. Rathenau's at the recent A.E.G. meeting, I came to the conclusion that his hearers must have been either drugged with despair or of German nationality. The electrical trade has furnished thousands of soldiers for the war, and some of the largest concerns are still struggling with staffs depleted of their best workmen at the commencement of the war. Some of us have to mourn colleagues as a result of this war, and yet, after 12 months, the director of a purely German company, English only by a legal device, is able to stand up and declare that his premises are still open, and that his business is in being. It is no good begging the question, for we know that the German stocks in England have been exhausted months ago, and my own opinion by comparison of the furtive-looking drawings which the Electrical Co. now furnish with their tenders, is that the machines they are selling are made and bought in England. I claim neither excessive sentiment nor patriotism, but the attitude of mind of an English firm who knowingly sell machines in order to keep the Electrical Co. in being after the war is incomprehensible.

At a music hall the other evening I noticed that quite the most popular song was one which shrieked in a minor key about our duty to keep the home fires burning till the boys come home, and undoubtedly this is a sentiment which is of tremendous importance in these dark times.

Without losing our self-proportion in any way whatever, it is our duty to our workers who are now fighting for us to stamp out once and for all the jumping-off places in England from which, after the war, the German concerns will start their campaign menacing the livelihood of the English soldier.

I have no use whatever for racial hatred as a religion, but I honestly believe that if one's sense of proportion is to go, the "Gott Strafe England" is less reprehensible than this nasty furtive money-getting.

I do not think any decent Englishman will materially disagree with the above attitude of mine, and if so, is there no way of definitely tracking down the people who are selling machines to the German companies? I do not know why the B.E.A.M.A. have not taken action before, as they, I hear, represent the bulk of the electrical trade.

I would gladly take a page of the Electrical Review which could be reserved for the names of firms who have not supplied for the last nine months any machinery whatever to certain firms named on this page. This should help a little, anyway.

No Furtiveness.

September 28*th*, 1915.

BUSINESS NOTES.

Consular Notes.—GREECE.—The American Consul at Athens reports that announcement has recently been made that the Government Commission charged with the study of the question has recommended the award to the Western Electric Co., of Chicago, of the contract for furnishing and installing a central station and switchboard at Salonika and furnishing a central station at Athens with all equipment, including several thousand telephone instruments. The price to be paid by the Greek Government is understood to be in the neighbourhood of £40,000, and payments will be extended over a period of several years.

ADEN.—The American Consul at Aden reports that an electric railway between the various parts of Aden-Tawahi, Maala, Crater and Shaikh Othman—would undoubtedly pay well upon the comparatively small capital required for its installation. Not only would it carry passengers between these places, but also freight from Tawahi and Crater to the wharves at Maala. The same power plant could develop sufficient electricity to supply Aden with electric light and power for electric fans, which would tend to make life endurable in one of the hottest places on the globe.

PERU.—The American Consul at Callao reports that the company known there as the Empresos Electricas Asociadas (Lima Light, Power and Tramways Co.) holds practically a monopoly of the electric railway, power and light in Lima, Callao, and several of the suburban towns. The company's revenues from its various branches during 1914 amounted to $1,913,468, as compared with $1,981,560 in 1913, a reduction of $68.092. The gross expenditures were $1,328 223 in 1914 and $1,420 594 in 1913, representing an economy of $92,371. In view of the fact that these results were obtained during the most abnormal year in the history of the company, and the net receipts of the year under review were the largest yet obtained by the company, the year's results were highly satisfactory. The two principal factors that affected the revenues of the company were the disturbed political situation in the first half of 1914 and the consequences of the European war during the second half.

The light and electric power section shows for 1914 a decrease in gross receipts of $1,732. A considerable decrease in the revenues from the consumption of electrical energy in motive power is to be expected during the present year on account of the decreased operation or the complete stoppage of the principal consuming factories and the closing of other workshops and centres of industry during the latter part of 1914.

During 1914 the installation of the fourth hydroelectric unit in the Yanacoto generating station was completed, furnishing four units with a total capacity of 10,000 h.p. And the new contract for the public lighting of Lima, which has been under negotiation for a long time, was also ratified during the year. This contract is for a term of 10 years, and fixes the rate of service to be rendered at $4,866 a month, or $58.392 a year. The company is obliged to provide 660 lamps and 1.600 incandescents for the services of the city, and to effect all extensions which may be normally required by the municipality in the lighting service. Such installations are to be made without cost to the municipality and remain the property of the company.

The gross receipts of the urban and interurban tramways amounted during 1914 to about £200 000, a decrease of about £9.000 in comparison with 1913. The gross receipts of the Lima urban tramways were about £90,000, or about £3.800 less than the preceding year. This section was augmented during the year by 12 new American-built cars of the latest type. There was a reduction in the revenues of the Lima-Cherrillas tramway of about £2,350, the gross revenues of the year being about £56,000. The branch from Lima to Callao also suffered decreased revenues to the amount of about £35 000, in comparison with 1913. This is due to the suspension of maritime traffic and the limitation of business in Callao, an essentially maritime port, the traffic of which is dependent upon the volume of business and movement therein. The Magdalena Interurban Tramway is the only one that showed an increase in the gross receipts of the year, being about £7.000 in 1913 and about £7.500 in 1914. The number of passengers carried by the tramways of the company fell off from 29.020,888 in 1913, to 28 120,425 for 1914. A dividend of 1 per cent. was distributed during 1914 in accordance with the agreement entered into with the bondholders. The tenth annual report of the directors of the Sociedad Electrici de Arequipa, Ltd., shows that the lighting service in 1914 returned revenues to the amount of about £15,600, or about £770 greater than in 1913. The gain in the revenues from the power service during 1914 over 1913 was about £970.

SOUTH AFRICA.—The American Consul at Port Elizabeth reports that the opportunities for increasing American trade in the future should be fairly numerous. There is still, however, one most essential detail for American exporters to learn. South Africa, as a whole, is conservative, and many of its people are most pronounced in their ideas, and cling tenaciously to them. When the products required are more or less similar to lines already established, and in many instances superior, American salesmen are apt to make the mistake of attempting immediately to convince the prospective customer of the inferiority of the article he has been selling in comparison with the article he wishes him to sell. Experience has taught older salesmen in South Africa a better method. The product is discussed cautiously until the salesman is able to determine what chance, if any, there is of introducing his line. If considered favourable, the proposition is presented as soon as possible. If only trifling details of construction or finish are objected to, and the trade is of reasonable importance, the desired changes are agreed to. If of considerable importance, the salesman procures samples and prices, and submits to his principals for decision as to whether or not they can be manufactured at prices quoted, or lower. In many staple products standards and patterns of long years' standing are still in use, with little evidence of desire to change. The Consul accordingly observes that if American manufacturers want the trade they must either make the goods asked for, or engage in a campaign of education in connection with their products.

CHINA.—The American Consul at Shanghai reports that the railless electric cars which were placed in the Shanghai Streets several months ago by the Shanghai Tramways Co., and subsequently withdrawn on account of the imperfect roadbed have now been restored, the roads having been rebuilt with concrete foundation and surface so as to be able to bear the weight of the cars. Five cars are being placed in service on one road. A number of improvements have been made in the cars since they were first placed in service. It is expected that this railless car system will be given a thorough test, and if it proves successful other routes will be established. Elsewhere the Consul reports that American railway and electrical supplies are being favourably received, and large purchases will necessarily have to be made in the near future, particularly for the necessary upkeep of the railways now in operation. The aggressive local managers of the United States Steel Corporation and other American enterprises are alert and capable of securing and holding available and desirable trade.

BRAZIL.—The American Consul at Bahia reports that work in a large hydro-electric plant was practically stopped throughout last year. The company constructing it is called the Companhia Brazileira de Energia Electrica (of which the chief owners are Messrs. Guinle & Co., of Rio de Janeiro). The plant is planned to generate 25,000 H.P. by using a natural fall in the River Paraguassu, near Bahia, but the company has been subjected to delays, and has asked for an extension of time for its franchise with which to complete sufficient of its plant to generate 5,000 H.P. It is hoped that this will be ready in 15 months.

Catalogues and Lists.—Messrs. Siebe, Gorman and Co., Ltd., Westminster Bridge Road, London, S.E.—Illustrated pamphlet describing their "Vivator" oxygen resuscitating apparatus, for use in cases of collapse from electric shock, gas-poisoning, apparent drowning, &c.

The Electrical Supplies Co., 53, Victoria Street, London, S.W.—Catalogue entitled "Concerning Electric Fires," containing illustrations, brief particulars and notes of prices of "Quead" and "Ensign" pattern electric fires.

Messrs. Dick, Kerr & Co., Ltd., Abchurch Yard, Cannon Street, London, E.C.—This is a well-produced art publication bound in a cover of neat design, in the 40 pages of which is given an interesting account of the company, the various works in which it conducts its manifold electrical manufacturing operations, and some of the important contracts (electrical, engineering, and general contracting) that have been carried out by it in all parts of the world. The publication is fully and excellently illustrated, the many half-tones including views of the electric manufacturing works at Preston, and their various departments, the Britannia Lamp Works, and the Britannia Engineering Works at Kilmarnock. Among the plant illustrated we observe turbo-alternator sets for the L. & S.W. Railway, the L.C.C., for Madras and for St. Helens, alternators for Japan and British Columbia, the power house at Kinlochleven, electric locomotives for British Columbia, H.T., D.C., electric railway work in Lancashire, Thury winding gear, steam locomotives, track construction in Mexico, electric tramway construction at Mandalay, Walton pumping station, the experimental tank of the National Physical Laboratory, electrically operated bascule bridge at Deptford Creek, ferro-concrete building work, and reservoir work of the Metropolitan Water Board. Many other views show electrical and other machinery, and from what we have said, it will be seen that the publication contains a representative account by pen and picture of the large and varied undertakings carried out by one of the best known of British electrical and engineering manufacturing and contracting firms. Editions of the work in Spanish and Portuguese are now in preparation. Not a large number of copies of the book are available for distribution, but the firm will be pleased to send a copy to any *bonâ fide* inquirer on receipt of application.

The British Thomson-Houston Co., Ltd., Rugby.—Illustrated price list giving particulars of motor control panels for C.C. circuits.

Messrs. A. Gallenkamp & Co., Ltd., 19/21, Sun Street, Finsbury Square, London, E.C.—Illustrated list No. 65 (8 pages) containing full particulars of their improved electric laboratory furnaces.

India-Rubber Gutta-Percha and Telegraph Works Co., Ltd., 106, Cannon Street, London, E.C.—Folder, giving particulars, prices, and test results, of Hercules dry cells.

British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.—A new illustrated price list of Mazda wire-drawn lamps. Voltage, wattage, candle-power, dimensions and price are all clearly tabulated. All the standard Mazda lamps are included, and Mazda "half-watts" have a couple of pages to themselves. A quite distinctive design in colour adorns the cover. In the charming flight of fancy the sun absolutely doesn't stand the ghost of a chance.

New Zealand Imports.—An Australian newspaper states that at a conference of New Zealand Chambers of Commerce early in August a resolution was passed in favour of legislation to make compulsory the marking of the name of the country of origin on all goods imported into New Zealand.

Bankruptcy Proceedings.—Alexander B. Gillespie, electrical engineer, 499, George Street, Aberdeen, was examined in sequestration, before Sheriff Laing. In reply to Mr. S. M. Chrystall (for the creditors) Gillespie explained that he had been in business since 1912 in the shop. Previous to that he had been in a small workshop. He had a partner for about a year. He first found himself in serious difficulties in 1914, but he had been in difficulties all along for want of capital. He had very little capital when he started, only a pound or two. He had taken things too cheaply, and had one or two bad debts. He had had some very big contracts. His liabilities were £218, and his assets £46, providing for a dividend of 3s. 6d. in the £. The Sheriff administered the usual oath.

T. A. Flather, electrical engineer, Leeds.—October 13th is the last day for the receipt of proofs for dividend by Mr. H. C. Bowling, 24, Bond Street, Leeds, the trustee.

Catalogues Wanted.—Messrs. Marsh Bros., who have removed to 41-43, Fargate, Sheffield, where they have fitted out a complete electrical showroom, invite manufacturers to send them copies of their latest lists of electrical accessories, heating and cooking appliances.

Trade Announcements.—We are informed that the Robertson Electric Lamps, Ltd., and Osram Lamp Works, Ltd., have been amalgamated, and the business will in future be carried on under the title of Osram-Robertson Lamp Works, Ltd. In connection with this almagamation the new company has purchased the entire interest in the Lemington Glass Works, Ltd, Lemington-on-Tyne, which company will continue under its own name as heretofore. The Osram-Robertson Lamp Works, Ltd., has taken over the obligations of all three companies.

Messrs. James Gordon & Co. removed on Tuesday last to larger offices at Canada House, Kingsway, London, W.C. Telephone No. "Holborn 1195."

In order to more efficiently cope with extending business, the Swedish General Electric, Ltd., have now opened up a branch office at Lloyd's Bank Buildings, Manchester, which will deal with all inquiries emanating from Manchester, Lancashire and Cheshire districts generally.

LIGHTING and POWER NOTES.

Aberdeen.—Price Increase.—The T.C. has rejected, by 20 votes to 10, the Electricity Committee's recommendation that the charges for electricity be increased by 15 per cent. all round, and decided that the charge for current for lighting (including public lighting) be increased by 10 per cent., and the charge for motive power (including heating and cooking) be increased by 25 per cent.

Abertillery.—Annual Report.—The report of the Council's electricity undertaking for the year ended March 31st last, shows that the income for the year amounted to £2,301, an increase of £253 on the previous year; the expenditure was £1,855 and the gross profit £445, an increase of £340; after deducting loan and other charges £1,751, there was a deficit of £1,306. The net deficit since the inception of the undertaking to March 31st is stated as £4,827; at that date £2,901 had been provided out of the district rate, and a further £620 has since been transferred to rate account, leaving £1,306 to be provided for in future. The cost per unit sold had been reduced from 4·197d. to 3·649d., and the sale had increased by 10,970 units for the year under review.

Bootle.—Proposed Loan.—The T.C. has confirmed a proposal of the Electricity Committee to acquire for the electricity works two boilers in course of construction by Messrs. Babcock and Wilcox, Ltd. Application is to be made for sanction to borrow £8,000, £5,500 being for the boilers and £2,500 to cover cost of erection, &c.

Bristol.—Price Increase.—The T.C. has increased the price of current for lighting by 7½ per cent., and for all other and combined supplies by 15 per cent., from the date of recording the meters for the September quarter.

Bury (Lancashire).—Overhead Cables.—The B. of T. has sanctioned the placing of overhead cables from Barnbrook, Bury, for the transmission of electric current in bulk to the Heywood Corporation. As far as possible the tramway standards along Bell Lane and Rochdale Old Road will be used.

Buxton.—The contractors for the electric light at St. Mary's new church have asked the U.D.C. for terms for electricity. The Council has replied regretting that it cannot advise the placing of a distributor for the supply along Dale Road, and suggesting that a cable be laid, if required, subject to the net cost being charged to the Church Building Committee.

Castlewellan. — Prov. Order. — The L.G.B. has informed Downpatrick Council, that as a result of the inquiry recently held into the application of the Council to be vested with powers of an urban authority in order to light the town of Castlewellan by electricity, such power has been granted. The Board has also approved of the E.L. scheme and the number of lamps to be erected.

Carrickmacross.—A limited company has been formed, with a capital of £6,000, to purchase the business of the manufacture and sale of gas and electricity now carried on—the former by the Carrickmacross Gas Co., and the latter by Messrs. John McKeever and J. J. McCaul, of that town. The electrical plant is capable of dealing with 200 average installations; 25 per cent. of this number have already been connected, and orders are coming in regularly. The new company takes over important contracts for electric supply to the Great Northern Railway Co., of Ireland, and the Carrickmacross U.D.C.

Charleville (Co. Cork).—The public electric lighting scheme, which cost about £2,500, has now a revenue of about £600.

Chesham.—By arrangement with the E.L. Co., the U.D.C. has decided to discontinue street lighting.

Colchester.—Year's Working.—The accounts of the electricity supply undertaking for the year ended March 31st last show an increase in the output, 1,658,596 units having been sold, as compared with 1,623,526 during the preceding year. The total income was £18,110, an increase of £301. The works cost was £10,297, an increase of £159, and gross profit £7,813; after deducting £5,914 for interest and redemption charges, and writing off £1,086 for prepayment installations, there was a net profit of £813. The load factor was 20·49 per cent., maximum load 924 kw., and the generating plant capacity 2,030 kw. The total costs per unit were 1·49d., and the average price obtained from private supply was 2·99d. per unit, public lamps 2·23d., and tramways 1½d.

Continental.—Russia.—In a study of the resources of the Caucasus in connection with the Russian mobilisation of industry, it is observed that the hydro-electric installations in the towns of Hagri, Suchum, Novykaphon, Batoum, Artvin, and Borzhom have outputs of 540 to 1,500 h.p. They are being turned to account at the moment for the usual local requirements; but a portion of their power, it is claimed, should be used for the production of chemicals. In the matter of equipping electric furnaces in the Caucasus for the production of nitrates, the Commission has entered into negotiations with suitable firms.

It is stated in the Caucasian Press, that the question of using the water power on the Rivers Kuban and Maloi-Latu is being considered. The Council of the Caucasian Viceroy has approved the chief points of an agreement (with some change of details) with Y. Nikolenku, for a period of 75 years, allotting him land on the said rivers; but with the right of the Government to buy him out after 30 years. The estimated power of the station is 45,000 kw., and exceeds that of all the other electricity works of the Caucasus put together, which aggregate 30,600 kw., not counting the plant connected with the mining industries. It also exceeds the power of the Larsk station included in the Stewart concession. The Nikolenku concern will require a capital of 15,000,000 roubles.

Spain.—A small electricity generating station has just been completed and put in operation at Ciudad Rodrigo, by the Sociedad Hidroelectrica del Agueda. Certain available water-power near the town is being utilised.

Doncaster.—Annual Accounts.—The abstract of accounts for the year ended March 31st, of the electricity department, shows receipts amounting to £15,789, as compared with £14,344 during 1913-14; the expenditure was £14,494, as against £13,329 during the preceding year, and there was a surplus of £1,295, as against £1,015 in 1913-14. Under existing powers the Corporation can still borrow £874 for the electricity department, whilst the undertaking still owes a balance of £69,860 of the sums which have been borrowed for expenditure on the works.

East Ham.—Annual Accounts.—The total income of the electricity undertaking for the year ended March 31st last was £29,859, as compared with £32,737 for the previous year, a decrease of £2,878. The expenditure was £18,599, a decrease of £1,624 as compared with 1913-14. The gross profit was £11,260, against £12,514, a decrease of £1,254, represented by £2,878 deficiency in income, less £1,624 decrease in expenditure. After meeting all charges, including revenue contributions to capital expenditure, there remains a deficit at the close of the year of £365. The Electric Lighting Committee recommends that the deficiency be charged to the depreciation and renewals fund. Having regard to the decreased consumption of current for public lighting and business premises in consequence with the restricted lighting order, together with the extra cost of generation, the Committee recommends the Council to increase the charges for all current supplied, by 20 per cent., from and including the December quarter.

Fleetwood.—Price Increase.—The Electricity Committee has recommended that from the end of September the price of current should be increased 10 per cent., the increase not to apply to electricity consumed through prepayment meters.

The question of the conversion of the existing gas lamps in the town to electric lamps has been deferred.

Gravesend.—The T.C. has adopted the recommendation of the Electricity Committee to erect a concrete retaining wall at the works for increasing the capacity of the coal store, at a cost of about £250.

Grimsby.—Price Increase.—The E.L. Committee has increased the charges for current as under:—Lighting, from 3¾d. to 4d. per unit; maximum demand, from 1d. to 1¼d.; power, first 450 units, from 2¼d. to 2½d., with no charge beyond; time switch, first 50 units, from 8s. to 9s. The increases will add £1,000 per annum to the revenue.

Hastings.—Price Increase.—The T.C. announces that as from the reading of the meters for the current quarter, the charges for current supplied to private consumers will be temporarily increased by 10 per cent. This is due to the increased cost of fuel and materials, and to other existing exceptional circumstances.

Hawick.—Valuation Appeal.—At the Annual Valuation Appeal Court, the Urban Electric Supply Co., Ltd., appealed against the assessors' valuation of their works at £2,420, and proposed that it should be returned at £1,180, the amount last year having been £1,700. The Court fixed the valuation at £2,300. It was stated that there would be an appeal to the Court of Session.

Holyhead.—The U.D.C. has decided to give the London and North-Western Railway Co. a supply of current for lighting and power at Holyhead station, at 3d. per unit. The annual consumption will be about 94,000 units for lighting, and 1,300 units for power.

Kilmallock (Co. Limerick). — E.L. Scheme.—A public meeting has appointed a Committee to take steps for an improved public electric light service. Messrs. J. J. Murphy & Co., who furnish the present service, intimated that they would maintain it until April next, and that they were prepared to take shares in the new scheme.

London. — Stepney. — Year's Working. — The accounts of the Corporation electricity undertaking for the year ended March 31st last show a total income of £93,637, being an increase of £7,197 over the previous year; the total expenditure amounted to £48,568, an increase on 1914 of £6,514; this leaves a surplus to be carried to net revenue account of £45,070, as compared with £44,387, representing a gross profit of approximately 8¼ per cent. on the average capital employed. There has been an increase in the number of units sold, from 16,197,123 to 18,757,007, made up as follows:—Private consumers for lighting, 4,668,062 units; for power and heating, 7,751,032 units; in bulk for lighting, power and heating, 4,112,801 units; public bulk supply, 1,562,707 units; and public street lighting, 662,405 units. The total net revenue account, including the amount brought forward, amounted to £45,611; after deducting £31,442 for loan charges, £1,200 for stand-by and other charges amounting to £2,267, the net profit carried to the appropriation account was £10,702, as compared with £14,177 in the previous year. The net profit of £10,702, with £1,448 brought forward, amounts to £12,150, which it is proposed to deal with as follows:—£525 income-tax on profits; £6,165 capital expenditure; £502 to be written off capital account in respect of assets (machinery, mains and meters) now non-existent, less £13 on house services; £1,837 in respect of items of a special nature; and £2,000 to reserve, carrying forward £1,134. The general reserve account now stands at £28,000. The total average cost per unit sold was 1·024d., the lowest but one on the record of the undertaking.

Hackney. — Price Increase. — The Electricity Committee reports that, after consideration of the borough electrical engineer's report upon the position of the electricity undertaking as affected by the conditions now prevailing, it is anticipated that a considerable loss on the year's working will occur instead of a surplus of £30, as anticipated when the estimates were under consideration; under the circumstances, in order to meet the deficit, the Committee recommends that, as from the date of the readings of the meters for the quarter ending December, 1915, the existing scale of charges for electricity be increased by 10 per cent.

Hammersmith.—The Electricity Committee recommends that a supply of electricity be given to the works of Regal Films, Ltd., who are prepared to guarantee a minimum payment of £100 per annum for a period of five years.

The electrical engineer reports that, owing to the increased demand for electrical energy for factories engaged on Government work, it will be necessary to obtain seven additional 200-kw. transformers.

The L.C.C. has made arrangements for the B.C.'s application for a loan for the proportion of the cost of the Battersea, Fulham and Hammersmith linking-up scheme, to be reconsidered at its first meeting after the recess.

Poplar.—The electrical engineer reports a substantial increase in the output of the undertaking for the June quarter of 1,076,456 units, or 31 per cent. The total income was increased by £3,297, while the coal bill was only increased by £1,858. The net profit, when ascertained, will show an increase over the corresponding quarter of last year, due, in the opinion of the Electricity Committee, entirely to the favourable purchase of coal in November last for future delivery.

Bethnal Green.—Mr. H. W. Couzens, the Council's consulting electrical engineer, has reported that in the area of the new Tyssen Street sub-station there are sundry premises which are likely to become users of electricity if a supply is available, and he suggests that it would be in the interests of the Council, when the road is opened, that a distributor cable should also be laid in order to afford a supply to that district. The suggestion has been approved.

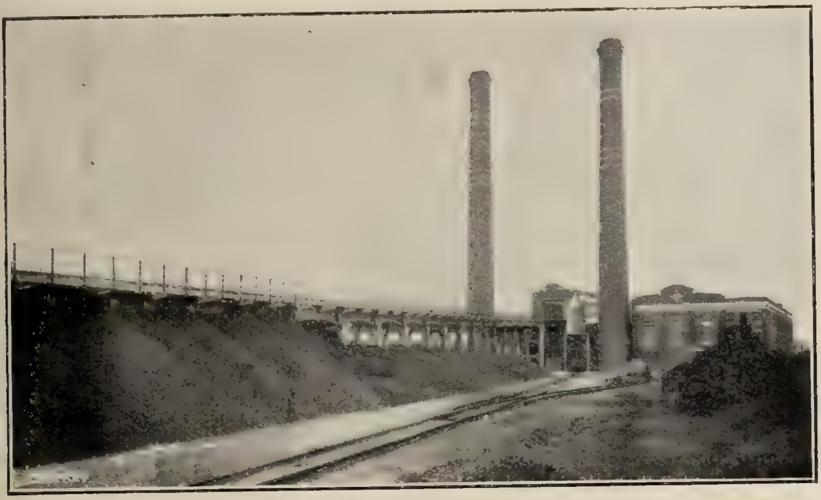
Stoke Newington.—The electricity accounts show a balance of £3,810; £3,000 has been carried to reserve, £500 to the credit of rates account, and the balance carried forward.

(*Continued on page 435.*)

LONDON AND SOUTH-WESTERN RAILWAY ELECTRIFICATION.

(*Continued from page* 391.)

We illustrate herewith the ferro-concrete viaduct built by Messrs. Holloway Bros., Ltd., which serves the purpose of a coal conveyor, and the store of coal outside the boiler-house; this coal can be conveniently shovelled into trucks on the adjoining siding, hauled up to the railway, and then carried along the viaduct into the bunkers over the boiler-house firing floor. These bunkers are of reinforced concrete, and have a capacity of about 1,400 tons. They deliver the coal through chutes to the hoppers of the mechanical stokers in the usual way.



Exterior of L. and S.W. Ry. Power House, showing Coal Viaduct and Outdoor Coal Store.

The boilers, of which 16 are at present installed, are of Messrs. Babcock & Wilcox's make, and are arranged in two rows running parallel with the turbine room, as shown in the adjoining view; the stokers are of the chain-grate type, operated by sprocket wheels and chains from a shaft running the whole length of each range of boilers, and driven by a motor, as shown on the left of the view. Two handsome brick chimneys, constructed on the Alphons Custodis principle, have been erected outside the boiler house at the permanent end of the building; each chimney is 230 ft. high, and has an internal diameter of 13 ft. 6 in. at the top. Green economisers are used to heat the feed-water, and the boilers are provided with internal superheaters, the output of each unit being normally over 20,000 lb. of steam per hour at a pressure of 200 lb. per sq. in., and with a superheat of 200° F.

The feed-water make-up, which is derived from the town mains, is softened and purified in an installation of water treating and filtering apparatus in the boiler house, and is stored in a covered reservoir having a capacity of 110,000 gallons, which runs the whole length of the building on the flat roof over the switchgear bay, and is divided into two compartments.

The ash-handling apparatus is situated at the end of the boiler house, and comprises a motor-driven blower connected with a receiver outside the building (shown in our view of the coal store); pipes running under each range of boilers in the basement open into this receiver, and are provided with openings under each boiler, which are normally closed by cast-iron plugs (see illustrations, p. 432). The ashes are dropped from chutes into a truck which is equipped with a motor-driven clinker-breaker, and after being reduced to a manageable size are fed into the pipe, the powerful in-draught ensuring that no dust or fumes shall escape into the surrounding atmosphere. The ashes are swept along into the receiver, where they are separated from the air-current, and are finally dropped into trucks on the siding below. Additional pipes are carried under the back sections of the boilers, to enable soot, &c., to be removed from below the tubes in the same way. The process is very rapid, cleanly, and economical.

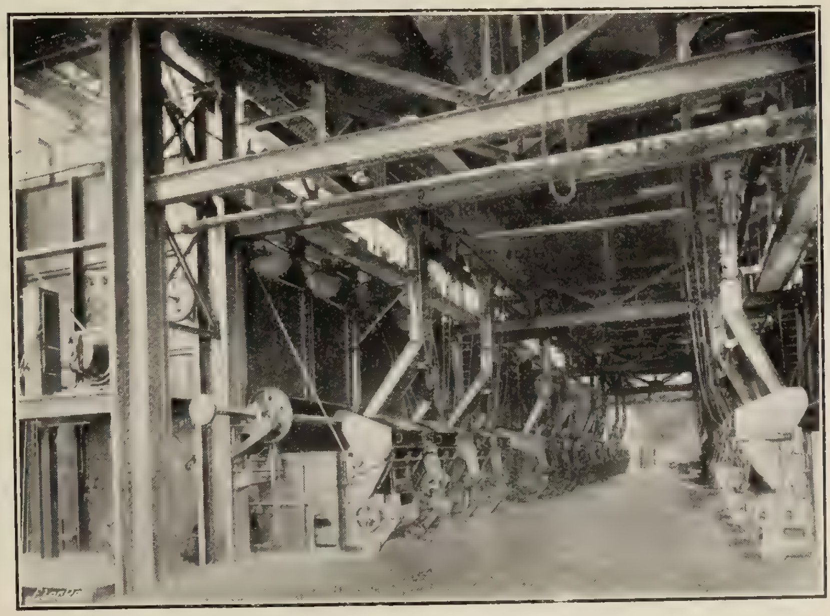
Two of the feed pumps and a sump pump in the boiler house are driven by steam; with these exceptions, all the pumps and auxiliary machinery throughout the power house are motor-driven. Amongst these machines are an air-compressor, and a vacuum pump for cleaning purposes. Two exhaust-steam feed-water heaters are provided.

The steam pipes are arranged on the unit system, a group of four boilers supplying each main turbine; the boilers and turbines can, however, also be connected to a common main, in order to give greater flexibility of working.

The main generating sets, which were supplied by Messrs. Dick, Kerr & Co., Ltd., are rated at 5,000 kw. each at 11,000 volts, 25 cycles per second, three-phase, when running at 1,500 r.p.m.

The turbines are of the impulse type, exhausting into condensers situated beneath them in the basement. Each generating set is provided with a direct-connected exciter, and a motor-driven fan for ventilating the alternator, the air being drawn through dry filters from outside the station.

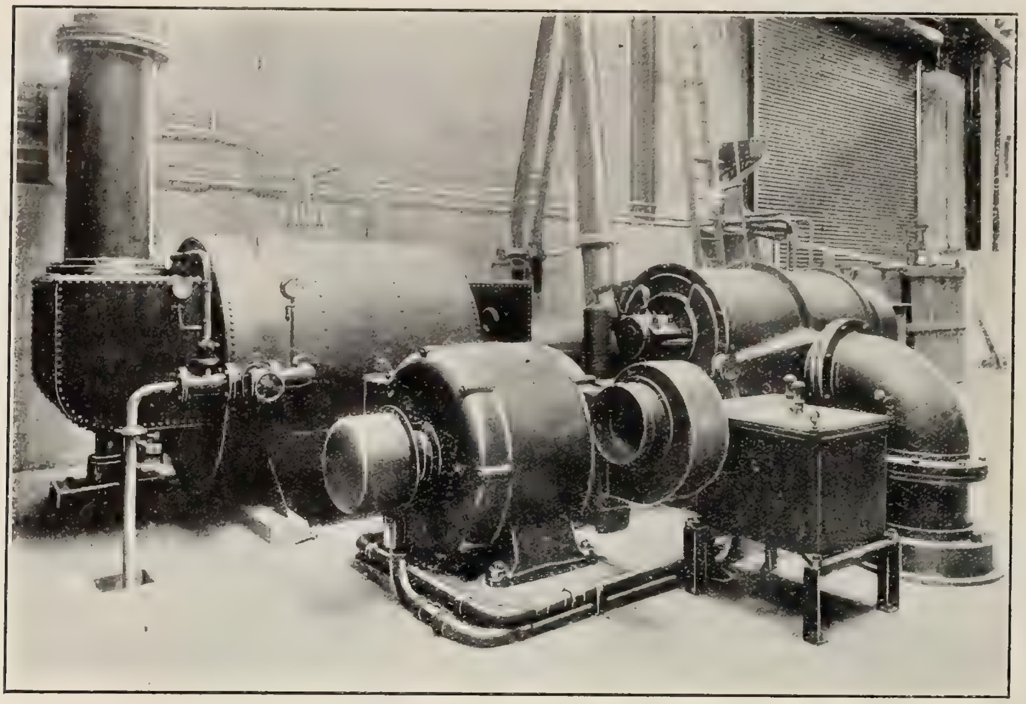
One of our views (p. 433) shows the generating sets, and incidentally the interior of the turbine room, together with the travelling crane, which was made by the Chatteris Engineering Works Co., and is of the three-motor type, with a lift of 40 tons. Another view shows the direct-current plant, consisting of three turbo-generators, made by Messrs. Dick, Kerr & Co., Ltd.; these are driven by turbines made by Messrs. Parsons and Co. through gearing, the turbines running at 5,000 r.p.m. and the dynamos at 575 r.p.m. These sets



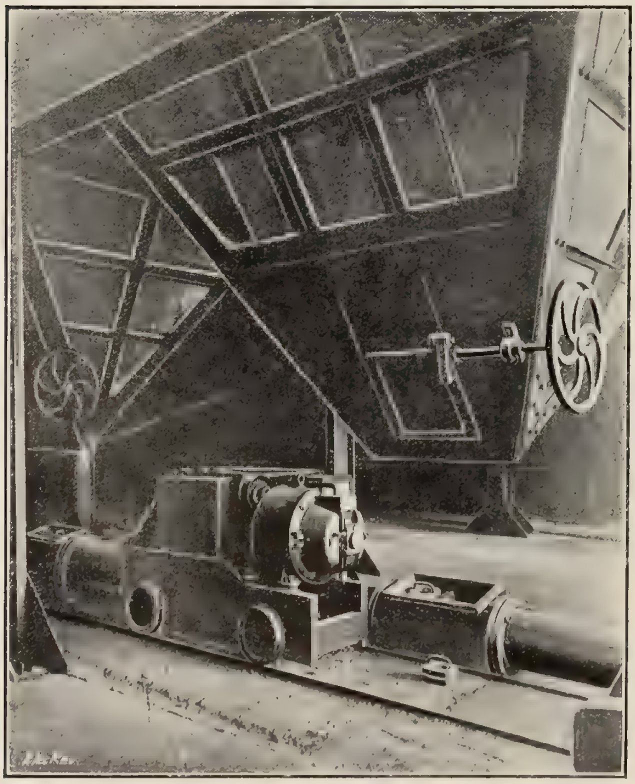
Interior of Boiler House.

have each an output of 400 kw. at 220 volts, and supply energy for lighting and auxiliary power purposes, in conjunction with a Tudor battery as a stand-by.

The condensing plant was made by Messrs. Willans and Robinson, Ltd., and is provided with their rotary air-pump system, which is shown in one of our views. In this system the air is extracted from the condenser by means of an ejector, the condensed steam being removed by a separate centrifugal pump from the bottom of the condenser. The pumps are driven by a small steam turbine, seen in the background of the illustration, while the circulating water pump is driven by a motor.



B. & W. Pneumatic Ash-handling Plant.

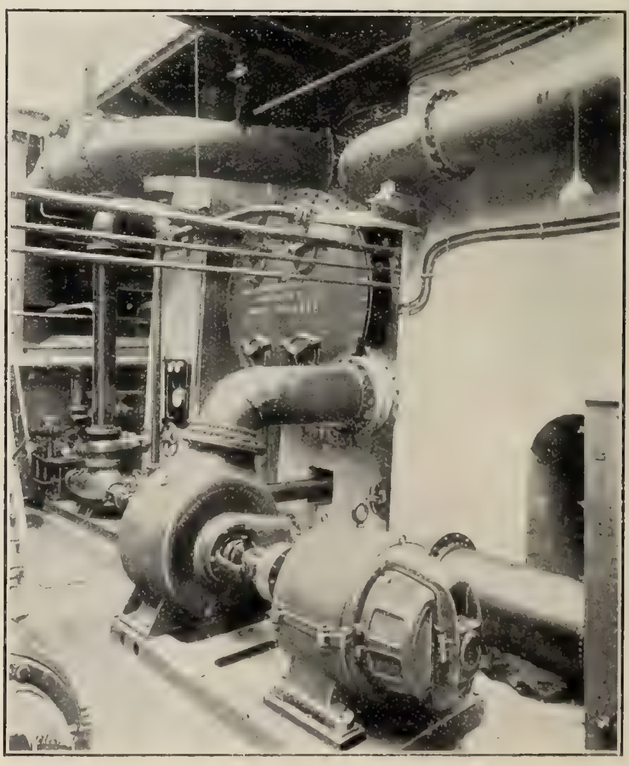


Ash Chutes, Clinker-Breaker and Pipes.

The system of dealing with the circulating water presents some novel features. As already mentioned, the circulating water is derived from the River Wandle, through open ferro-concrete ducts; the supply duct is laid with a fall towards the power house, and is provided at the inlet with a screen consisting of fixed bars, which are cleaned by means of a motor-driven rake, and are designed to deal with 2,000,000 gallons of water per hour. Close to the power house the water enters a chamber in which is mounted a rotary screen, in the form of a perforated disk, which is kept in rotation by a motor. A series of water jets directed against the upper portion of the disk, at the back, blows out any matter that may have collected in the perforations, driving it into a catching trough, from which the sludge is led into a perforated skip; the skip, when full, is hoisted by a crane and emptied into a truck.

From the fine screen the supply duct passes along the whole length of the engine room, alongside of the condensing plant in the basement. The discharge from the condensers is delivered into a similar duct, which conveys it back to the river over a series of cascades, by which it will be cooled to within a few degrees of the inlet temperature before it is finally discharged into the river. (This part of the plant is not as yet completed.)

Three large cooling towers, built by the Klein Engineering Co., Ltd., have been erected alongside of the water ducts at the river end of the power house, and the arrangement is such that at times when the supply of water from the river is inadequate, the discharge water can be pumped over the towers and delivered, after cooling, to the inlet duct. The ducts are built of reinforced concrete with a brick lining, waterproof sheeting being inserted between the lining and the concrete to prevent seepage.

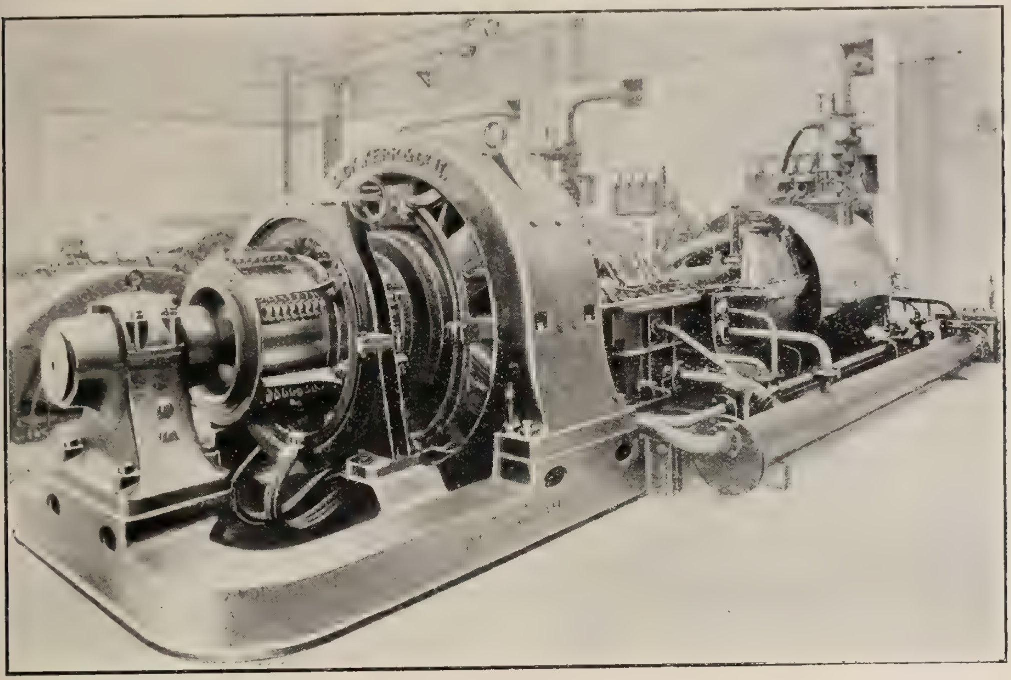


Willans Condensing Plant.

(To be continued.)

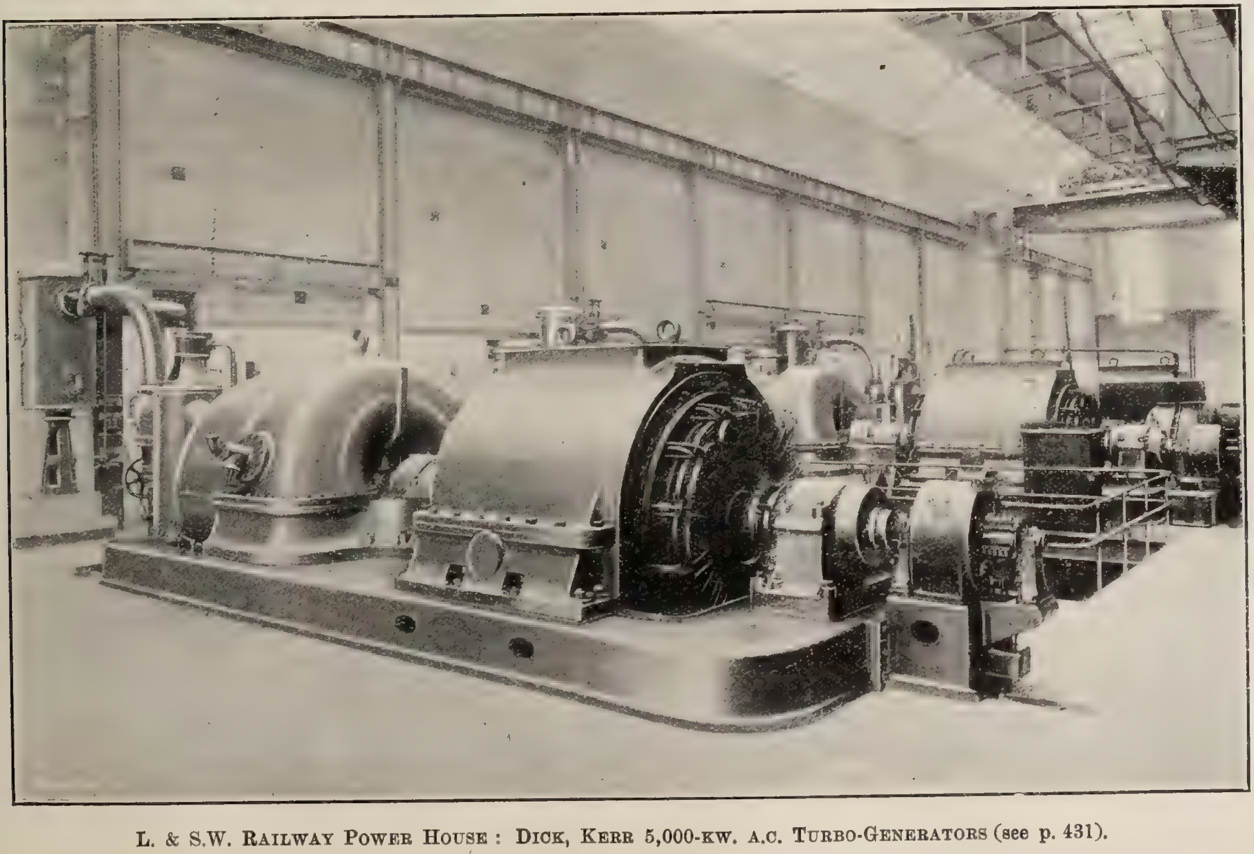
THE SUPPLY OF ELECTRICITY AT STOWMARKET.

The Suffolk Electricity Supply Co. has recently completed an entirely new generating station at Stowmarket, which will practically supersede the old plant.



L. & S.W. Railway Power House: Dick, Kerr-Parsons D.C. Turbo-Generators.

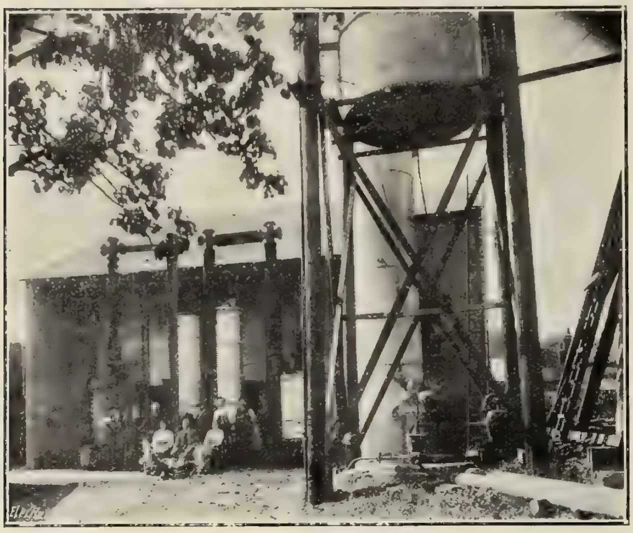
Two four-cylinder vertical gas engines supplied by Messrs. Fielding & Platt, of Gloucester, have been installed, together with two multipolar dynamos made by Messrs. Mather & Platt and the General Electric Co., Ltd., respectively. One of these sets is entirely new, but the other has been doing duty in the company's Felixstowe station for some years. The new set has cylinders 1 in. larger in diameter than the old one, and develops 180 B.H.P. as against 150 B.H.P. for the smaller size; otherwise the engines are substantially alike. The makers have, however, introduced a special ignition shaft across the tops of the cylinders in the new engine, with a handwheel for altering the timing. The ignition circuits derive their current from the main supply, and there are two lamps in series with the circuit for each cylinder, consequently the drivers have an ocular demonstration when any failure occurs. Both sets run at about 250 R.P.M. A rather unusual feature, devised by Mr. Napier Prentice, the engineer to the company, is the plan of drawing the air for the engines through the closed crank cases, whereby the moving parts are cooled while oil leakage is prevented owing to the slight vacuum induced. Naturally, oil separators have to be provided between the crank case and the engine cylinders, otherwise a good deal of oil would be drawn off with the air. This arrangement also prevents any leakage of gas into the engine room, which may have got past the piston rings.



L. & S.W. Railway Power House: Dick, Kerr 5,000-kw. A.C. Turbo-Generators (see p. 431).

Starting is effected by compressed air at 300 lb. pressure, which is stored in two vertical steel cylinders alongside of the engines. These air reservoirs are cross connected to either engine, while the motor-driven compressor is in duplicate, hence any failure of the air pressure is highly improbable.

The water from the cylinder jackets is pumped over a wooden cooling tower of the "Klein" type, with the usual cooled-water tank below it. Two motor-driven centrifugal pumps are used for circulating the water, one of which draws from a hot well and pumps the water over the tower, while the other forces the cooled water through the engines, whence it returns to the hot well by gravitation. There is of course some loss by evaporation, and this is made up from the town mains. The cooling system is completed by a circular galvanised steel tank mounted on a wooden framing, and having a capacity of 1,000 gallons. This tank, which is always kept full, forms an emergency supply in case the pumps fail.


Stowmarket Electricity Works: Producer House.

Outside the generating station, and only protected by side walls and a roof, are two producers, together with the usual wet and dry scrubbers, a special feature of the plant being the cooling of the gas in a considerable length of gilled piping between the producers and the scrubbers. The fuel used is coke, which is hauled up to the feeding platform in a wheeled truck arranged for tipping when slung. When starting, the fires are drawn up by a motor-driven fan, which sucks from the piping at each engine, thus saving several idle revolutions for exhausting the air in the pipes.

Great care is taken to prevent gas getting into the engine room, and there is no communication with the producers except by going outside the building.

Another feature is the utilisation of the exhausts to provide ventilation. For this purpose the exhaust pipes are surrounded by an old boiler shell set up on end, and the heat from the pipes, with the discharge of the exhaust gases near the top, causes a strong updraught.

In the engine room the exhaust pipes from each engine are enclosed by metal screens open at the top, and communicating with the pipe trenches at the bottom. These trenches naturally open into the bottom of the boiler shell, hence air is being continually drawn in from the engine room, and carries off the heat from the exhaust pipes while promoting ventilation.

Below the emergency cooling-water tank is a similar tank, which supplies the wet scrubbers, the water being drawn from a well and raised by a motor-driven centrifugal pump. It is interesting to note that the effluent from the scrubbers is turned into the sewers, as has been done from the old plant for years, without giving rise to any complaints.

Hitherto the pressure of supply has been 100 volts, but with the new station this voltage is being doubled, and the dynamos are shunt-wound to suit.

The old battery, which was supplied by the D.P. Battery Co., has been increased to suit the new voltage, and now consists of 110 cells. Charging and discharging is carried out through a Crompton hand-regulated booster, but regulating cells and switches are also provided, to avoid running machinery at night.

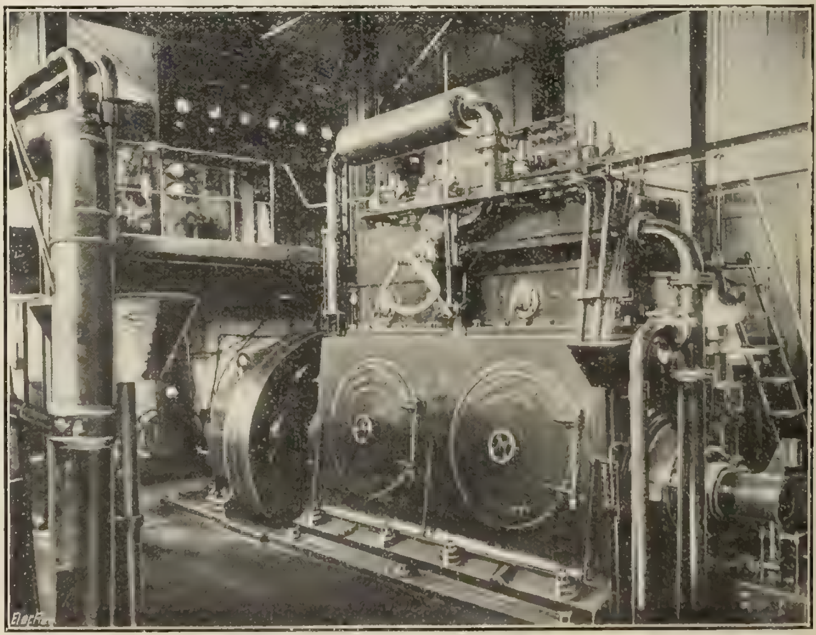
In one corner of the engine room, on a raised steel and concrete platform, is the switchboard, consisting of enamelled slate panels, with the usual fittings, and having very ample space at the back.

The engine room, forming the main building, is framed in steel, and filled in with brickwork, except the wall at one end, which is of corrugated iron, to allow of easy extension. Runways are provided over the generating plant, upon which is mounted a 5-ton crane. Terralite cement has been used for the floors, with footways of chequered bricks, and the roof is of corrugated iron carried on steel principals.

The battery room by the side of the engine room also has a corrugated iron end wall to allow of extension.

Excepting for the engines, dynamos, auxiliaries, and battery, this plant has been designed by Mr. Napier Prentice, and much of it has been made locally, while the erection has been carried out by the company's own staff. Even the cooling tower was made by local carpenters, although the design of the inside was supplied by the Klein Engineering Co., and all the motors were made by the East Anglian Engineering Co. at Stowmarket.

The work is being paid for largely out of revenue, hence economy has been closely studied, the scrubbers, for example, being made from the flues which came out of the boiler shell that surrounds the exhaust pipes.


Stowmarket: One of the Generating Sets.

Gretna Railway Disaster.—In his report to the Board of Trade on the Gretna troop train disaster of May 22nd, which involved 227 deaths and 246 cases of injury, Lieut.-Colonel Druitt repeats recommendations previously made for preventing the terrible results arising from the outbreak of fire among the wreckage after a bad collision. These include the provision of electric lighting in all new stock, gas lighting in existing stock to be abolished and electric lighting to be provided as opportunity admits.

After describing the scene following the collision the inspector says: "Fire under such conditions was inevitable, and I consider that the cause of the outbreak in the main part of the wreckage was due to live coals from the overturned engine of the troop train, and this was afterwards intensified by the escape of gas from the cylinders as they burst. But I consider that the fire would have occurred even if all the vehicles had been fitted for electric lighting."

Lieut.-Colonel Druitt understands that most of the principal companies are providing electric light in all new carriage stock, and some are arranging to convert existing gas-lit stock as opportunity occurs, but this must necessarily be a slow process spread over many years.

In the inspector's opinion, the responsibility for the collision lies entirely with the two signalmen, J. Tinsley and G. Meakin, who were sentenced at Edinburgh recently to three years' penal servitude and eighteen months' imprisonment respectively. The report mentions various rules, the infringement or neglect of which contributed to bring about the disaster.—*Daily Telegraph.*

LIGHTING AND POWER NOTES.

(*Continued from page* 430.)

Kirkheaton.—Proposed E.L. Scheme.—The members of the Council at their last meeting had a lengthy discussion in regard to the proposed applications of the Huddersfield Corporation and the Electrical Distribution of Yorkshire, Ltd., for provisional orders authorising them to supply electricity in the district of Kirkheaton, and eventually it was decided that the Council should give its support to the latter body.

Loughborough.—Price Increase. — Owing to the large increase in the cost of coal and wages, the T.C. has decided to add 12½ per cent. to all accounts for current, and to allow a discount of 5 per cent. for prompt payment of accounts.

Luton.—The electrical engineer is of opinion that as the H.T. mains to the sub-stations would probably have to be duplicated in five or six years' time, it would be ultimately more economical to lay the cable in ducts (instead of in wooden troughs), at an extra cost of £670. The Council has been recommended to comply with the engineer's suggestion.

Newcastle-on-Tyne.—Electric Cooking.—The Newcastle-on-Tyne Electric Supply Co. and its associated companies have reduced the price of current for heating and cooking purposes; the companies are also hiring out suitable electric heating and cooking apparatus.

Perth.—The Electricity Committee proposes to fix the charges for electricity for the coming year at the same rate as last year, and the T.C. is recommended accordingly.

Salford.—In the course of his just-published annual report, Mr. J. A. Robertson, borough electrical engineer, states that in January last he made certain recommendations as to the future development of electricity supply in the borough. In view of the restrictions placed by the Government on capital expenditure by local authorities during the war, and the difficulty and additional expense involved in carrying out new works at the present time, he was of opinion that the proper course was to utilise the existing works to their fullest possible capacity, even at a sacrifice in economy, leaving the question of a new station over until conditions are again normal.

Sheffield.—New Plant.—The Finance Committee of the Council is considering the question of important extensions of the electric supply department. It was reported that owing to the demand for power it was necessary that additional machinery should be purchased for the department, and that the Government was assisting the department to get the same. The estimated cost of the machinery and work was £100,000. The chairman of the Electric Supply Committee attended and asked the Finance Committee to approve of the machinery being purchased at any time if it was found desirable for this work to be done.

Southend-on-Sea.—Price Increase.—There was a discussion at last week's meeting of the Corporation on the Electricity Committee's proposal to increase the rate charged for current supplied through prepayment meters (reported in our last issue). Councillor Mitchell protested against this imposition made solely on the recommendation of the electrical engineer. Last year, he said, the Council made £12,000 profit on the undertaking by excessive charges in all its departments. On behalf of the Committee, Ald. Martin, said it had had a lot of trouble with the prepayment meters, and though the Council had been charging 5d. the amount derivable as income was less than 3d. The charges for the prepayment meters were such a worry that they had to increase the price to bring them to a paying level. The report was adopted.

Watford.—Loan Sanction.—The U.D.C. has received sanction to a loan of £1,850, part of amounts overdrawn on two sanctions of £2,585, and as regards the balance of £735, details are asked for. The L.G.B. has informed the Council that it is not prepared to sanction money for the laying of further mains, or for other purposes for the undertaking, except for purposes of the war. The Council has applied for a loan of £1,560 for mains enlargements, &c., caused by increased demands.

Wetherby.—E.L. Proposals.—The clerk to the Board of Guardians and R.D.C. has been instructed to communicate with three firms of electrical engineers, asking if they were prepared to report upon the advisability of applying for a provisional order empowering the Council to supply electricity for lighting purposes in the district.

Whitby.—Year's Working.—In connection with the electricity undertaking the following figures are included in the annual accounts for the year ended March 31st last. Receipts, £4,749; expenditure, £4,877; deficit, £128, which has been carried to the district fund. The amount borrowed in connection with the undertaking amounts to £36,286, of which £22,150 is outstanding.

Wigan.—L.G.B. Inquiry.—A L.G.B. inquiry was held last week into the application for sanction to borrow £6,700 for electrical undertaking. The money is required for two Stirling boilers, £4,620; mechanical stokers and fan, £1,152; pipe work, £508, and foundations, £225. The request was made that the matter might be treated as urgent, as the firms who desired more power were engaged on Government work.

Windsor.—Electric Pumping.—The new pumping plant installed at the waterworks consists of two Rees-Roturbo four-stage centrifugal pumps, operated by two electric motors of 135 B.H.P., the normal capacity being 60,000 gallons per hour, against a head of 226 ft., but this can be increased, should occasion arise, to 87,000 gallons, against the same pressure. Current is supplied from a trunk main coupling the Slough and Windsor generating stations, so that a supply is available from either works. A ten years' agreement has been entered into between the Corporation and the electrical company, whereby the Corporation agrees to pay a minimum sum of £150 per year, which includes the lighting of the buildings, and entitles the Corporation to 400 hours' pumping at the full rate before being liable for any extra charge for the power supplied.

TRAMWAY and RAILWAY NOTES.

Australia.—In the report of the Chief Commissioner of the New South Wales Government Railways and Tramways for the year ended June 30th, 1915, it is stated, under the heading of "Tramways," that the total electric current output for the year was 93,554,559 KW.-hours, of which the alternating current gave 92,500,524 and the direct current 1,054,035 KW.-hours. On comparison with the previous year, the total output shows a decrease of 3,515,762 KW.-hours, or 3·62 per cent. The new power house at White Bay is practically completed, and the two turbo-alternators "are now ready for operation as soon as the necessary switchgear is installed." It is added that in connection with the electric lighting of suburban railway stations, 5½ miles of H.T. transmission cable have been erected between Petersham and Flemington, and 2½ miles of H.T. concentric cable laid underground between Sydney Yard and Petersham Railway Station.

The Sydney tramways show a profit for the year ended June 30th last of £90,135, due to the increase in the fares which came into force in April, 1914. During the year eight miles of new tramways were constructed, making a total number of miles open 219¾.—*Sydney Daily Telegraph.*

Blackpool.—Tramway Traffics.—During the 28 days ending September 16th the tramway receipts were £14,763, or £5,186 more than during the corresponding period of last year. During the corresponding four weeks of 1913, however, the total receipts were £15,373. At September 16th the total receipts from the beginning of the year were £54,278, against £54,752 last year.

Chester.—Year's Working.—The total revenue from the tramways for the year ended March 25th last was £13,382, and the working expenses were £8,590. The net balance was £903.

The Tramways Committee has decided to abolish workmen's return fares as from October 1st.

Continental.—Italy.—The Italian State Railways are introducing a new type of electric locomotive, designed as 2-C-2, for high-speed service on lines with many curves, such as those in the Ligurean Riviera. Twenty-four of these locomotives have been ordered, 18 of them from the Tecnomasio Italiano Brown-Boveri, of Milan, with the mechanical parts partly from the Officine Meccaniche, of Milan, and partly from the Stabilimento Breda, near Milan. The other six will be supplied by the Construzioni Meccaniche di Sarrono, with electrical equipment by the Maschinenfabrik Oerlikon, Switzerland. Both are designed by the State Railway Department, and the construction is substantially identical.—*Elec. Rly. Journal.*

Spain.—According to the *Gaceta de Madrid*, a concession has been granted to Don Juan Gari for the construction and working of an electric tramway between Mongat and Tiana, in the province of Barcelona.

The same issue of the *Gaceta* also notifies that the concession for the construction and working of an electric tramway from Deusto to Ibarrecolanda, in the Province of Vizcaya, has been awarded to the Compania Vizcaina de Electricidad.—*B. of T. Journal.*

East Ham.—Year's Working.—The total income of the tramways undertaking for the 12 months ended March 31st was £60,570, as compared with £55,747 for the previous year, an increase of £4,823. The expenditure for the 12 months was £51,957, an increase of £3,060 as compared with 1913-14. The gross profit was £8,613, against £6,850, the increase being represented by £4,823 extra income, less £3,060 increase in expenditure. The balance carried to the net revenue account, together with a transfer from the borough rate of £6,288, sinking fund moneys applied in lieu of permanent borrowing £522, and depreciation and renewal fund moneys of £3,535, amounted to £18,958, representing the sum available for the payment of interest on, and repayment of, debt and special expenditure. After charging interest on, and repayment of loans, including contributions to sinking funds, amounting to £12,137, together with the sum of £4,167 in respect of revenue contributions to capital expenditure during the year, and to which must be added the deficiency at the commencement of the year of £7,523, there remains a deficiency at the close of the year amounting to £4,869. £4,000 of this sum has been provided for by the rates. The Tramways Committee recommends approval of the accounts, and that the engineer and manager be directed to submit a report on the question of a revision in the present fares and stages.

Croydon.—The Tramways Committee of the B.C. reported on Monday that it had effected certain economies, and was of opinion that no further reduction of expenditure could be made without impairing the efficiency of the service. Alderman Allen (the chairman) said the only thing left was to reduce the early morning cars, which he did not think the Committee would recommend or the Council accept. As a matter of fact, they were not so well used as before the war, and were always run at a loss. Since April the increase in the tramway receipts had been £3,462. Councillor Lighton said that in nine weeks their cars had run 16,000 fewer miles and consumed 4,455 less units, but had carried 380,000 passengers more than in the corresponding period of last year. The earnings per car-mile had increased from 7·66d. to 8·89d. Answering a question, Ald. Allen said that all conductors and drivers were men unfit for military service. With the Forces are 37 per cent. of the staff as existing at the outbreak of war.

Doncaster.—Year's Working.—The accounts of the Corporation tramways department for the year ended March 31st, 1915, show that the income was £25,435, as compared with £23,224 in the preceding year, whilst the expenditures were £22,579 and £21,998 respectively, the total surplus being £2,855, as against £1,226 in 1913-14. Of the total amounts borrowed for expenditure on the undertaking, £127,825 is still owing, and under its existing powers the Corporation can still borrow £4,975 in connection with the tramways department.

Meltham.—Proposed Tramway Extension.—At a joint meeting of representatives of the Council and the South Crosland U.D.C., the question of electric tramways from Huddersfield was considered, and a unanimous desire was expressed that the cars should be run through Netherton to Meltham.

Oldham.—Female Labour.—Women car conductors are to be started shortly at a commencing wage of 25s. per week, which is the same as that paid to male conductors at the commencement.

Rawtenstall. — Female Labour. — The Tramways Committee has decided to invite applications from women desirous of becoming car conductors during the period of the war only.

Railway Electrification.—The electrification of the main line of the Chicago, Milwaukee and St. Paul Railway between Three Forks and Deer Lodge, Montana—a length of 113 miles—is approaching completion. Tests of the locomotive equipment are to be made shortly between Lombard and Three Forks, the part of the road which has some of the heaviest grades encountered on the division. The locomotives will operate from an overhead trolley on 3,000-volt direct current.—*Financial News.*

TELEGRAPH and TELEPHONE NOTES.

Austrian Telephone Service.—The Postmaster-General, Mr. Spence, states that last year there was a loss of £290,000 on the telephone service; economies have been made resulting in a saving of £90,000, but the remainder will have to be met by increasing the charges.

Illicit Wireless.—At Sydney, N.S.W., on August 5th, R. Evans was charged with having in his possession apparatus capable of being used for tapping wireless messages, and was fined £50, or, in default, six months' imprisonment.

The Telephone Service.—The increased charges for calls from public telephone call offices and the revised scale of fees for the use of the trunk telephone lines come into operation to-day.

Wireless in the Air Service.—A large number of members of the Royal Flying Corps are daily receiving training in wireless telegraphy at Marconi House, the Marconi Co. having placed practically its entire resources at the disposal of the corps.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—October 25th. Six electrically-operated wharf capstans, for the Sydney Harbour Trust. Forms of tender from the Engineer-in-Chief, Harbour Trust Offices, Circular Quay.*

December 6th. Municipal Council. 33,000-volt outdoor transformers and switchgear. Specifications (10s. 6d.) from Electric Light Department, Town Hall.

October 25th. For the Commonwealth Department of Defence (Navy Office). Supply, delivery and erection of power-station plant and equipment for the Commonwealth Naval Dockyard, Sydney.*

January 12th. N.S.W. Railway and Tramways Department. Two water-tube boilers, each 8,000 sq. ft. heating surface, complete with economisers, superheaters and chimney stack, for the Zara Street power house, Newcastle. Particulars, Electrical Engineer's Office, 61, Hunter Street, Sydney.—Specification (No. 468), 20s. each.—*Tenders.*

January 31st, 1916. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust.

Victoria.—December 14th. P.M.G. For delivery in all States, 18,670 common-battery wall pattern telephones, manufactured in Australia. Sched. No. 1,264.

Victorian Railways.—January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

Brisbane.—November 17th. P.M.G.'s Department. Switchboard parts, schedule 343; telegraph instruments, schedule No. 345.

Greystones (Co. Wicklow).—One 60-B.H.P. gas engine, alternator, switchboard panel for Greystones Electric Light and Power Co. See "Official Notices" to-day.

Halifax.—October 6th. Foundations for two cooling towers at the electricity works, Foundry Street. Specification, &c. (£5), from Mr. J. Lord, M.I.C.E., Borough Engineer, Town Hall.

Littleborough.—October 22nd. U.D.C. H.T. cables, road-work, &c., transformers and switchgear for sub-station. See "Official Notices" to-day.

London.—H.M. Office of Works.—October 1st. Repair of incandescent electric lamps. See "Official Notices" September 17th.

L.C.C.—October 5th. Heating and ventilating installation at Charlton Tram Depôt. Specification, &c. (£1 1s.), from Superintendent Architect's Department, Aldine House, Bedford St., W.C.

Hammersmith.—The Electricity Committee recommends that tenders be invited for the supply of seven 200-kw. transformers.

New Zealand. — Dunedin. — November 3rd. City Council. Insulated and bare copper wire for a period of two years.* November 3rd. City Council. One 3,000-volt regulator.*

Salford.—October 4th. 20,000 pairs of carbons for the electricity department. See "Official Notices" September 24th.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Aylesbury.—The U.D.C. has accepted the tender of Messrs. E. T. Mackrill & Sons, electrical engineers, of Aylesbury, for a motor pump, at £69.

Barnsley.—The Borough Education Committee has accepted the tender of Mr. Edward Broley, of Barnsley, for E.L. work at Agnes Road Schools, at £72.

Beleek.—At a recent meeting of the District Council the tender of the Beleek Pottery Co. for lighting the town by electricity was accepted.

Bristol. — The Corporation Docks Committee has accepted the tender of Messrs. Johnson & Phillips, Ltd., for the supply of 7/16 paper-insulated, lead-covered and armoured main cable.

Bootle.—The T.C. has decided to accept a tender for about £8,000 for additional machinery at the Marsh Lane electricity works, required in consequence of the increasing output of energy for power purposes.

Buxton.—The U.D.C. has accepted the tender of the B.I. and Helsby Cables, Ltd., for the supply of two feeder pillars and four feeders, at £207.

Haslingden.—Messrs. S. S. Stott & Co., Laneside Foundry, Haslingden, have placed the contract for the electric lighting of the whole of their erecting shops, machine shops, &c., with Mr. A. M. Cramp, of Haslingden.

London.—H.M. Office of Works has accepted the tender of the Foster Engineering Co., Ltd., for 12 months' supply of metal-filament lamps under Section 1.

Bethnal Green.—The B.C. Electricity Committee recommends the acceptance of the tender of Messrs. Higginbottom & Mannock, Ltd., for two travelling cranes for the sub-stations, for £270. The only other tender received was from Messrs. Carrick & Ritchie, at £300.

Hammersmith.—The Electricity Committee has instructed the electrical engineer to negotiate a contract with the present contractors (The Main Colliery Co., Ltd.) for steam coal, for 5,000 tons of Welsh coal, to be delivered at the rate of 100 tons per week during the year ending July, 1916, at a total maximum price of 22s. 10d. per ton.

Stepney.—The Electricity Committee reports the purchase of 5,145 tons of coal, at prices varying from 17s. 9d. to 23s. per ton; and has accepted the tenders of Messrs. E. Foster & Co. for the supply of 1,200 tons of Ibstock small peas, at 20s. 6d. per ton; 3,000 tons of Ibstock double-screened nuts, at £1 2s. per ton, and 2,000 tons of Measham pearls, at 18s. 9d. per ton, to be supplied in barges at the Limehouse generating station in equal monthly quantities during 12 months. The Committee recommends that the tender of Messrs. Strachan & Henshaw, Ltd., be accepted for two extra ash-skips for the telpher track, at £67.

Wolverhampton.—The Guardians have accepted the following tenders for requirements during the half-year ending March:—

L. Andrew & Co.—Leclanché cells, metallic-filament and carbon-filament lamps.
Callender's Cable & Construction Co, Ltd.—Cable.
Edison & Swan United Electric Light Co, Ltd.—Leclanché cells, and white opal shades.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, October 2nd. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "The Wonders of Coal," by Mr. G. R. Kew.

Society of Engineers.—Monday, October 4th. At 7.30 p.m. At Surveyors' Institution, Great George Street, Westminster. Paper on "Law and Engineering," by Mr. S. G. Turner.

Nottingham Society of Engineers.—Wednesday, October 6th. At 8 p.m. At Welbeck Hotel. Annual Meeting.

Electro-Harmonic Society.—Friday, October 8th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

NOTES.

Electro-Harmonic Society.—This Society opens its thirtieth season with a Smoking Concert at the Holborn Restaurant (King's Hall), on Friday evening, October 8th, 1915, commencing at 8 o'clock. The preliminary programme is as follows:—Mr. Joseph Cheetham, tenor; Mr. Joseph Farrington, bass-baritone; Mr. Rupert Hazell, novel instrumentalist and humorist; Mr. George Gower, banjoist; Mr. Fred Curtis, humorist; Mr. Finlay Dunn, entertainer at the piano; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist. The other concerts of the season have been fixed for the following dates:—

Monday, November 15th.—Ladies' Night.
Friday, December 17th.—Smoking Concert.
Friday, January 7th.—Smoking Concert.
Monday, February 14th.—Ladies' Night.
Friday, March 17th.—Smoking Concert.

Motor-Starting by Wireless.—Starting a motor-car engine by means of wireless telegraphy is a novel idea. At the Indiana State Fair the motor of a Model 83 Overland was started every five minutes by a wireless spark from the Overland headquarters in Indianopolis, five miles away. The Overland car on exhibition at the Fair grounds was fitted up with a receiving apparatus and the necessary automatic switches and relays for throwing the electric current on and off the starter and magneto. An automatic switch was regulated so as to allow the car to run for 45 seconds, after which the magneto was cut off.—*Daily News.*

Institution and Lecture Notes.—Association of Mining Electrical Engineers (West of Scotland Branch).—On Saturday last the members of the Branch visited Auchincruive Colliery, Prestwick, belonging to Messrs. Wm. Baird & Co., Ltd. Chief interest centred in the electrical installation, which is believed to be one of the most extensive and complete in Scotland. The installation, which is on the "Thury" principle, was begun in 1908, under the direction of Messrs. Selby, Bigge & Co., and completed about four years ago. The plant included the following interesting features:—Separate colliery centre operated entirely by electric power from a central generating station, with two main winding equipments, fitted with motors of the "Thury" variable-voltage constant-current series type, mixed-pressure turbo-alternators, exhaust steam accumulator, "Thury" automatic voltage regulator, motor equipment on large ventilating fan, and a motor-generator of the fly-wheel storage type, with automatic slip regulator. After the inspection of the colliery, the company were entertained to luncheon.

University of London.—On Wednesday next, Prof. J. A. Fleming will deliver an introductory lecture on "Science in the War and After the War," at University College, at 5 p.m.

Iron and Steel Institute.—At the meeting of the Institute, last week, Sir Wm. Beardmore was elected president for next year.

Electric-Light Switching Competitions.—Messrs. A. P. Lundberg & Sons announce that their next examination and competition will be held in February, 1916; full particulars (including the exam. questions) will be published in the form of a pamphlet, which will be posted later on to all intending competitors. Money prizes, book prizes, and certificates will be awarded. Applications for the pamphlet may be sent in at any time to the firm at 477, Liverpool Road, N.

Volunteer Notes.—Engineering Institutions' Volunteer Training Corps.—

Company Orders.—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week commencing October 4th, 1915:—

Drills, 6.30 to 7.30; 7.30 to 8.30 p.m.

Monday, October 4th.—Section 1, Technical; Section 4, Squad signalling class.
Tuesday, October 5th.—Section 2, Technical; Section 3, Shooting.
Thursday, October 7th.—Section 3, Technical; Section 2, Shooting.
Friday, October 8th.—Section 4, Technical; Section 1, Squad signalling class.
Saturday, October 9th.—Company Parade, 2.30 p.m. Route march.

Arrangements have been made to share headquarters with the 4th Battalion Central London Regiment Volunteers, at Chester House, Eccleston Place (three minutes' walk from Victoria Station, Brighton Line).

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, September 30th, 1915:—

Week-end Parades.—Saturday.—The Battalion will parade at Baker Street Station at 2.30 p.m. and proceed by route march to Wembley Camp.

Sunday.—7 a.m., Réveillé; 10 a.m., Church Parade; 10.30 a.m., "B" and "C" Companies, Instruction in Cooking; 2.30 p.m., "B" and "C" Companies, Bombing; 10.30 a.m., "A" and "D" Companies will build a single lock bridge, under the supervision of Mr. S. A. Marples.

Musketry.—Saturday next, October 2nd.—There will be Shooting at both Acton and Bisley Ranges as usual. Members proceeding to Bisley must report themselves to Sergeant Gotter at the Barrier of No. 9 Platform, Waterloo Station, at 12.45 p.m.

A. G. Joiner, *Major and Adjutant*, O.B.C.

Board of Trade Lists.—The Board of Trade Commercial Intelligence Branch records in list No. 39 applications received for manufacturers or producers of the following:—

China-ware for electrical purposes, including shades.
Opal and opal-cased bowls and hemispheres for electric light fittings.
Electrical glass shades.

List No. 40 contains inquiries for makers of small buzzers for electrical signalling and tapper clocks.

Appointments Vacant.—Switchboard attendant (27s.), for Wakefield Corporation; shift engineer (£2) for Oldham Corporation; meter tester (40s.) for Salford Electricity Works; senior and junior engineers-in-charge (£4 and £3 respectively) for Belfast Tramway and Electricity Committee. Particulars are given in our advertisement pages.

The Admiralty Metal Brokers.—Messrs. H. R. Merton & Co.—Mr. R. Pearce having asked whether Henry R. Merton & Co., Ltd., are still employed by the Admiralty as metal brokers, having regard to the facts alleged by the Solicitor-General on September 17th in the case of the s.s. *Bilbister*, in the Admiralty Prize Court; and, if so, whether such employment will cease, and when; Mr. Macnamara has replied: "The answer is in the negative."

Australia.—Agencies Wanted.—A Sydney firm wishes to take up agencies for United Kingdom manufacturers of electric lighting sets for cars and electrical fittings, lamps and sundries. Particulars can be obtained at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Electric Furnaces for Canada.—An order has been placed by the Canadian Brake Shoe Co., Ltd., Sherbrooke, Quebec, Canada, for the installation of a Snyder electric furnace for melting steel. This furnace will melt and refine cold material, and will deliver 24 tons per day of 24 hours. The company has been operating a steel foundry for many years, using electric furnaces exclusively for melting. It now has six furnaces of the three-electrode type in operation.—*Mining World.*

Wiring Methods in France.—A correspondent, writing to thank us for copies of the Electrical Review, says:—"It is a real pleasure to be able to keep in touch with electrical affairs. I have been much interested in the French installations I have seen over here; in some points they are very practical, and show great ingenuity, but their house installations, with flex tin-tacked to boards or ceilings without insulators, are enough to make an English inspector have a fit on the spot, that anyone should dare to take such liberties with his goddess 'Electra'!"

"Fire Warning" Posters.—The British Fire Prevention Committee's "Fire Warnings" have been mentioned in our pages from time to time in connection with the War Emergency, but the different forms of "Fire Warnings" available, and the fact that they can be obtained gratuitously, do not appear to be generally known. Over a quarter of a million posters have already been issued by the Committee, free of charge.

All communications as to "Warnings" should be in writing addressed to the Registrar, the British Fire Prevention Committee, 8, Waterloo Place, London, S.W., and not by caller or telephone.

Inquiries.—Makers of glass insulators are asked for.

Eductional.—NORTHAMPTON POLYTECHNIC INSTITUTE.—The "Announcements" recently issued for the new session indicate that the Institute is not only well equipped for educational work, but also fosters the social welfare of its students in many ways. The day courses commence on Monday next, and the evening classes have already begun. Courses are provided in civil, mechanical and electrical engineering, technical optics and horology, as well as radiotelegraphy, submarine cable work, and electrochemistry. Various additions have been made to the equipment, including special transformers and motors, a Tirrill regulator, and a mercury arc rectifier. The principal, Dr. R. M. Walmsley, is head of the electrical engineering department, with Mr. F. M. Denton as Associate Head.

MANCHESTER MUNICIPAL SCHOOL OF TECHNOLOGY.—The prospectus of part-time courses in mechanical and electrical engineering has been received. Prof. Miles Walker is head of the department of electrical engineering, with Mr. J. Lustgarten as chief assistant, and the part-time courses, which extend over five years, are arranged for the benefit of those who, while otherwise occupied in the daytime, desire to fit themselve for responsible positions by evening study.

BOROUGH POLYTECHNIC INSTITUTE, Borough Road, S.E—Reopened on September 27th. Particulars of courses in electrotechnics are given in our advertisement pages to-day.

KING'S COLLEGE FOR WOMEN.—The Household and Social Science Department at Campden Hill has been equipped with a kitchen laboratory, in which experiments will be carried on in cooking all kinds of food by different processes; gas cookers, haybox apparatus, electric ovens and gas ovens, fitted with separate meters, so that the students can compare the cost of fuel, are features of the central kitchen.

Wireless Telegraph Patents.—It is reported that a syndicate, representing Marconi interests, has acquired the Poulsen patent rights, and that the latter will in due course become the property of the Marconi organisation.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—A sum of 50 guineas is to be given to the electrical engineer at Bedford for work done by him outside his duties as engineer, particularly in preparing specifications and supervising work in connection with the Isolation Hospital, Corporation buildings, and all centres controlled by the Education Committee.

Reference was made at a meeting of the Falkirk Town Council to the patriotism of MR. RANSOM, the electrical engineer, who has joined H.M. Forces, and best wishes were extended to him.

MR. A. H. GATES, having been discharged from military service, it is proposed to re-engage him as chief technical assistant at the Luton Council's electricity works, at £3 10s. per week.

Tramway Officials.—MR. J. R. GROVES, manager of the Worcester tramways, has been appointed manager of the Electric Traction Co.'s system at Gravesend and Northfleet. Mr. Groves has been at Worcester for seven years, and previously held positions at Cardiff, Great Yarmouth and Croydon.

General.—We have pleasure in offering our most cordial congratulations to MONS. MONTPELLIER, rédacteur-en-chef of *L'Electricien*, who has been nominated to the grade of Chevalier of the Legion of Honour. At the outbreak of war he entered upon service as Chief of Section of the Central Military Telegraphs at Paris. The same honour had previously been conferred upon M. J. L. Routin, engineer to Messrs. Bréguet.

At the Catholic Church of St. Simon Stock, Putney, the marriage has taken place of MR. HERVEY J. V. COWARD, who is on the staff of the Underground Railways Electric Power Station, Lot's Road, Chelsea, and Miss Minnie Victoria Morgan, youngest daughter of the late Mr. A. Houlston Morgan, of Bradley Hill (Glos.). The presents included a marble clock from the bridegrooms's colleagues.

MR. HAROLD R. NASH, chief of the cable order and estimating office of the St. Helens Cable and Rubber Co., and Miss Florence H. Hill, confidential clerk to the manager and secretary of the firm, were married at the Parish Church, Lowton, on September 22nd. The staff of the cable works gave the newly-married couple a case of cutlery, and Miss Hill, who has been with the firm for 12 years, was handed an enamelled carriage clock.

At Worksop Congregational Church on September 23rd the marriage took place of MR. E. B. VERE, electrical engineer, of Rossington, and Miss Dorothy Dawse, only daughter of Mr. H. E. Dawes, of Worksop.

ALD. WALTER PHELPS GIBBINGS, chairman of the Electricity Committee, has accepted the Mayoralty of Carlisle for the coming municipal year.

On September 25th, MR. ROWLAND A. EVANS, representative of the lift department at Messrs. Gimson & Co. (Leicester), Ltd., Leicester, was married to Beatrice Irene, only daughter of Mr. and Mrs. T. Merchant, of Leicester, at Dover Street Baptist Church, Rev. Rowland Evans, father of the bridgroom, performing the ceremony.

MR. E. W. SIMMONS, second cost clerk in the Stepney B.C. electricity supply department, has resigned his appointment owing to a breakdown of health.

Roll of Honour.—Sergt. THOMAS HAWTHORNE, of the 7th Lancs. Fusiliers, is officially reported wounded from the Dardanelles, but a letter from a chum states that he has been killed. He was 23 years of age, and was employed before the war at the British Westinghouse Works at Trafford Park.

Private ALEC. DUNN (20), of the 7th Battalion Lancashire Fusiliers, and formerly employed at the British Westinghouse Works, Trafford Park, has been wounded in the fighting at Gallipoli.

Private A. SNELHAM, of the Australian Contingent, who is reported wounded and missing at the Dardanelles, served his apprenticeship with Messrs. Dick, Kerr & Co., Preston, and about three years ago went out to Australia to work in the copper mines. He is 25 years of age.

Private SAMUEL GREGORY, of the 7th Lancs. Fusiliers, who has been killed in action, was 22 years of age, and was formerly employed by the British Westinghouse Co. at Trafford Park.

Private JOHN BAILEY, of the 6th Battn. South Lancashire Regt., has died on board ship from wounds received in action at the Dardanelles. He was employed before the war at the Warrington Corporation electricity works.

MR. A. C. GILLING, electrical engineer to the Epsom Urban Council, who has been on active service for about nine months with the Queen's Westminsters, has returned from the Front suffering from a shrapnel wound in the head, which, fortunately, is not serious. We are pleased to learn that Mr. Gilling has, without application, been given a commission in the Royal Flying Corps, and he commences his aviation training forthwith.

Lance-Corporal A. WOODWARD, 7th South Staffs. Regt., who was engaged with the British Thomson-Houston Co., Ltd., Rugby, has lost his life at the Dardanelles. He was killed whilst attending to a wounded comrade.

Warrant Telegraphist ERNEST A. SUTTON, Royal Naval Reserve, who lost his life in the sinking of H.M. trawler *City of London*, in the North Sea, on September 14th, was formerly on the wireless staff of the Marconi Co. Later he was with the General Electric Co., Ltd., of London, where he was assistant manager of one of the departments. After the outbreak of war he offered his services to the Admiralty, and at the time of his death he was nominated for further promotion.

Intelligence has reached his home at Margate of the death from wounds received in action in the Dardanelles of Private HENRY MINTER, electrical engineer, who was serving with the Australian Imperial Force, which he joined at Toowoomba, Queensland, on the outbreak of war. Deceased received his training at the works of the Adams Manufacturing Co., Bedford, and he left for Queensland in September, 1911.

For conspicuous gallantry in rescuing his Section Officer under heavy fire, Sapper ERNEST JACKSON, of the Royal Engineers, has been awarded the D.C.M. When he enlisted Jackson, who was only 18 years of age, was with Mr. Simpson, manager of the Preston tramways.

News has been received of the death of Private ARTHUR SULCH, of the 5th Battalion Duke of Wellington's West Riding Regiment (Huddersfield Territorials), in the trenches in France. He was 20 years of age and was formerly employed by Mr. T. W. Broadbent, electrical engineer, of Huddersfield.

Private F. WHITTAKER, of the 9th Battalion West Riding Regiment, who has been missing since September 3rd, was formerly employed by the Yorkshire Electric Power Co., at Dewsbury, and enlisted in September, 1914. He went out to the Dardanelles last July.

We are sure that we voice the sentiments of a large company of electrical men when we offer to Mr. and Mrs. H. Scholey, of Bedford Park, W., and 56, Victoria Street, S.W., our very deep sympathy with them in the death of their only son—indeed, their only child—Lieut. CHAS. HARRY NORMAN SCHOLEY, of the 9th Battalion Rifle Brigade, who was killed in action on the Western Front on Sunday last, September 26th. Lieutenant Scholey, who was 23 years of age, was educated at Uppingham, and was an undergraduate at Clare College, Cambridge, when war broke out. He received his commission through the University, and in September, 1914, was posted to the Rifle Brigade. In February he was made First Lieutenant and was given his company in August last. He won his school colours for Rugby football, and at Cambridge obtained the College colours for cricket, Rugby and hockey.

Obituary.—The interment took place last week at Chester Cemetery of the remains of the late MR. JOHN GARDNER, general manager of the Chester Corporation tramways. The deceased, who was 64 years of age, was formerly connected with the traffic department of the Liverpool tramways, and in 1885 was appointed manager of the Chester Tramways Co. In 1901 he became general manager of the Chester Corporation tramways, and electric traction was inaugurated 18 months later.

REVIEWS.

Arithmetic of Alternating Currents. By E. H. Crapper. London: Whittaker & Co. Price 2s. 6d. net.

This little volume comprises an admirable selection of worked examples and graduated exercises (with answers) in various alternating-current exercises. Whilst it has, naturally, no particular "plot," the book is very well arranged and in every way up to the high standard we should expect from the author. It should meet fully the needs of those many students who desire guidance and material on which to practise in the way of numerical quantitative exercises. Alternating-current problems of every kind demand a good deal of mathematical working for their solution, and, though the mathematics required be comparatively simple, more practice is required to gain confidence and readiness in its application than can easily be provided for in a standard text-book on alternating-current theory. By preparing a treatise devoted specifically to the arithmetic of the subject, the author has earned the gratitude of what will, we are sure, be a very extensive circle of readers.

It is important to note that the book is much more than a mere collection of problems. At the beginning of each chapter is a brief expository introduction leading up to the particular group of problems and calculations forming the main bulk of the chapter. So successful has the author been in this respect that he has actually succeeded in making the book readable, whilst still fulfilling all the aims generally attempted unsuccessfully by the orthodox collections of "Exercises" in text-books. There are ten chapters in all, the longest being devoted to calculations relating to generation of alternating E.M.F.'s; inductive circuits; and capacity and condensers. Chapters of intermediate length are devoted to periodic and alternating quantities in general; to resistance, inductance and capacity in parallel; and to static transformers; whilst the remaining chapters deal with inductances, polyphase power, induction motors, and transformers. Altogether there are 50 worked examples and 182 exercises, and it is safe to say that any reader studying this work will find his progress made as easy and interesting as possible and will acquire, by the time he reaches the last page, a thorough grounding in the fundamental principles of a branch of electrical engineering of immense and daily increasing importance. Candidates for C. & G. examinations and other students traversing the scope of the latter will find this volume of great assistance.

Graphical Determination of Sags and Stresses for Overhead Line Construction. By Guido & Marco Semenza. (Translated from the Italian by C. O. Mailloux.) London: Hill Publishing Co. Price 12s. 6d. net.

There can be no doubt that many overhead line breakages due to the action of the elements—wind, snow, ice, cold and heat—and commonly set down as dispensations of Providence, could be averted by taking into account, when erecting the lines, those physical factors on which their stability depends. Costly high-tension transmission lines are generally erected very carefully under full recognition of the influence of atmospheric and climatic conditions, but smaller (and far more numerous) lines are usually adjusted "by eye." Expert as the line foreman undoubtedly becomes in thus securing what he considers the desirable result, it is obviously impossible for him to allow for varying atmospheric conditions from day to day and to ensure that the line shall be safe under the worst conditions arising in the locality, unless he has at his disposal some means which he can apply in the field to ascertain what sag and tension under existing atmospheric conditions will ensure safety under the worst conditions.

The claim made for the present work is that it provides "a method for determining sags and stresses which, while based rigorously and solidly upon sound scientific principles, is so simple in application and practical in use that an intelligent lineman or foreman can use it without difficulty." Since the curves permit the requisite information to be determined without calculation on the part of those using them, we believe the main object of the work is fulfilled, but it might have been fulfilled in a more satisfactory manner. As the book stands, we doubt whether any average lineman or foreman could find out how to use it for himself. The engineer in charge of the work could, however, draw up a set of instructions for the use of "practical" men hitherto unfamiliar with graphics or, at any rate, with its special phraseology. The authors' explanations, at least as presented in the translated work, are only likely to be comprehensible to the technically-trained engineer, and even the latter would find his path considerably smoothed were skeleton diagrams given in the text to illustrate the particular examples chosen for explanatory purposes. Seeing that the book is intended for field use, it would not be superfluous to print a copy of the loose temperature scales provided on one of the pages, so that, should the loose scales be lost, a fresh set could at once be prepared.

The general procedure adopted in using the charts is as follows: From the first chart a factor *m* is read off, according to the wind and ice load to which the line may be exposed. The actual span is multiplied by this factor to give a hypothetical span, which is subsequently adopted in reading from the later charts, the sag at given temperature corresponding to any particular tension in the line. The curves apply only to copper conductors, and in preparing them it has been assumed that the line hangs in a parabola (instead of a catenary). Other assumptions are also made to simplify matters without introducing serious error within practical limits of the quantities concerned. In order that the appropriate large scale chart may be selected quickly, an index-chart is included with the range of the individual charts demarcated by red rectangles.

The general function and character of the work are set out in Part I, which is followed by a detailed exposition of the scientific principles underlying the construction of the curves and of their mathematical evolution. This section and Part V, which gives the derivation and theoretical discussion of various formulæ used in Part III, badly need revision, for misprints are frequent and the keying of the symbols used is very unsatisfactory. The trained engineer, who alone could attempt to read these sections of the book, will not find any great difficulty in making the necessary amendments; but that does not excuse their being necessary. It is only fair to add that the charts can be used without any reference to the defective mathematical sections. Part III gives instructions for and examples of the practical use of the charts, and should, in our opinion, be simplified in phraseology and supplemented by explanatory diagrams. Part IV is very useful, giving, as it does, information regarding allowances in various countries for the effect of wind and ice load on stresses and sags in overhead lines.

This book and the charts which it introduces should be very useful to all engineers engaged in overhead constructional work, and it is particularly unfortunate that the present edition should include blemishes which could easily have been avoided, and which, while in no sense vital, must prove annoying to the reader.

NEW COMPANIES REGISTERED.

Institute of Industry (of Great Britain and Ireland), Ltd. (141,643).—This company was registered on September 22nd as a company limited by guarantee with an unlimited number of members, each liable for £5 in the event of winding-up, to promote, increase and develop the industrial, scientific, financial and commercial activity of the United Kingdom of Great Britain and Ireland, and His Majesty's Overseas Dominions, Colonies, Dependencies and Possessions, and generally to further and encourage inter-Imperial trade throughout the British Empire by all lawful means, and to capture, retain and develop branches of industry, trade and commerce which have fallen into the hands of those who are now alien enemies of Great Britain, to watch over the interests of non-alien traders in connection with rates charged by railway and shipping companies and other carriers for the conveyance of goods, and to endeavour to obtain the removal or reduction of all unfair or excessive rates, tolls and charges. The subscribers are:—S. R. Illingworth, Fern Villa, Chesham Bois, Bucks., chemist; W. P. Thomson, Hatton Court, E.C., chemist; J. Hay, 138, Leadenhall Street, E.C., merchant; Sir H. H. Bartlett, 56, Victoria Street, S.W.; A. H. Norton, 2, Eldon Street, E.C., consulting engineer; Sir James Heath, Bart., Oxenden Hall, Market Harborough; J. Taylor Peddie, 39, Murray Road, Wimbledon, S.W., director. The subscribers to the memorandum of association and such following named persons as shall consent to become members shall be the first members of the Institute: Sir William Beardmore, Bart., Sir Clifford J. Cory, Bart., Arthur du Cros, J.P., M.P., C. Johnson, G. A. Wills, G. McLaren Brown, and Sir George Watson, Bart. The management is vested in a Court of Directors. The first directors are: Sir H. H. Bartlett, Bart., 56, Victoria Street, Westminster, builder and contractor; Sir William Beardmore, Bart. (Messrs. W. Beardmore & Co., Ltd.), Glasgow, shipowner; Sir Clifford Cory, Bart., 98, Mount Street, W., colliery owner and coal merchant; Arthur du Cros, J.P., M.P., 14, Regent Street, W., motor-car manufacturer; L. Evans, "Russell," near Watford, Herts., paper manufacturer; Sir James Heath, Bart., Oxenden Hall, Market Harborough, ironmaster; G. B. Hunter, "The Willows," Clayton Road, Newcastle-on-Tyne, shipbuilder; C. Johnson (The Rolls-Royce Co., Ltd.), Conduit Street, W., motor-car manufacturer; J. W. Macdonald (Messrs. Henry Tate & Sons, Ltd.), Silvertown, E., sugar refiner; W. J. Noble, Bath House, Putney Heath, S.W., shipowner; J. Taylor Peddie, 39, Murray Road, Wimbledon, S.W., director; Sir Adolph Tuck, Bart. (Messrs. Raphael Tuck & Sons), Moorfields, E.C., publisher; J. Turner (Messrs. Read, Holliday & Sons, Ltd.), Huddersfield, dye manufacturer; Sir William G. Watson, Bart., Salhampstead House, near Reading, company director; G. A. Wills, "Burwalls," Leigh Woods, Clifton, Bristol, tobacco manufacturer; G. Maclaren Brown, The Canadian Pacific Railway Co., Charing Cross, S.W., railway manager; W. Deakin, "Thornleigh," Oakfields Road, Selly Park, Birmingham, engineer; S. R. Illingworth, Fern Villa, Chesham Bois, Bucks., chemist; T. C. Moore, Shelton, Stoke-on-Trent, pottery manufacturer; A. Home-Morton, 2, Eldon Street, E.C., consulting engineer. Until otherwise determined the entrance fee payable on election shall be five guineas in the case either of an individual member, not being a representative member; ten guineas in the case of a partnership firm, company or corporation with a paid-up capital not exceeding £200,000, or by any unincorporated association or body not having a share capital, or by a member representative of any partnership, company, corporation, or association with a paid-up capital exceeding £200,000; but no entrance fee shall be payable by any of the first thousand members of the Institute (including the subscribers to the memorandum of association). Solicitors: Rutter, Veitch & Bond, Norfolk House, Norfolk Street, Strand, W.C. Secretary: L. Atkinson, Aldwych Site, W.C. Registered office: Exhibition Buildings, Aldwych Site, Strand, W.C.

Electrode Company of Sheffield, Ltd. (141,654).—This company was registered on September 23rd, with a capital of £40,000 in £1 shares, to manufacture, buy, sell and otherwise deal in carbon and other electrodes used in connection with electric furnaces and other materials and appliances for the manufacture of steel and alloys or otherwise, which can conveniently be made or dealt with in connection or simultaneously therewith; also to carry on the business of general merchants, ironmasters smelters, engineers, etc The subscribers (with one share each) are: D. Vickers, River Don Works, Sheffield, steel manufacturer; W. C. Whiteley, Wood Hall, Sheffield, steel manufacturer; H. Peile, Milburn House, Newcastle-on-Tyne, alloy manufacturer; W. H. Ellis, Westwood, Ecclesall, Sheffield, civil engineer; F. C. Fairholme, Netherhall, Hathersage, Derbyshire, civil engineer; I. B. Milne, Cross Grove House, Totley, near Sheffield, metallurgical director; C. W. Kayser, Eaton Hall, near Retford, steel manufacturer.

Private company. The number of directors is not to be less than four or more than ten; every shareholder or group of shareholders holding 4,000 shares shall be entitled to nominate a director in respect of each complete 4,000 shares held. The following are the first directors nominated by the firms whose names are given in parentheses: D. Vickers and W. Clarke (Vickers, Ltd.); H. Peile (Newcastle Alloy Co.); W. H. Ellis (John Brown & Co., Ltd.); F. C. Fairholme (Thomas Firth & Sons, Ltd.); I. B. Milne (Hadfields, Ltd.); C. W. Kayser (Kayser, Ellison & Co., Ltd., and Samuel Osborne & Co., Ltd.). The directors for the time being may co-opt other directors, but so that the maximum number is not exceeded and that such co-option shall not interfere with the rights of individual shareholders under the above provisions. Solicitors: G. E. Branson, 9, Bank Street, Sheffield. Registered by Jordan and Sons, Ltd., 116-7, Chancery Lane.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Brilliant Sign Co. (1907), Ltd.—Mortgage and Land Registry Charge on Paragon Works, Uxbridge Road, Shepherd's Bush, both dated September 9th, 1915, to secure all moneys due or to become due from the company to Capital and Counties Bank, Ltd., 39, Threadneedle Street, E.C. Also debenture, and as collateral security thereto, a mortgage, both of even date, to secure £9,000, charged on company's undertaking and property, present and future, including uncalled capital. Holders: Capital and Counties Bank, Ltd., 39, Threadneedle Street, E.C.

Tyer and Co., Ltd.—A memorandum of satisfaction in full on September 11th, 1915, of debentures dated March 10th, 1913, securing £7,000, has been filed.—Particulars of £15,000 debentures, created September 14th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Banbury and District Electric Supply Co., Ltd.—A memorandum of satisfaction in full on December 31st, 1914, of debentures dated March 26th, 1913, securing £200 has been filed.

Sheerness and District Electric Power and Traction Co., Ltd.—A memorandum of satisfaction in full on January 1st, 1915, of debentures dated December 8th, 1914, securing £315, has been filed.

Imperial Light, Ltd.—A memorandum of satisfaction to the extent of £2,600 (being amount outstanding) on September 14th, 1915, of debentures dated November 7th, 1910, securing £5,000, has been filed.

Oriental Telephone and Electric Co., Ltd.—A memorandum of satisfaction to the extent of £1,200 on September 15th, 1915, of debenture stock secured by trust deed dated June 28th, 1905, and supplemental deed of acknowledgment dated June 12th, 1907, securing £200,000, has been filed.

Telephone Co. of Egypt, Ltd.—A memorandum of satisfaction to the extent of £700 on September 15th, 1915, of debenture stock, secured by trust deed dated July 27th, 1904, and three supplemental deeds of acknowledgment dated February 21st, 1906, March 4th, 1908, and October 27th, 1909, securing £200,000, has been filed.

CITY NOTES.

Dundee, Broughty Ferry and District Tramways Co., Ltd.

Presiding over the annual meeting, Mr. George Balfour, the Chairman, replied to the criticism directed against the company in connection with the taking over of part of the line by the Corporation of Dundee. He deprecated what he characterised as the wild statements on the part of members of the Town Council before the true facts of the case were known, and he maintained that no fault lay with the company in connection with the trouble that had arisen. Continuing, he said the year ending July 31st had been a particularly troublesome one, and the direct effects of the war were reflected in the decreased receipts, the receipts from all sources being £13,293, or approximately £700 less than the previous year. In addition to decreased receipts, expenses had increased, the principal increase being in connection with fuel, which cost about £400 more than in the previous year, the decrease in receipts and the increased cost of fuel accounting for the difference of nearly £1,100 in gross profit, viz., £5,284, compared with £6,328 for the previous year. In moving the adoption of the report and the accounts, Mr. Balfour said the directors did not recommend payment of any dividend on the ordinary shares for last year, and they were certain that this would be approved by the shareholders. The decrease in profits would not alone have determined the directors to pass the ordinary share dividend, but the decrease in profit, coinciding with the altered conditions of running and the prevailing uncertain outlook, made it essential to adopt a cautious policy.

The motion was adopted.

The Petrograd Electric Lighting Co. of 1886.

The report for 1914 of the Petrograd Electric Lighting Co. of 1886, the situation of which has occupied a large amount of public attention during the past twelve months in consequence of German interests in the undertaking, stated that the participation of German capital and the activity of German subjects in the administration of the company down to the outbreak of war had been made the pretext by the Moscow City Council for representing that the working of the Moscow station was irreconcilable with the public interests, and asking for the liquidation of the company. As, however, it could be proved that the majority of the company's shares belonged to Swiss subjects, the company expressed the hope that the Government would limit its action to the placing of the company under special State control. Since the end of November the company had been without any communication with the works at Lodz, and the working results of the latter had, therefore, only been included to the close of that month. As a consequence of the war, the consumption of energy by a number of industrial companies had experienced a diminution, although the decrease was more than counterbalanced by the connection of new works which were chiefly engaged on army contracts.

The increase in the share capital to £5,000,000 which was resolved upon in January, 1914, had been carried out by the issue of new shares for £1,000,000 shortly before the outbreak of the war, each new share being entitled to one half of the dividend devolving upon the old shares. Concerning the participation of the company in other undertakings, the report mentioned that 70 per cent. of the share capital of £1,200,000 of the Imatra Co. for the Distribution of Electrical Energy, of Brussels, had been paid up down to the occurrence of hostilities, and had been mostly employed in the works of the Russian Overland Central Stations Co. and in connection with the site and rights of the hydro-electric works at the Vuoksen Falls in Finland. The works at Bogorodsk of the Moscow Electric Power Transmission Co., of Petrograd, were brought into operation in February, 1914, and were working satisfactorily, but no information was available respecting the works at Sosnowice, which were to have been started in the autumn of 1914.

If 10 roubles are accepted as the equivalent of £1 sterling, the accounts for 1914 show gross receipts of £1,661,200, as compared with £1,371,200 in the preceding year, whilst the working expenses were £804,700 and £643,500 in the two years respectively. After deducting general expenses, taxes, loss in exchange, etc., the net profits are returned at £683,800, as against £603,500 in 1913. It is proposed to pay, as was announced two or three months ago, 11 per cent. on the preference capital, as in the previous year, and 8 per cent. on the ordinary shares, as in 1913. Owing, however, to the situation created by the war, it is proposed to place the £387,000 required for the payment of the dividends to a special account, the period for the actual distribution being left to the discretion of the directors.

Russian Companies.

The Moscow Electric Power Transmission Co. (Electroperodatscha), in which the Petrograd Electric Lighting Co. of 1886 is interested, incurred a loss of £21,000 in 1914 on a share capital of £600,000, this being the second working year.

The Russian Overland Central Stations Co. has declared a dividend of 4 per cent. for 1914 on share capital of £400,000.

The Russian Dynamo Co., of Moscow, has decided to pay 4 per cent. on ordinary share capital of £400,000 for 1914.

The Russian Wireless Telegraphy Co. has resolved to divide 15 per cent. on the ordinary capital of £300,000 for 1914.

The Petrograd Electrical Installations Co., which, in conjunction with the 1886 company and the Belgian Co., supplies energy in the Russian capital, has decided to distribute 10.2 per cent. on share capital of £1,160,000 for 1914.

The Riga Tramway Co. intends to pay 8 per cent. for the past year.

Lower Thames Land and Power Co.—The *Financial Times* states that, subject to the consent of the Treasury being obtained (formal application has already been made for the necessary sanction), it is reported that the County of London Electric Supply Co. has decided to offer to its share and debenture-holders an opportunity of participating in an issue of debentures relating to a new enterprise to be known as the Lower Thames Land Development and Power Co., Ltd. The property to be owned by this concern will consist of 308 acres of land at Barking, an option over which was acquired some little time ago on what are regarded as favourable terms. Apparently only a comparatively small proportion of the area in question will be required for the purposes of a generating station, and the remainder of the property will be dealt with by the new company in a manner suitable to the general scheme which it has in view. The authorised debenture issue of the new concern is £100,000, carrying interest at 5½ per cent., and constituting a first mortgage for 25 years. Of this total it is proposed to offer £80,000 for subscription at par. The County of London Electric Supply Co. will guarantee unconditionally the capital, interest and sinking fund. Statements which have appeared in print to the effect that the foregoing scheme has some bearing upon the pre-war project for the consolidation of the electric lighting and power industry of London are believed to be erroneous.

Our contemporary in its issue of Wednesday states that the formation of the Lower Thames Land, &c., Co., has no bearing on electrical enterprise. The company has been created merely for the purpose of purchasing and developing a building site at Barking, while, incidentally, a portion of this site is to be leased to the County of London Co., who come into the matter solely as intermediaries.

German Electrical Companies.

The *Kabelwerk Rheydt* proposes to pay a dividend of 18 per cent. for 1914-15, as compared with 12 per cent. in the preceding year, and the Elektrizitatswerk Westfalen 6 per cent., as against 4 per cent.

The *Bergmann Elektrizitats Unternehmungen, of Berlin*—the financial organisation of the Bergmann Electricity Works Co., which discontinued the negotiation of fresh business in 1912—earned gross profits of £5,300 in 1914-15, as compared with £15,500 in the previous year, the net surplus being £441, as against £9,500 in 1913-14. The debit balance brought forward has, consequently, been reduced to £26,700 on a share capital of £300,000.

The directors of the *Elektrometallurgische Werke, of Horrem, A.G.*, which company was formed two years ago by the Metal Bank and the Griesheim-Elektron Co., report that the year 1914 was part of the preparatory period. After setting aside £1,400 for depreciation, the accounts indicate a loss of £3,300 for the year, thus increasing the debit balance to £5,600 on an ordinary share capital of £50,000.

The *Brandenburg Carbid und Elektrizitats Werke A.G., of Berlin*, in reporting an increase in the gross profits in 1914-15, states that the expansion was due both to the supply of electricity and the production of carbide in Germany, and by the Norsk (Norwegian) Elektrokemisk Aktieselskab. The sales of electricity advanced from 4,400,000 KW.-hrs. in 1913-14 to 4,900,000 KW.-hrs. last year, despite the prejudicial effects of the war, whilst as a consequence of the favourable water conditions the output of carbide in 1914-15 was considerably greater than in the previous year, both at the inland works and at those of the Norwegian company, which was able to pay 14 per cent. for 1914, as compared with 6 per cent. in 1913. The gross profits of the Brandenburg company amounted to £26,000, as against £23,000, and the net profits to £15,000, as contrasted with £9,100. It is proposed to pay a dividend of 7 per cent. on a share capital of £175,000, this comparing with no distribution in 1913-14.

The shareholders in the *Deutsche Popelampen A.G., of Aix-la-Chapelle*, have decided to dissolve the company, whose working in 1914-15 resulted in a loss of £8,400. According to the report submitted at the recent meeting, the fifth year's trading closed with a considerable loss, because the conditions of trade had become more difficult for wire lamps in so far that consumers would only purchase approved wire lamps, whilst the war had rendered it impossible to obtain raw materials and trained workers. The directors had, therefore, been compelled to dispose of the glow lamp machinery. It had, however, been possible to find a market abroad, although at unfavourable prices, for most of the so-called lamps of second quality, as they would have become worthless if kept in stock for a long time. The insulating tube department developed down to the outbreak of the war so that large profits could have been reckoned on, but it could not be continued owing to the lack of raw materials, which were requisitioned by the military authorities, and the department for welding materials yielded profits which were too small to be of importance to the undertaking as a whole.

STOCKS AND SHARES.

Tuesday Evening.

The brilliant work of the British and French Armies announced at the beginning of the week has had the effect of neutralising the dullness produced by the Budget, the Bulgarian uncertainties, and other such influences. The long-expected advance appears to have started, and the news received on Sunday is accepted in the City as the first instalment of what are confidently hoped to be several chapters of steady pressure forward. Once more we are all amateur generals; and the armchair critics of our various newspapers are, for the time being, regarded as of little account.

From the point of view of prices, the change has been less marked in them than in sentiment. The Stock Exchange atmosphere has altered from dulness and depression to cheerfulness and light. Buying has been stimulated to some extent, but it is not surprising that markets should require more support than they have received hitherto before they can go substantially better. The American rate of exchange is still, it is evident, giving the Anglo-French Commission a good deal of trouble, but that New York considers the issue of the loan as good as made is apparent enough from the boom which is taking place in American rails, and in securities of all kinds on that side of the water. The shares of industrial companies, in particular, are soaring—electrics with the rest; and the huge amount of money which the States is making out of the war is reflected in marked Stock Exchange activity.

On this side, the County of London Electric Supply Co. is offering to its shareholders and debenture holders an amount of £80,000, in 5½ per cent. 25-year first mortgage bearer debentures, in a new company to be called the Lower Thames Land Development & Power Co., Ltd., which has a nominal capital of £100,000. The County Co., according to the circular in front of us, has exercised its option for the purchase of about 300 acres of land at Barking, with river frontage, for the erection of a new power station; but as the company will require only a certain portion of this land for generation purposes, the other undertaking has been formed to acquire and develop the whole property. The debentures are being offered at par. The principal and interest in the new concern will be guaranteed unconditionally by the County of London Electric Supply Co.; and as the annual amount for interest and sinking fund under the guarantee is £6,550, and the surplus profits of the County Co. for the year ended December last were £106,000, there is no question of the soundness of the security.

The electric lighting market is comatose. Metropolitans have gone back to 2¼, a fall of ¼, but County preference retain their rise of last week, and other shares in the market are just steady. Little trade is being done in any of the shares.

In the telegraph section, a fall of 10 points in Indo-Europeans has dropped the price to 40. Shares changed hands as low as 34½ about a week ago, but these apparently have been taken by purchasers at 39½ and 40; so that, incidentally, it might be assumed that somebody made a handsome profit. The purchaser, however, might quite fairly retort that he was taking a big risk in buying the shares at all, inasmuch as the immediate future of the company, from the dividend point of view, is somewhat undecided. Supposing the current dividend to be maintained, however, the yield on the money comes to 8⅛ per cent. at 40, from which it is obvious that plenty of margin exists for a reduction in the rate distributed at present. Westerns are better at 12; Eastern Extensions and Eastern Telegraph ordinary have both hardened a trifle.

The fact of the income-tax being raised to 3s. 6d. cannot fail to direct attention to the companies which pay their dividends free of tax. This practice is followed by various telegraph companies, as indicated in our lists, but there is nothing to guarantee, of course, that in any half-year all the companies, or any one of them, may not depart from their present method, and in future send out their dividends less tax. It is often asked why all companies do not pay their dividends tax free, but very little consideration suffices to show that there are several sound reasons against their doing so. The one which tells probably more than the rest, however, is that a company can pay a higher rate less tax than it can if it declares its dividend free; and with the tax on unearned incomes standing at 3s. 6d. in the £1, 5 per cent. free of tax, to take an example, is equal to practically 6 per cent. gross. And it cannot be gainsaid that 6 per cent. does look better than 5 per cent., although actually the result may be the same if the dividends are paid gross and net respectively.

The Home Railway market is taking a turn for the better on the whole, but Electrics are weak, and further falls have occurred in Metropolitans, in Districts and in Underground Electric "A" shares, while the income bonds of the last-named company remain about 71. The market is regaining a little of the confidence that was handled so roughly by the threatened coal strike and railway trouble, but investors are not keen on putting money into these securities now. It is possible there will be a further reduction in prices before the Home Railway market really arrives at something like a steady level.

The question of Excess Profits Tax has raised a storm of doubt and discussion in business circles. Those who have most closely studied Mr. McKenna's speeches are at one in declaring their inability to elucidate the knotty points. The text of the Finance Bill, when it appears, will probably throw light upon the subject. Various companies connected with the electrical industry are expected to come within the clause; and while it may make a considerable difference to those concerns which have been doing well out of the war, it may also affect others, the profits in which have risen, although for causes entirely removed from the all-prevailing factor.

Manufacturing shares in the electric market are somewhat irregular in price. Edison & Swans have fallen to half-a-sovereign; India-Rubber shares weakened to 8, a drop of ¾; and Henleys at 12½ show a fall of £1. Allowing for the fact that the dividend on Henleys is paid free of tax at present, the yield at 12½ is the substantial one of £9 2s. per cent. on the money.

For the time being, we leave our calculations of yield practically unchanged, because they are worked out on the convenient basis of an income tax of 2s. 6d. in the £, and for the calendar year January 1st to December 31st, 1915, the rate actually comes to 2s. 8d. in the £ in the great majority of cases.

One of the features of the last day or two is a meteoric rise in American Marconis, which lifted the price from 15s. to 19s. 6d. The buying emanated mostly from the United States, and was confined to these particular shares, the parent Marconis and Canadian Marconis failing to obtain any benefit from the jump in Americans. It is freely stated that the American Marconi Co. is doing extremely well, and, in addition, there is a New York boom, already referred to, in the shares of nearly all the railroad and industrial companies.

The armament market is firm, on an excellent report published by the Birmingham Small Arms Co. Rubber shares, after being a dull spot, have taken a turn for the better. Business in both sections, however, is meagre. There is some improvement amongst copper shares, in consequence of the demand from America, but base metal issues on the whole continue to show heaviness.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend, 1914.	Price Sept. 28, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	7½	—	£6 13 4
do. 7 per cent. Pref.	7	7½	—	4 16 7
Charing Cross Ordinary	5	3¾	—	6 18 4
do. do. do. 4½ Pref.	4½	3¾	—	6 0 0
do. do. City Pref.	4½	3¾	—	6 0 0
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4¼	—	5 17 8
do. 4½ Deb.	4½	88	—	4 17 10
City of London	9	12½	—	7 7 0
do. do. 6 per cent. Pref.	6	10¾	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10¼	—	6 16 7
do. do. 6 per cent. Pref.	6	10½	—	5 14 8
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6¼	—	7 4 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4¾	—	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	8½	2¼	— ¼	7 15 7
do. 4½ per cent. Pref.	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6¾	—	7 8 2
do. do. do. 7 per cent. Pref.	7	6½	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6¾	—	6 13 4
do. 4½ Pref.	4½	4¼	—	5 9 0

Telegraphs and Telephones.

	Dividend, 1914.	Price Sept. 28, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	98½	—	6 2 0
do. Def.	1½	22	—	6 16 4
Chile Telephone	8	6½	—	6 3 0
Cuba Sub. Ord.	5	8	— ¼	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	12	+ ⅛	*6 13 4
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord.	7	116	+1	*6 18 0
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	80	—1	5 0 0
Globe Tel. and T. Ord.	6	9¾	—	*7 0 8
do. Pref.	6	9¾	—	6 3 0
Gt. Northern Tel.	22	33	—	6 13 4
Indo-European	13	40	—10	8 2 6
Marconi	10	1⅞	—	5 6 8
New York Tel. 4½	4½	99	+ ½	4 11 0
Oriental Telephone Ord.	10	1 15/16	—	5 8 1
do. Pref.	6	1⅛	—	5 6 8
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5½	—	*8 6 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12	—	*6 13 4
do. 4 Deb.	4	80	—1	5 0 0

Home Rails.

	Dividend, 1914.	Price Sept. 28, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented	4	70	—	5 14 4
Metropolitan	1½	28	— ½	5 8 8
do. District	Nil	13½	— ¾	Nil
Underground Electric Ordinary	Nil	1½	—	Nil
do. do. "A"	Nil	5/6d.	— 3d.	Nil
do. do. Income	6	71	—	*9 11 8

Foreign Trams, &c.

	Dividend, 1914.	Price Sept. 28, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Arg. Trams, First Pref.	5½	8¾	—	7 6 8
do. 2nd Pref.	5½	8¼	—	8 9 2
do. 4 Deb.	4	73	—	5 9 7
do. 4½ Deb.	4½	72	—	6 5 0
do. 5 Deb.	5	74	—	6 15 2
Bra Tractions	3½	49	+1½	7 2 10
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	38	—	Nil
do. 5 per cent. Bonds	—	40	—	Nil
do. 6 per cent. Bonds	—	85	—	Nil
Mexican Light Common	Nil	25	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	40	—	—
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	98	—	5 2 0

Manufacturing Companies.

	Dividend, 1914.	Price Sept. 28, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	2 3/16	—	6 8 5
British Aluminium Ord.	5	1 1/16	—	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	10⅝	—	7 1 2
do. Pref.	6	5⅞	—	5 2 2
British Westinghouse Pref.	7½	33/-	+6d.	9 1 10
do. 4 Deb.	4	70	+2	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref.	5	4½	—	5 11 3
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	61/-	—	4 18 6
Edison & Swan, £3 pd.	Nil	10/-	—1/-	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	58	—	6 18 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/-	—	7 7 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	12½	—1	*9 2 0
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	8	— ⅜	6 5 0
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

County of Durham Electrical Power Distribution Co., Ltd.—A financial contemporary states that the directors have decided not to declare an interim dividend on the preference shares.

Lancashire Dynamo and Motor Co., Ltd.—Interim dividend at the rate of 6 per cent. per annum (3 per cent. actual), the same as a year ago.—*Times.*

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 29th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a „ Nitric	„	..	..
a „ Oxalic	per lb.	1/-	..
a „ Sulphuric	per cwt.	..	..
a Ammoniac Sal	„	..	..
a Ammonia, Muriate (large crystal)	per ton	£44	£4 inc.
a Bleaching powder	„	£9	..
a Bisulphide of Carbon	„	£23	..
a Borax	„	£23	..
a Copper Sulphate	„	£28	..
a Lead, Nitrate	„	..	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %)	per ton	..	..
a „ Chlorate	per lb.	1/4½	..
a „ Perchlorate	„	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers	„	£11 10	..
a „ Recovered	„	£8	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %)	„	..	..
a „ Chlorate	per lb.	1/3½	½d. inc.
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	5½d.	½d. inc.

METALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
b Aluminium Ingots, in ton lots	per ton	..	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	..	..
b „ Sheet, in ton lots	„	..	..
p Babbitt's metal ingots	„	..	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/0¾ to 1/1	..
c „ Tubes (solid drawn)	„	1/0¾ to 1/1	..
c „ Wire, basis	„	1/1¼ to 1/1½	..
c Copper Tubes (solid drawn)	„	1/1 to 1/1¼	..
g „ Bars (best selected)	per ton	£96	£2 dec.
g „ Sheet	„	£96	£2 dec.
g „ Rod	„	£96	£2 dec.
d „ (Electrolytic) Bars	„	£88	£5 inc.
d „ „ Sheets	„	£106	£5 inc.
d „ „ Rods	„	£95	£5 inc.
d „ „ H.C. Wire	per lb.	11½d.	½d. inc.
f Ebonite Rod	„	8/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/4½	¼d. dec.
l Iron Pig (Cleveland warrants)	per ton	64/10	..
l „ Wire, galv. No. 8, P.O. qual.	„	£26	..
g Lead, English Pig	„	£25	£1 inc.
g Mercury	per bot.	£16 5 to £16 7 6	..
e Mica (in original cases) small	per lb.	6d. to 3/-	2d. to 6d. in.
e „ „ „ medium	„	3/6 to 6/-	6d. to 1/- in.
e „ „ „ large	„	7/6 to 14/- & up.	1/- to 3/6 in.
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	..	..
p „ „ rolled bars & rods	„	..	..
p „ „ rolled strip & sheet	„	..	..
o Platinum	per oz.	190/-	5/- inc.
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	„	£153 to £154	..
n „ Wire, Nos. 1 to 16	per lb.	2/7	..
p White Anti-friction Metals	per ton	..	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a	G. Boor & Co.	h	Edward Till & Co.
b	The British Aluminium Co., Ltd.	l	Bolling & Lowe.
c	Thos. Bolton & Sons, Ltd.	k	Morris Ashby, Ltd.
d	Frederick Smith & Co.	l	Richard Johnson & Nephew, Ltd.
e	F. Wiggins & Sons.	n	P. Ormiston & Sons.
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	o	Johnson, Matthey & Co., Ltd.
g	James & Shakspeare.	p	
		r	W. F. Dennis & Co.

Winnipeg Electric Railway Co. — A dividend of 2½ per cent. for the quarter ending September 30th, 1915, being at the rate of 10 per cent. per annum, is announced.

Madras Electric Tramways (1904), Ltd. — The directors have declared an interim dividend at the rate of 6 per cent. on the preference shares.

Globe Telegraph and Trust Co., Ltd.—The directors have declared a first interim dividend of 2s. per share, free of income-tax, on the ordinary shares.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—A dividend on the preference shares at the rate of 4 per cent. per annum for the six months ending 30th inst. has been declared.

Russia.—The Bielostock (Russia) Electrical Co., capital 2,000,000 roubles, made a profit in its second (1914) working year of 182,067 roubles; 100,000 roubles (or 5 per cent.) will be distributed in dividend.

THE PROBLEM OF THE "POINT-FIVE" TARIFF.

[COMMUNICATED.]

ıe "point-five" tariff—officially defined as any scheme der which energy for heating and cooking is obtained at ıd. per KW.-hour, with or without a preliminary fixed arge—has undoubtedly come to stay. The number of oint-five" supply areas increases steadily, the heating d cooking connections therein increase rapidly, and it ems no over-statement of the case to say that really impor-ıt development in domestic heating and cooking depends energy being available at 0·5d. per unit (or less). The portant point is to have a cheap rate for actual consump-ın; this is an invaluable asset to canvassers, and eliminates nsumers' dissatisfaction due to high bills caused by cur-ıt wastage which, in the form it usually takes, is not pensive to the supply station.

One may safely look forward to the number of "point-e" undertakings being very materially increased in the ar future (for domestic heating and cooking apparatus ems at last to be emerging on a commercially and techni-lly satisfactory basis), and it is, therefore, worth while ying attention to the fixed charge which supplements the l. a unit tariff. The ideal arrangement would naturally to supply all energy at a single flat rate, and there no reason why this should not be approached as station ad factors increase. It seems quite certain, however, that uniform flat rate can only be justified by practically 100 per cent. station load factor, since no improvement in orage cells can make storage of electrical energy as simple, ıeap, and efficient as the purely mechanical storage of gas gasometers. In this respect, gas supply engineers have a ry material advantage over electricity canvassers, who ıd it a perplexing task to explain to the lay mind why ırrent for power should cost so much less than current for ghting.

However, the fact remains that for the present a charge ½d. per unit consumed for heating and cooking must practically every case be supplemented by a fixed charge. o levy this indirectly, by stipulating that so many lamps be stalled and operated on the ordinary lighting tariff, requires ıplex wiring, and at once rouses the consumer's suspicion ıat he is being badly "done" on the lighting units. As a atter of fact, there is a very excellent reason for selling ırrent at different rates at different times of day, but if ıis be applied to the cooking supply, it makes cooking ery dear between certain hours, and, in the aggregate, it is nwise to use this system.

The best compromise—for a compromise is imperative, ith the cost of generation varying from hour to hour, and latively negligible storage provided—is to supply energy r all domestic purposes at a flat rate of ½d., covering all ıpital expenses and the extra cost of peak supply by a fixed ıarge; the consumer is then no longer perplexed by ariations in the price paid for a given amount of a given ommodity—he obtains current for all purposes at a uniform nd very low rate, and if his cook leaves the stove switches on" an hour or so longer than she need do, the cost of ıe extra energy consumed is not a serious item.

So far, so good; but it is in the determination of the fixed harge that difficulties appear. The majority of existing point five" undertakings assess fixed charges on the basis of ıteable value, and it would seem that there is considerable isk of this becoming standard practice. The writer cannot elieve it is desirable that this should happen, and in the ollowing paragraphs are set out arguments which seem to im deserving of close consideration, as well as figures and urves, which appear to demonstrate conclusively that the ateable value basis is not equitable.

The most tempting feature of the rateable value tariff, rom the central station point of view, is its simplicity. All ouses have their rateable values assessed, and it is only ecessary to take a certain percentage thereof, and charge all nits at ½d., and the job is done. The fundamental ssumption is that rateable value is a reasonably accurate ıeasure of the electricity-consuming capacity of private remises, and the fundamental weakness of the system is ıat it is not necessarily or even generally anything of the kind. In a particular row of houses under the writer's observation, all rated at the same value, one is occupied by a family keeping two servants, and holding frequent parties, during which every room in the house is brilliantly lighted. The next house is occupied by a quiet and smaller family, burning about one-third the number of lights used by their neighbours. The next house is a boarding establishment, and the next again is occupied by eccentric persons of the daylight-saving persuasion. And so it goes on along the street in question, and, broadly, the writer ventures to suggest, all over any town.

The object and tendency of any "fixed-charge-plus-small-unit-charge" system is to encourage liberal use of electricity by all persons, but it cannot be ignored that houses of similar size and quality shelter families of very different sizes and habits, and, in fact, that rateable value bears neither theoretical nor actual relationship to the current consumption of a household.

Concrete support for this contention is to be found in fig. 1, which presents graphically some data included in the latest report of the working of "point-five" tariffs in conjunction with rateable-value fixed charges. These statistics, presented by Messrs. Blackman and Roles at the recent I.M.E.A. meeting, show the average units used per consumer during a period of 12 months by consumers having rateable values between £10 and £20; £20 and £30, and so on. In plotting the data it has been assumed that the average rateable values of the several groups are £15, £25, &c. This assumption and the fact that different numbers of consumers are included in obtaining the averages for the various groups doubtless affects the absolute accuracy of the curves, but the latter show that although there is a natural tendency for consumption to increase with rateable value, the increase is by no means smoothly progressive nor is there a reasonably constant ratio between the consumption in houses rated at, say, £25 and £55. For instance:—

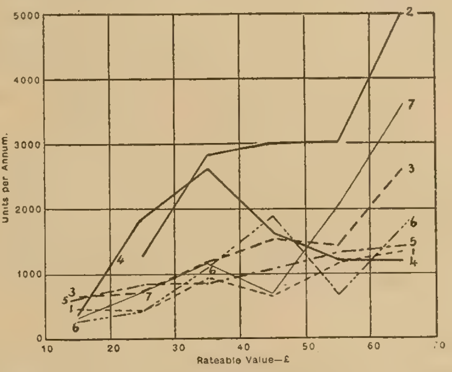


Fig. 1.—Showing Average Units per Annum in Houses of Different "R.V."

Ratio Units per Annum per Consumer in Houses Rated £55 : £25.

1. Barnes	2·6	5. Sunderland	1·6
2. Blackpool	2·3	6. Worcester	1·6
3. Bradford	1·9	7. Wrexham	2 8
4. Carlisle	0·65		

The numerals correspond to those on the various curve sheets.

Though, as mentioned, some part of the disparity between these figures may be due to the different number of cases averaged in various groups, that only goes to show that the rateable value in individual cases is a very poor index of current consumption. Whereas in Sunderland the rateable value percentage charge is *increased* as rateable value increases (from 10 per cent. between £15 and £30 to 15 per cent. over £70), the charge in Blackpool is normally 12½ per cent. on assessment, and is reduced to 10 per cent. on houses rated over £100.

In any event, if a different percentage of R.V. is to be charged in the case of different sized houses (as seems desirable), and if allowance is to be made for the effect of specially large or small gardens on rateable value (as seems essential), the R.V. tariff at once loses its merits of simplicity and power of being easily understood by the layman.

The method generally employed (at the time of initiating the new tariff) in determining the percentage of rateable value to be taken as the fixed charge, is to analyse previous accounts, and see what percentage of rateable value will, in conjunction with $\frac{1}{2}$d. per unit, give the same revenue from lighting as the previous flat rate (say, 4d. a unit). This amounts to securing the station's revenue and supplying all additional units at $\frac{1}{2}$d. It is a simple, if tedious, method of arriving at a suitable *average* percentage on rateable value, but there is nothing to secure (1) that this percentage will not be far wide of the mark in individual cases; and (2) that the percentage decided by reference to previous accounts will be at all suitable under the new conditions which it is desired to bring about by the new tariff.

Generally the percentage charge is 10, 12½ or 15 per cent. on rateable value, but it makes a considerable difference to consumers, and so, ultimately, to the station's prospects, which percentage is adopted. To illustrate this, fig. 2 has been prepared. As a reasonable basis (averaging the general tendency of the curves in fig. 1), let us assume the following average annual consumptions for houses rated as below:—

R.V.	Units.	R.V.	Units.
£15	500	£45	1,400
25	750	55	1,800
35	1,000	65	2,200

Then, with all units at $\frac{1}{2}$d. and fixed charges of 10, 12½ and 15 per cent. in turn on rateable value, the average cost per unit varies as shown in fig. 2. In this case 2½ per cent. on rateable value corresponds to about 0·2d. per unit difference in mean price per unit, and hence to about 10s. per annum on the bill for a £15 house and £2 per annum on the bill for a £65 house. This difference in bill—which may easily arise due to (1) erroneous assumption of rateable value percentage applying to old conditions; (2) inapplicability of assumption to new conditions; or (3) variations in percentage rateable value properly applying to houses of different R.V.—is here about 13 per cent. on the total amount, and in the long run cannot but tell against the station's financial position or against the development of supply (according as the difference is in immediate favour of the consumer or the station).

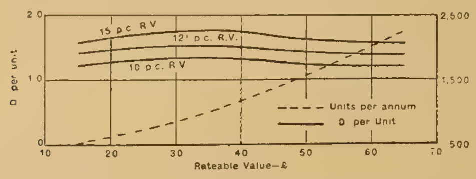


Fig. 2.—Effect of "R.V." Charge on Mean Price per Unit.

(*To be concluded.*)

PREFERENTIAL RATES FOR EXPORTS.

By FRANK BROADBENT.

Whether we label ourselves and each other Liberal, Conservative or Radical, the fact remains that the human mind is inherently Conservative, and resists to the uttermost a change of opinion. It takes an earthquake or a world-war to shake it out of itself, and hence we find ourselves to-day calmly thinking things which a couple of years ago we should have considered almost sacrilegious. When we find erstwhile Free Traders of the staunchest type cheerfully welcoming a 33⅓ per cent. import duty on motor-cars, for example, we need not fear to ventilate the subject of preferential rates for exported articles.

To have suggested, say, a couple of years ago, that electrical manufacturers should, as a definite policy, adopt a system of preferential rates for exported goods, charging lower rates to the overseas purchaser than to the home buyer, would have raised such cries as "German methods," "dumping," and the like, and it would have been argued that the home consumer must necessarily be saddled with the losses on the export trade. It has, in fact, been seriously and consistently argued that this is the normal condition of affairs in such countries as Germany and America.

But electrical engineers who have raised the formulation of preferential tariffs for electricity supply almost to the dignity of a fine art, should have no difficulty in applying the system in one or other of its many modifications to the export or any other department of the electrical industry. The argument that, under a preferential tariff, the home consumer pays for the losses on overseas trade, is practically the same as that of the lighting consumer who protests that he bears the losses on the sale of cheap units to the power consumer. This argument, based as it is upon the false assumption that all units generated have an equal value, does not at this time of day call for serious treatment. The justification of the policy lies in the fact that the development of the power load has resulted in a general lowering of lighting rates due to the all-round reduction in standing charges per unit sold.

Having accepted and approved of the principle of differentiation when applied to the supply of electricity, we cannot logically object to it when applied to the supply of any other electrical commodity. We are therefore justified, from a business point of view, in regarding the home trader as the lighting consumer, and the overseas trader as the power consumer, and just as a discriminating tariff policy has resulted in an enormous increase in the electric supply business and a lowering of costs all round, so we may assume that if scientifically adapted it should have a similar effect in manufacturing industries generally, and help towards securing a very much larger share of the export trade than we have hitherto enjoyed.

In addition, however, to costs of manufacture, there are, in dealing with export matters, the questions of railway charges and freight to consider; but it should not be impossible to apply some modification of the system of electricity supply tariffs even to these.

We have a system of charging known as the "telephone" system, which might be just as accurately described as the parcel-post system. In the latter, according to the new Budget, we shall pay 4d. a lb. for the first lb. and 1d. for each additional lb. carried. This is not quite the best statement of the method of charging, which is more accurately expressed by saying that the rate of charge is 1d. per lb., plus 3d. per package for standing charges. The bulk of the parcels for long-distance transmission are carried by the railway companies, the short distances being dealt with by the P.O. motor vans. The average price paid by the general public for small packages carried on the railways and delivered to their destination is approximately 1d. per lb. for any distance within the United Kingdom. Presumably it pays the railway companies.

There is no hard-and-fast rate for goods traffic, the price depending upon the character and quantity of the goods and the distance to be covered; but it should be possible for an association of manufacturers—the B.E.A.M.A., for example—who could guarantee a minimum amount of traffic per annum, to secure much better rates than those at present in vogue. By a system of co-operation it might be possible for the manufacturers in certain areas to fill a certain number of truckloads for each outgoing steamer from the nearest port, and in this way get rates for truckloads instead of rates per cwt. or per ton. Then a sliding scale of discounts depending on the quantity shipped per annum might be arranged, the quantity being the aggregate of the individual shipments of the members of the group.

The question of freight is more difficult, because lines of steamers to various foreign ports are controlled by certain combinations of shipowners who, in the absence of any competition, are in a position to make their own terms. Moreover, the rates vary with the demand for ships. There is certainly scope for improvement from the exporter's point of view, but as the method of charging is practically standardised throughout the world, it would need a world-wide movement among shippers to secure any improvement. That better terms *can* be obtained is proved by the success of the Government in connection with the meat contracts. To illustrate one only of the disadvantages under which the exporter labours, take the case of a manufacturer who exports motors and arc lamps to the Colonies, say, Australia. Four arc lamps, with their globes, weighing, say, 4½ cwt. including cases, would measure about 60 cb. ft., and would therefore, on a measurement basis, be charged for as if they weighed 1½ tons. At 40s. a ton (pre-war rate) this would amount to £3, or, approximately, 10 per cent. of the total value of the goods. In the same sized case a motor weighing 1½ tons could be packed, costing about three times a much as the arc lamp consignment. The cost of freight would be about the same. Each package is rated separately, that is to say, if one package measures 40 cb. ft., and weighs ½ ton, it is charged for as 1 ton, whereas another package of the same size, weighing 1½ tons, would be charged for as 1½ tons. The consignor, therefore, would pay freight on 2½ tons, although either by weight or by measurement the two packages, taken together, are only 2 tons.

It does not seem quite equitable that an exporter should not be able to average the weights and measurements of several cases. Moreover, if he tries to economise by packing several things in one case, and so getting an average value, he may find himself charged at a higher rate for exceeding a weight limit.

In the meantime, the only thing an exporter can do is to study the question of packing very carefully with a view to reducing his measurements to a minimum, remembering that an external stiffening batten, or a projecting bolt, may easily add 10 per cent. to the measurement and freight of a small case.

TRADE STATISTICS OF SOUTH AFRICA.

The following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1914, has been taken from the recently issued official trade statistics. The figures for 1913 are added for purposes of comparison, and notes of any increases or decreases are given.

	1913. £	1914. £	Inc. or dec. £
Asbestos manufactures.—			
From Great Britain ...	4,000	3,000	− 1,000
,, Other countries ...	4,000	3,000	− 1,000
Total	8,000	6,000	− 2,000
Brass manufactures.—			
From Great Britain ...	31,000	26,000	− 5,000
,, Germany	2,000	1,000	− 1,000
,, Other countries ...	2,000	2,000	—
Total	35,000	29,000	− 6,000
Copper, plate and sheet.—			
From Great Britain ...	4,000	3,000	− 1,000
,, Other countries ...	1,000	1,000	—
Total	5,000	4,000	− 1,000
Copper manufactures.—			
From Great Britain ...	5,000	4,000	− 1,000
,, Other countries ...	2,000	—	− 2,000
Total	7,000	4,000	− 3,000
Electrical cable and wire.—			
From Great Britain ...	170,000	173,000	+ 3,000
,, Germany	71,000	18,000	− 53,000
,, Other countries ...	10,000	3,000	− 7,000
Total	251,000	194,000	− 57,000
Electrical fittings, including posts.—			
From Great Britain ...	155,000	157,000	+ 2,000
,, Germany	67,000	40,000	− 27,000
,, Holland	3,000	3,000	—
,, United States ...	30,000	22,000	− 8,000
,, Other countries ...	9,000	10,000	+ 1,000
Total	264,000	232,000	− 32,000
India-rubber of all kinds.—			
From Great Britain ...	29,000	27,000	− 2,000
,, Germany	3,000	3,000	—
,, United States ...	3,000	3,000	—
,, Other countries ...	1,000	1,000	—
Total	36,000	34,000	− 2,000
Lamps and lampware.—			
From Great Britain ...	19,000	16,000	− 3,000
,, Germany	21,000	11,000	− 10,000
,, United States ...	15,000	12,000	− 3,000
,, Other countries ...	3,000	2,000	− 1,000
Total	58,000	41,000	− 17,000
Machine bands and belting.—			
From Great Britain ...	100,000	87,000	− 13,000
,, United States ...	37,000	34,000	− 3,000
,, Other countries ...	4,000	4,000	—
Total	141,000	125,000	− 16,000
Electrical machinery.—			
From Great Britain ...	142,000	178,000	+ 36,000
,, Germany	253,000	168,000	− 85,000
,, United States ...	51,000	83,000	+ 32,000
,, Other countries ...	5,000	5,000	—
Total	451,000	434,000	− 17,000
Cranes, elevators and lifts.—			
From Great Britain ...	45,000	31,000	− 14,000
,, United States ...	11,000	3,000	− 7,000
,, Other countries ...	7,000	1,000	− 6,000
Total	63,000	35,000	− 28,000
Mining machinery.—			
From Great Britain ...	512,000	460,000	− 52,000
,, Germany	74,000	60,000	− 14,000
,, United States ...	161,000	155,000	− 6,000
,, Other countries ...	19,000	28,000	+ 9,000
Total	766,000	703,000	− 63,000
Machinery not specially mentioned (other than agricultural, manufacturing, etc.).—			
From Great Britain ...	341,000	328,000	− 13,000
,, Germany	39,000	23,000	− 16,000
,, United States ...	39,000	28,000	− 11,000
,, Other countries ...	8,000	10,000	+ 2,000
Total	427,000	389,000	− 38,000
Railway rails.—			
From Great Britain ...	13,000	5,000	− 8,000
,, Belgium	1,000	1,000	—
,, Germany	61,000	67,000	+ 6,000
,, United States ...	4,000	5,000	+ 1,000
Total	79,000	78,000	− 1,000
Telegraph and telephone material.—			
From Great Britain ...	10,000	9,000	− 1,000
,, Germany	1,000	1,000	—
,, Sweden	3,000	2,000	− 1,000
,, United States ...	1,000	1,000	—
,, Other countries ...	3,000	2,000	− 1,000
Total	18,000	15,000	− 3,000
Tramway rails.—			
From Great Britain ...	2,000	2,000	—
,, Germany	14,000	7,000	− 7,000
,, United States ...	5,000	4,000	− 1,000
,, Other countries ...	—	1,000	+ 1,000
Total	21,000	14,000	− 7,000
Tramway rolling-stock.—			
From Great Britain ...	16,000	19,000	+ 3,000
,, United States ...	12,000	2,000	− 10,000
Total	28,000	21,000	− 7,000
Other tramway materials.—			
From Great Britain ...	11,000	12,000	+ 1,000
,, Germany	1,000	2,000	+ 1,000
,, United States ...	5,000	5,000	—
Total	17,000	19,000	+ 2,000

In addition to the above the following goods were imported as "Government Stores":—

Brassware.—			
From United Kingdom ...	8,000	3,000	− 5,000
Copper, plate and sheet.—			
From United Kingdom ...	20,000	14,000	− 6,000
Electrical cable and wire.—			
From United Kingdom ...	63,000	49,000	− 14,000
Electric fittings.—			
From United Kingdom ...	24,000	6,000	− 18,000
,, Germany	2,000	500	− 1,500
,, Other countries ...	1,000	1,000	—
Total	27,000	7,500	− 19,500
India-rubber.—			
From United Kingdom ...	4,000	6,000	+ 2,000
Lampware.—			
From United Kingdom ...	4,000	4,000	—
Cranes and elevators.—			
From United Kingdom ...	25,000	14,000	− 11,000
Electrical machinery.—			
From United Kingdom ...	12,000	9,000	− 3,000

	1913. £	1914. £	Inc. or dec. £	
Other machinery.—				
From United Kingdom ...	56,000	38,000	−	18,000
,, Other countries ...	4,000	4,000		—
Total	60,000	42,000	−	18,000
Railway rails.—				
From United Kingdom ...	388,000	367,000	−	21,000
,, Germany	—	10,000	+	10,000
,, Canada	—	177,000	+	177,000
Total	388,000	554,000	+	166,000
Telegraph and telephone material.—				
From United Kingdom ...	125,000	103,000	−	22,000
,, Sweden	31,000	36,000	+	5,000
,, Other countries ...	1,000	1,000		—
Total	157,000	140,000	−	17,000

ARC PHENOMENA.

By A. G. COLLIS.

(*Abstract of paper read at the Panama Pacific Convention of the* American Institute of Electrical Engineers, *San Francisco, Cal., September 16th,* 1915.)

One of the most important fields of science is that which deals with "arc phenomena" occasioned by the duties of switchgear, which form such important links of an electrical transmission. In my previous publications there are oscillograph records of the effects produced by opening moderate currents and voltages, such as are met with in every day practice. This paper deals with investigations on critical phenomena obtained from circuits of much larger dimensions.

Herewith are illustrations obtained by photographing the arc formed by opening A.C. circuits under oil, and attention is directed to their various shapes caused by special forms of contacts.

For the purposes of these experiments the same switch was used in every case, fitted with different contacts as shown below. The photographs were obtained by using a camera and intensifier, the shutter of which was directly connected to the operating mechanism of the switch, one side of the switch case being fitted with a transparent flexible partition revealing the arc disturbance.

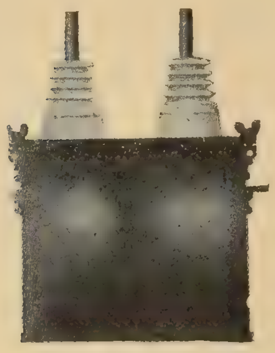


Fig. 1.

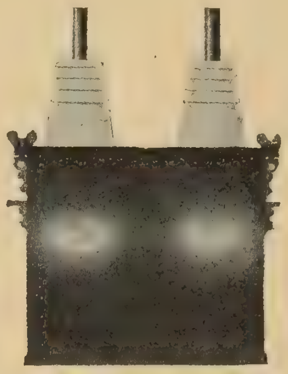


Fig. 3.

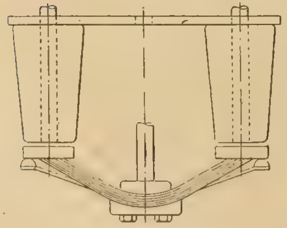


Fig. 2.—Brush Laminated.

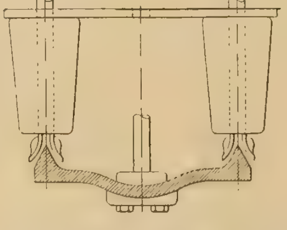


Fig. 4.—Solid Wedge Form of Contact.

Fig. 1 illustrates the arc formed by rupturing a non-inductive 3-phase circuit, 6,600 volts, 200 amperes, (R.M.S.) at unity power factor. The oil switch contacts (fig. 2) operated in a vertical plane, the total length of break being 10¼ in. per phase. It will be observed that the shape of the arc is an ellipse, its greater diameter being directed horizontally towards the sides of the tank. In nearly all the cases of switch bursts that have come under my personal observation, the damage is more apparent on the sides of the oil tank, following the direction of the flow of the current. Front or back explosions are not so prominent, which may, of course, be due incidentally to the relative positions of the arc contacts, and it is for this reason that the photo plate produces the shape of the arc where it was felt its effect would be most severe. The shape of the arc follows the shape of the arcing contacts, and there is no doubt that the disturbances following rupture are directly related to the shape of arc contacts as will be commented upon later.

Fig. 3 illustrates the formation of the arc, in oil, by rupturing a 3-phase 6,600-volt, 220-ampere (R.M.S.) inductive circuit at 0.9 power factor. The contacts used in this case were of the well-known "wedge" form, fig. 4. The rupture in this case is slightly more severe than in the case of fig. 1, and the arc is slightly larger. The pressure in lb. per square inch was 75, as per table herewith. It will be understood that the effects of explosion depend to a certain extent on the position of the wave at the time of opening. No oscillograph tests were taken at the time when the photo plate was exposed to the arc. The tendency of the arc in this case is to turn upwards when directed outwards, and it is of the "heart shape" variety. Several designers, in order to quench the arc more effectively, have used artificial "arc dampers" placed in a diagonal direction over the forces of explosion to press the oil over the neighbourhood of the rupture zone, from which it would appear that they conjectured that the greatest strain during the rupture appeared in this region. These illustrations confirm this opinion. On the other hand, some engineers appear to consider that the arc damping fluid should be forced on the rupture zone from the vertical position, *i.e.*, directly over the centre of the disturbed area. The result of this method is shown in fig. 5, which illustrates the arc made by breaking a similar circuit 180 amperes (R.M.S.) at 6,600 volts, 0.83 power factor. The form of contact used (see fig. 6) is the brush form, as in fig. 1, but fitted with vertical trailing arc pieces. It will be observed that the arc pieces were fixed at the side of the main contacts, one inside and the other outside. These arcing pieces were placed in this position for the purpose of observing whether the arc phenomena followed a natural sequence or if its artificial creation was caused by the individual shape and character of the contacts. It would appear, as shown in the illustration, that the arc is influenced by the construction of the trailing pieces. It will be observed that the natural formation of an arc can be artificially directed and modified by contact design, considerably increasing or decreasing the capacity of switches of limited rupturing capacity. Thus a switch with one form of contact and a rupturing capacity of, say, 10,000 K.V.A., might be so reconstructed and modified as to have its capacity increased to 15,000 K.V.A. There is no doubt that the direction of the explosive forces produced by the arc is related to its power to withstand heavy duties, the shape and position of the "arc trailers" having a relative bearing on its formation.

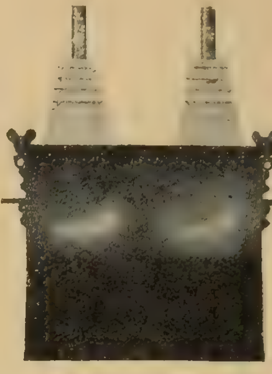


Fig. 5.

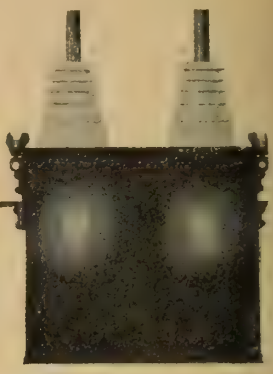


Fig. 7.

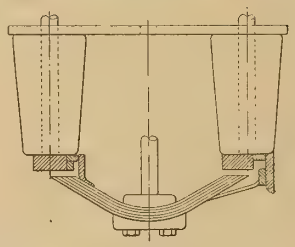


Fig. 6.—Brush Contact with Trailing Pieces Inside and Outside.

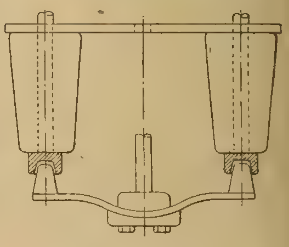


Fig. 8.—Cone Contacts.

Fig. 7 illustrates the arc formed by breaking circuit with the cone contacts, fig. 8, the shape of the arc being of the "filbert character," showing the maximum force divided along a vertical plane. This class of contact is not so much in common use as those shown in figs. 2 and 4. The shape of the arc is more ideal and the rupturing capacity of the switch increased over those of its neighbours in comparison. The circuit ruptured in this case had a practically non-inductive load of 125 amperes (R.M.S.) at 6,600 volts, unity power factor. Thus the arc should be smaller in dimensions than those preceding it. Auxiliary arc dampers were provided with this switch, forcing the oil in a downward direction towards the seat of the explosion. The effects of these are shown in the illustration. For very heavy rupturing capacities, "arc dampers" are considered necessary, and will be commented upon later.

Fig. 9 illustrates the arc formed by breaking a circuit of 300 amperes (R.M.S.), 6,600 volts, power factor approximately unity. The arcing contacts are shown in fig. 10 and are known as the double-brush type, the oil being forced over the centre of the arc zone. The illustration shows the effects of this feature. The increasing diagonal forces as interpreted from the shape of the arc structure, with the maximum strain directed towards the sides of the oil tank, are also shown. This type of contact was introduced very successfully on a 20,000-volt transmission, but the tendency is now to use an entirely different form of design for high-tension electrical transmissions.

Fig.	Amps.	Volts.	Lb. per sq. in. near arcs.	Lb. per sq. in. 2½ in. from contacts.
1	200	6,600	74	70
3	220	6,600	75	63
5	180	6,600	68	65
7	125	6,600	54	32
9	300	6,600	78	71

The pressures in pounds per square inch surrounding the arc area are given above. These pressures were obtained by inserting in the tank an operating cam, directly connected to an external indicating instrument, as used for hydraulic testing, the instrument being specially calibrated to record pressures in the oil tank.

Fig. 11 shows the distance rate of change declinations of forces directed toward the sides of the oil can resulting from various arc forms. The steeper the inclination of this characteristic, the greater the rupturing capacity of the switch.

As shown by the above illustrations, the pressure and formation of the arc is the critical point of an oil switch, and designers should concentrate their energies on the effective harnessing of its explosive features.

There exists a hypothesis that an arc ruptured in oil is immediately damped out by the oil rushing between the contacts, and intercepting the current flow at the zero point.

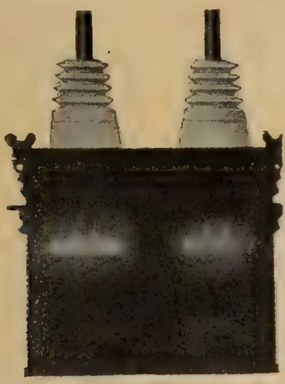


Fig. 9.

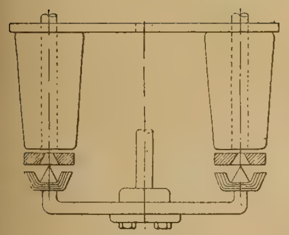


Fig. 10.—Hollow Conductor for Oil Brush Contacts.

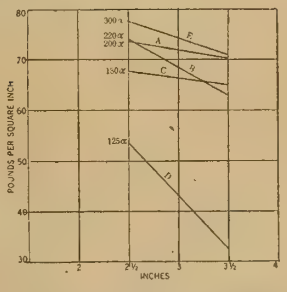


Fig. 11.—Diagram showing Decline of Forces in Various Arcs.

An analysis of the above proves that this is not the case. The formation of the arc sets up a vaporised space around the contacts, the intensity of which is proportional to the volume of force liberated; this prevents the oil (which is of a somewhat sluggish character) entering the space around the contacts. When the arc vapour is dissipated or approaches its extinguishable value by a decrease in the current, the oil is permitted to flow over the disturbed space.

It is obvious that a circuit in a dangerous condition should be relieved as quickly as possible, but such a circuit having appreciable inductance, if rapidly opened, may give rise to abnormal potential stresses, which may reach a value seven times the normal.

Oscillograph records already published show a current increment on short circuit at the rate of 850,000 amperes per second, but if a short circuit can be disconnected before the current reaches a dangerous value, the rise of pressure may not be excessive even with a rapid break. Thus the instantaneous opening of a short circuit does not necessarily interpose abnormal potentials.

The opening of a switch follows the period of maximum disturbance, and a certain amount of time must elapse before the circuit can be disconnected. The time taken by a positive relay for automatically tripping the switch averages 0.4 second. The time occupied by a gravity oil switch with a 5-in. break per pole per phase averages 0.6 second, so that, in all, the switch reaches the off position in a second. The time elapsed between the parting of the main and auxiliary contacts (assuming brush contacts) averages 0.2 second. By multiple breaks the rapidity of interrupting a circuit may be correspondingly increased, and for heavy duty at high pressures the multiple break is becoming a necessity.

Engineers have experienced considerable inconvenience by the appearance of surges when closing high-potential circuits. Flash-overs and breakdowns in some installations have been more frequent with the closing of the circuits than those produced when opening the supply. A series of experiments were carried out on a large power supply system in the Midlands by installing a series of earthed spark gaps on the end turns of a 500-KW. 6,600-volt slow-speed motor. These spark gaps were adjusted to flash over at definite voltages. When the results were plotted, a pressure of 27,000 volts was recorded by closing the overhead mains four miles long, while connecting this machine on to the circuit before starting up.

WAR ITEMS.

The Unassuming Hun.—"One of the principal reasons why the Germans covet as a permanent possession that portion of Northern France which they now occupy is its wealth in coal and iron, and it is clear that long before the declaration of war they were plotting, by their usual methods of spying and deceit, to seize the French ironworks at the earliest opportunity and turn them to account for their own benefit. An instance of how craftily this plan was pursued is given in our French contemporary 'l'Usine.' Within a stone's throw of the German frontier in Lorraine are the great French steelworks of Homécourt, the owners of which control a considerable part of the famous Briey ironstone mines. About fifteen years ago there came to the Homécourt works a retired officer of the German Navy, who had settled in Luxemburg and had been naturalised in that Duchy. He applied for employment as an engineer, and as he showed himself possessed of much technical knowledge and was no longer of German nationality, he was given a situation. The ex-German proved a veritable treasure. He was discreet, energetic, devoted to his work, and showed himself an excellent intermediary between Homécourt and the German works on the other side of the border with which his employers maintained close business relations. Not being a Frenchman he had no prospect of advancement to the higher posts in the company, and his salary remained modest, but this he did not seem to mind, and by degrees he passed through various departments of the works and acquired a thorough knowledge of them all. On July 30th a large number of the workmen at Homécourt left to join the French Army. On the same day, twenty-four hours before the actual declaration of war, the Germans crossed the frontier, seized Homécourt, and installed there a staff and workmen from their own side of the border. On Monday, August 3rd, the Homécourt steelworks started 'business as usual'—except that they were now a German factory, with the ex-German officer, in full uniform, installed as general manager. The ingenious gentleman's local knowledge has since proved of the greatest value to the invaders. One wonders whether there are any energetic, discreet and modest ex-Germans engaged in peaceful pursuits in this country who, in the event of an invasion of these islands, would promptly get into their old uniforms and convert themselves into business-managers for the invaders?"—"Ironmonger."

Exports to China and Siam During the War.—The "London Gazette" for September 24th contains a proclamation relating to the exportation of all articles to China and Siam during the war. The proclamation prohibits the exportation of all or any of the following articles:—"Arms, ammunition, military and naval stores, and any article which We shall judge capable of being converted into or made useful in increasing the quantity of arms, ammunition or military or naval stores to any country or place therein named whenever We shall judge such prohibition to be expedient, in order to prevent such arms, ammunition, or military or naval stores being used against Our forces or against any forces engaged or which may be engaged in military or naval operations in co-operation with Our Forces." The exportation of any such article as comes under the proclamation to any such country or place is prohibited unless consigned to persons authorised to receive it. A lengthy list follows of persons and bodies of persons to whom articles may be consigned.

Australia and Munitions.—The Australasian Government is forming an Industrial Corps, in which will be enrolled skilled mechanics and other workers for the manufacture of munitions and equipment. Among other articles they will make will be scientific apparatus, engineering parts, field wireless sets, and telephone equipment.

London's Restricted Lighting.—In reply to questions asked in the House of Commons last week, on the question of lighting regulations and air raids, Sir John Simon said that the regulations for lighting in the Metropolitan area, with a view to minimising risk from air raids, had been most carefully studied by expert officers of the Admiralty, and the scheme adopted by the Home Office and the Police Authorities was based on their advice, and was the result of repeated observations alike from the air and the ground. The main object to be aimed at was uniformity rather than absolute darkness, and it was a matter of great importance that the scheme should be applied equally in all parts of this area, exceptional darkness being as likely to prove a distinctive mark as exceptional brightness. Private citizens and local authorities had shown themselves generally willing to accept the application of the scheme and the lighting orders made to give effect to it, but as some cases of local departure from the scheme had come to his notice he was proposing to make a fresh order defining more exactly some of the requirements, as, for instance, in the matter of the lights in private houses and giving the police increased power to enforce it. On Tuesday this week Sir John announced that he was making the following order:—"Bright lights in hotels, flats, dwelling-houses, and premises of all descriptions not coming under the other provisions of this order must be shaded or windows screened, so that no bright light is cast in any direction outside." This will apply to bright lights visible from the rear of houses no less than to those visible from the front.

The Lighting of Armentières.—A correspondent sends us a letter received from a friend "On Active Service," in which the following remarks appear:—"Quite a good story has been told here. The facts of the case must be known to the enemy by now, so I presume it is giving nothing away for me to mention the details. The time dates back to the occasion when the Germans first occupied Lille while our troops occupied Armentières. On entering Lille, the Germans soon discovered the electric light works, and, of course, were not long in getting them into operation. They supplied themselves with electric light and, naturally, such an asset they made the worst of, for in a war area such a commodity must be 'some' capture. Thus they went on for two or three months in utter ignorance of the fact that, in addition to facilitating their own work, they were obliging the British military authorities, for Armentières was supplied with electric light and power from the same works. In point of fact, a farmhouse adjacent to the end of one of our communication trenches was so supplied until the Germans found out their colossal 'bloomer.'"

Australian Inventions.—The State Cabinet has decided to appoint a Patents Investigation Committee to assist in the development of inventions likely to be of general public utility. Any ideas which, after investigation, the board is of opinion are of value to the public will be submitted by it to the various public departments likely to be able to utilise them.

Royal Engineers.—In reply to a Parliamentary question as to whether an application was made in July by his Department to the Institution of Civil Engineers to procure for them officers for the Royal Engineers who had a knowledge of heavy construction work, Mr. Tennant stated last week, according to the "Times," that the statement was substantially accurate, and the result had been that 19 gentlemen had already received commissions in the R.E., and the consideration of the qualifications of others was proceeding with a view to the filling of further vacancies which might occur.

Trade Openings in Italy.—From the British Chamber of Commerce for Italy, in Genoa, we have received List No. 22 of openings for British articles in Italian markets, from which we give a selection below. Many of these firms formerly did business with German and Austrian houses, and now seek British connections:—

No. 919.—Agent at Genoa wishes to hear from British manufacturers of tools, machine tools, machinery, hardware, etc.—G.G.R.

No. 921.—Manufacturers of lamps, etc., at Marrare, wish to buy lamp glasses, globes, etc., general fittings and supplies for lighting.—F.S.S.

No. 930.—Merchants at Turin are open to buy (and would, after trying the goods, be disposed to accept agency) files, steel wire and steel sheets, machine tools, wood-working machinery, tools, drills, metal-working machinery. Branches at Milan, Genoa and Rome.—T.J.T.

No. 931.—Agent at Rome would buy for own account, or sell on commission with delcredere, electrical materials and machinery. Represented Berlin firm for 14 years; well introduced.—R.D.P.

No. 936.—Forwarding agents at Genoa, having opened a department for the representation of foreign firms, and having their own travellers, are anxious to hear from British manufacturers and shippers of raw materials for industry and articles of any sort.—G.C.P.

No. 939.—Engineer at Rome seeks agencies for Italy in building materials, iron girders, electric lighting material.—R.N.G.

The German War Loan.—After referring to a few examples of the "compulsory" applications of workers for the German war loan, the Central News correspondent at Zurich (according to the "Financial Times") quotes the following as an instance of how foreign, including British, capital lying in Germany is being drawn on for war loan purposes:—An international trading firm in which there are many English shareholders, and which has a large establishment in England, had delivered goods in Germany before the war from Holland to the value of 140,000 marks. This money was lying in German banks when the war broke out, and as it cannot be taken out of the country without heavy loss on exchange the only resource left to the Dutch directors, in their view at least, has been to invest the money in the war loan.

Iron and Steel Institute and Alien Enemy Members.—At the autumn meeting of the Institute last week the following new rules were adopted:—(1) In the event of a state of war existing between Great Britain and any other country or State, all members, honorary members, and honorary vice-presidents who shall be subjects of such enemy country or State shall forthwith cease to be members, honorary members, or honorary vice-presidents of the Institute, but they shall be eligible for election after the war in the usual manner. (2) The Council shall have absolute power to remove from the list of members of the Institute the name of any member, whether ordinary or honorary, for wilful contravention of the by-laws, or for any other reason which seems to them sufficient, and such ordinary or honorary member shall thereupon cease to be a member of the Institute.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

13,051. "Replaceable electrical safety fuses." W. J. John. September 13th. (Complete.)

13,062. "Electric absorbers for pendants, stand lamps, and the like." S. Quincey. September 13th.

13,079. "Means for regulating arc lamps." J. Brockie. September 13th

13,080. "Projector arc lamps." J. Brockie. September 13th.

13,110. "Portable electric writing-lamp." F. Summerfield. September 14th.

13,129. "Arrangement for producing short unidirected high-tension current impulses." W. Otto. September 14th. (Complete.)

13,137. "Shaft bearings." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). September 14th.

13,145. "Apparatus for cutting down wire entanglements, telephone and telegraph or other wires from a distance, also applicable for grappling purposes." J. W. Defries. September 14th.

13,207. "Alloys." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). September 15th.

13,216. "Electrical methods for sounding church and other bells." T. L. Southgate. September 16th.

13,220. "Electrical terminal." R. W. Paul. September 16th.

13,271. "Contact breakers for internal-combustion engines." W. G. Gray. September 17th.

13,283. "Means for regulating the output of dynamo-electrical machines driven at variable speeds." N. E. Dufty. September 17th.

13,286. "Method of manufacturing gear wheels." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). September 17th.

13,287. "Dynamo-electric machines." A. H. Neuland. September 17th. (Complete.)

13,294. "Connections for electrical conduits." O. J. Nilsen and C. T. Cromie. September 17th.

13,329. "Appliance attachable to a rifle, a pole, or the like for grappling and cutting down wire entanglements, telephone and telegraph or other wires." J. W. Defries. September 18th.

PUBLISHED SPECIFICATIONS.

1914.

12,910. Method for Generating High-frequency Electric Currents. C. Hoegerstaedt & Tempest. May 26th.

19,191. Holders for Electric Incandescent Lamps. St. Helens Cable and Rubber Co. & J. C. White. August 28th.

19,237. Mechanism for Printing-telegraph Systems. E. C. R. Marks (Morkrum Co., U.S.A.). August 29th.

19,319. Electric Connections. S. F. Tyler & W. J. E. Beere. September 1st

19,322. Electromagnetic Percussive Devices. J. W. Mackenzie (International Electric Tool Co.). September 1st.

21,368. Electric Contact Breakers or Interruptors. G. F. Cooke. October 22nd.

23,881. Electric Connections for Resistance Bodies. British Thomson-Houston Co. (General Electric Co., U.S.A.). December 10th.

1915.

641. Current-interrupting Devices for Magneto-ignition Apparatus. M. S Conner. January 15th.

1,275. Pocket Electric Flash Lights. W. J. Mellersh-Jackson (Posen). January 26th. (Addition to 18,809/14.)

2,490. Starting means for Electric Motors. W. J. Sheppard & G. A. Yarwood. February 16th.

3,284. Electric Motor Control Systems. Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co., U.S.A.). March 1st.

4,747. Electric Motor Control Systems. Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co., U.S.A.) March 26th.

4,748. Electric Circuit Controllers of the Drum Type. G. R. Radley. March 26th. (March 30th, 1914.)

5,994. Sound Transmitter. C. Still. April 21st.

7,510. Devices for Adjustably Suspending Electric and other Lamps, Electroliers, Gas Pendants, and other objects. W. H. Sturge. May 19th.

8,180. Three-way Electric Switch for Projectors and the like. Robert Bosch (firm of). June 2nd. (February 18th, 1915.)

8,189. Accumulator Cases for Motor Vehicles. P. A. H. Mossay. June 2nd.

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VOL. LXXVII. OCTOBER 8, 1915. No. 1,976.

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Vol. LXXVII.] **CONTENTS:** October 8, 1915. [No. 1,976.

Page
Railway Electrification ... 449
Rubber ... 450
The Spanish Electrical Industry ... 450
New Electric Steel Furnaces (*illus.*) ... 451
Electricity in Submarine Mining (*illus.*) ... 454
Correspondence—
  The A.E.G. Meeting ... 455
  Receipt Forms on Cheques ... 455
  A Transformer Query ... 455
New Electrical Devices, Fittings and Plant (*illus.*) ... 456
Damages on Breach of a Contract to Supply Machinery ... 459
Reviews ... 460
Business Notes ... 461
London and South-Western Railway Electrification (*illus.*) (*continued*) ... 463
The Works of Electro-Galvanizers, Ltd. (*illus.*) ... 465
Notes ... 470
City Notes ... 473
Stocks and Shares ... 473
Share List of Electrical Companies ... 474
Electric Tramway and Railway Traffic Returns ... 474
Metal Market.—Fluctuations in September ... 475
American Exports of Electrical Goods ... 475
The Problem of the "Point-Five" Tariff (*illus.*) (*concluded*) 476
Legal... ... 478
War Items ... 478
Our Legal Query Column ... 479
Foreign and Colonial Tariffs on Electrical Goods ... 479
New Patents Applied for, 1915 ... 480
Abstracts of Published Specifications ... 480
Contractors' Column ... Advertisement page xx

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RAILWAY ELECTRIFICATION.

IN our last three issues we have reproduced illustrations of the fine new power station of the London and South-Western Railway Co. at Wimbledon Park, which is approaching completion; very shortly the company will be in a position to commence electrical operation on some of its suburban lines—an event which will bring joy to the hearts of the long-suffering residents in the districts concerned, for, while we congratulate the directors on the receptive frame of mind which has enabled them to accept the new order of things as inevitable, we are impelled to remind them that the "leisurely jog-trot" methods that have prevailed on their system up to the present are years behind the times. The phrase we quote was used by a railway contemporary in this connection, and aptly describes the situation.

But let us not be ungenerous: the London and South-Western Railway Co., having recognised the necessity of adopting electric traction, has tackled the problem in no half-hearted fashion, and the scheme which it is now carrying out, embracing a system of 150 miles of track, must be regarded as one of the most important undertakings of the kind in this country, being, in fact, second only to that of the Brighton Co. in point of length of track to be electrified, and serving an area which, in many ways, is second to none.

The methods adopted for the electrification of the railway present many features of interest and not a few of novelty; in view of the wide experience that has already been acquired on English railway systems, as well as abroad, and has, no doubt, been fully utilised by the company's engineers, we take it that these methods are regarded by them as the best at present known for the class of traffic to be dealt with. Prominent amongst them are: The adoption of the third rail and direct current; the organisation of the rolling stock into set trains of three coaches each (two motor coaches with a trailer between); mounting the contactors inside the coaches instead of beneath them; and automatic acceleration. We might add the conversion of the existing rolling stock, but this is a matter which depends largely upon circumstances, and the same may be said regarding the policy of erecting a power station instead of purchasing energy from existing sources.

That the problem of electrification is still far from finding a broad solution is demonstrated by the fact that two of the most important electric railway systems in the country have been developed on divergent lines; the Brighton Co. adopted single-phase supply and overhead conductors, while the South-Western Co. has employed the third rail and direct current; the former buys energy, the latter produces it; and other differences might be named—yet both companies contemplate large extensions of their electrified systems, which must eventually result in "main-line electrification." It is certainly very regrettable that uniformity of system cannot be attained at present, though its value may perhaps be overestimated except in cases where interchange of passenger rolling-stock is concerned. The same conditions are met with in other countries that have carried out large projects of electrification, and clearly the battle of the systems is going to be prolonged indefinitely.

The growing importance of railway electrification in this country may be realised when we state that the aggregate length of single track now under, or being equipped for, electrical operation is nearly 1,000 miles.

Rubber.

The tendency of prices in the market for crude rubber has not disclosed any serious alteration during the past few weeks, and rates have, on the whole, been held together very well, and this in spite of the fact that good quantities have been reaching this side, although some delays have been experienced in discharging cargoes. The outlook is regarded as moderately satisfactory, and there has been a certain amount of forward buying done, mainly in connection with plantation grades. There seems no reason to anticipate any serious setback in prices, and there is no doubt about the excellence of consumption, and this is likely to continue for an indefinite period, war requirements being on an unprecedented scale. There has been some discussion regarding rubber supplies really intended for Germany being shipped to Scandinavia, and it is suggested that while the United Kingdom has been supplying increased quantities of rubber to the United States at the expense of other neutrals, American exporters have taken advantage of this to enlarge their consignments of rubber to Holland, Norway and Sweden. The re-exports of rubber from the United Kingdom to the countries named declined, from 17,727 centals of 100 lb. in January-May, 1914, to 16,693 centals in January-May, 1915, while the exports of rubber from the United States to the same destinations increased during that period from 1,579 centals to 5,040 centals.

It is understood that Germany is exceedingly short of rubber, and a reward of £5,000 has been offered by the German Government for the discovery of a satisfactory process of regenerating rubber. What is desired is something far in advance of any known process of reclaiming, and it is specified that by the regenerating process the resiliency of the original rubber must be recovered to an extent of at least 90 per cent. in order to make the process eligible for competition. There is not the least doubt that the problem of supplying the German Army with a sufficient quantity of tires is beginning to assume a grave aspect, and it is reported that negotiations have been opened up with the manufacturers of a fibre tire which it is hoped will prove a solution of the difficulties now being faced.

An official cablegram received from Singapore announces that the export of plantation rubber from the Straits Settlements during the month of August amounted to 2,295 tons, compared with 2,324 tons in July and 1,325 tons in the corresponding month last year. The following is a comparative table showing the totals for three years:—

	1913.	1914.	1915.
	Tons.	Tons.	Tons.
January	784	1,181	2,576
February	743	1,703	2,741
March	898	1,285	2,477
April	762	1,548	1,978
May	814	1,309	3,588
June	812	1,480	2,249
July	1,120	1,584	2,324
August...	1,315	1,325	2,295
Total	7,248	11,415	20,228

These figures include transhipments of rubber from various places in the neighbourhood of the Straits Settlements, such as Borneo, Java, Sumatra and the non-Federated Malay States, as well as rubber actually exported from the Colony, but do not include rubber exports from the Federated Malay States.

The Spanish Electrical Industry.

The industrial position in Spain is becoming very unfavourable owing to the scarcity of raw materials which are necessary to keep the manufacturing works in operation. It was stated two or three months ago that a large amount of electrical work was being held up in consequence of the war and the inability to obtain primary materials, there being no possible means in the country for securing these in a considerable quantity. As is known, Spain possesses important mining centres where iron ore, copper and other metals are produced in abundance, and the transportation of these raw materials to other countries provides occupation for a fleet of steamers which are almost exclusively engaged in this particular work. Senor E. Rubio, who draws attention to the subject in the *Energia Electrica*, states that the coal resources of the country are adequate for greatly developing the native industries. In this respect, however, the worthy Spaniard is not in harmony with other authorities, who submit that if the necessary colliery plant were available it might be possible to increase the present production of 4,150,000 tons of coal per annum by 25 per cent., but the machinery is lacking for the near future. Nevertheless, even a 25 per cent. augmentation of about 1,000,000 tons would not dispense with the necessity for importing coal as, under normal conditions, Spain imports about 2,500,000 tons of coal and coke yearly, chiefly from Great Britain. Senor Rubio, however, contends that the mineral riches of the country should form the basis of all kinds of metallurgical works which would be able to supply the whole of the requirements of the home market. To some extent the industries already exist.

Coming to consider the electrical industry in particular, the Spanish author recalls the existence in the country of important electrical engineering works, cable factories, lamp factories, &c. Although these branches do not enjoy the particular Government protection that is deemed to be necessary, everything was proceeding admirably down to the time of the outbreak of the war. The works construct generators, motors, transformers, &c, but they do not possess an adequate quantity of iron or steel sheets. The iron ores are exported, but the belligerent nations neither return them in a manufactured form nor permit the Spaniards to supply themselves through other neutral countries on the ground of their being contraband. In the case of the cable factories work was proceeding at full capacity, and makers were thinking of embarking on the export trade, but there is no national production of copper wire. The copper ore is exported, but there is no re-exportation in wire, sheets, &c., under existing conditions; and the same observations apply successively to the other engineering industries under the present state of war. Senor Rubio, however, overlooks the fact that a considerable amount of British capital is invested in Spanish iron ore and copper mines, and that even if it were regarded as commercially possible to erect smelting plant and transforming mills in that country, the Spanish market would be unable to absorb most of the output, whilst the difficulties in regard to the supply of native labour of the right kind would probably be insurmountable. At the same time, it is possible to appreciate the paradoxical statement that the identical country which is rich in raw materials has to beg of the belligerents for the re-exportation of the former in a semi-manufactured condition in the shape of sheets, wire, &c.

It is considered that the national needs of Spain require a solution of the problem, as many interests are being prejudiced by the suspension of electrical work, which could be carried out if the primary materials were available. One solution, according to Senor Rubio, is immediately at hand. It is that the Government should protect the electrical industry by making diplomatic representations, so as to secure the removal of the contraband veto on the export of the raw materials wanted by Spain, the Government giving, if necessary, a guarantee that they would be consumed in the country and prohibiting re-exportation. In addition it is suggested that the materials should for the time being be admitted free of duty or at reduced duties, and that the shipping companies should also lower their rates for freight. The permanent solution of the problem, in the opinion of the Spanish author, lies in the placing of the industries of the country in a state of true economic independence by discontinuing the "suicidal exports" of raw materials which, it is held, should be worked up in Spain, instead of its being necessary in normal times to procure semi-manufactures from the other nations which receive the Spanish iron, copper and other ores. Senor Rubio is under the impression that if the war had not occurred foreign capitalists would have been prepared to transform Spanish ores, particularly copper, into partly manufactured products in Spain, but he gives no authority for this assumption.

NEW ELECTRIC STEEL FURNACES.

In our issue of July 25th, 1913, we gave particulars of some electric steel furnaces in Sheffield, with special reference to one installed by Messrs. Electro-Metals, Ltd., which at that time was the only one of its kind in this country. Since that date great progress has been made, and the company has a large number of furnaces at work, in which many improvements have been made.

The Electro-Metals furnace is an arc furnace using two-phase current. It has two upper electrodes, and one lower or hearth electrode; the upper electrodes carry separate phases, and the lower electrode forms the common return of what is really a two-phase three-wire system. This is illustrated in fig. 1, which shows diagrammatically the essential features of the system. Two single-phase transformers (Scott connected) are shown, fed on the high-tension side with three-phase current and delivering low-tension two-phase current to the furnace. Thus current flows through the upper electrodes (A and B) across the arc gaps where the intense heat is generated, then through the metal charge and the basic lining to the lower electrode (N), and so returns to the transformers.

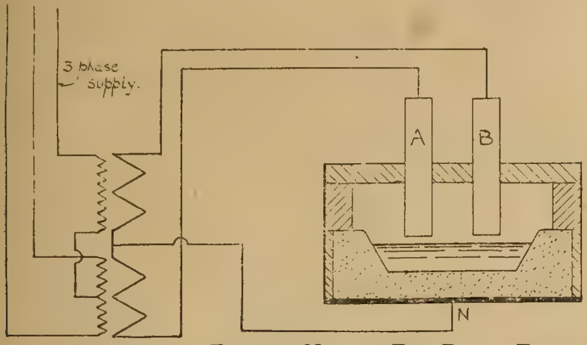


Fig. 1.—Diagram of Electro-Metals Two-Phase Furnace System.

The furnace is equally suitable for melting common steel or wrought iron scrap and refining to high quality steel, or for refining fluid metal from Bessemer vessels or open-hearth furnaces. It is admirably adapted for the production of tool or alloy steels and all grades of steel castings.

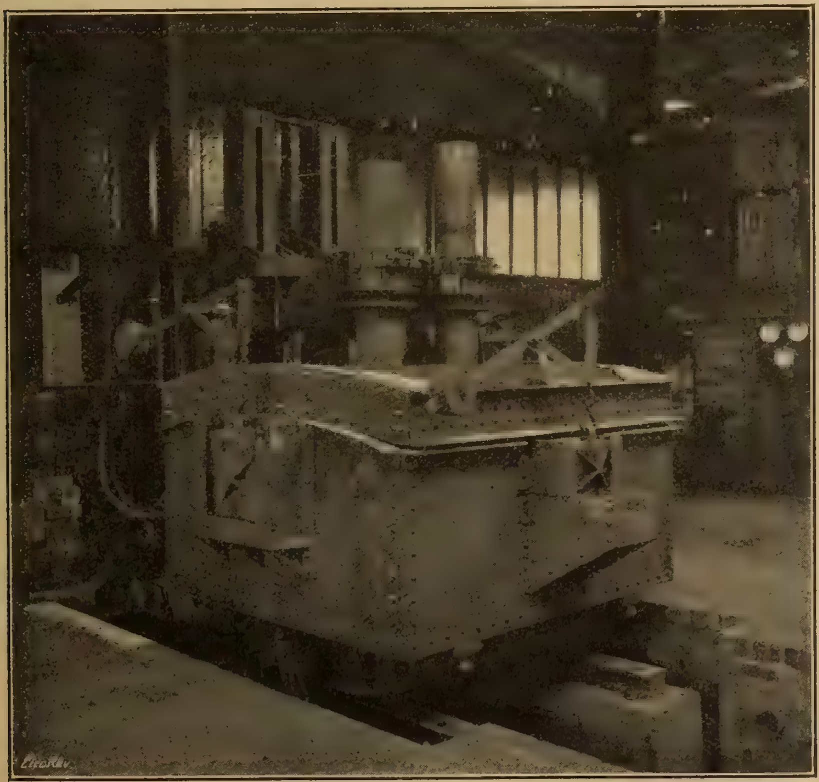


Fig. 2.—Electro-Metals 25-cwt. Furnace.

Continuous current is not suitable for electric steel furnace work, alternating current being always used. Practically all power supplies are either two or three-phase, and it is, therefore, one of the great advantages of the Electro-Metals two-phase system that such supplies can be utilised directly by means of static transformers, without the intervention of costly and inefficient motor-generator sets, such as are required for furnaces using single-phase current.

Where the primary supply is two-phase, power is delivered from the mains through two single transformers, one on each phase, to the furnace at suitable voltage. In the case of a three-phase primary supply, the two transformers are arranged with the well-known Scott connection to deliver two-phase low-tension current to the furnace.

The furnaces normally use current at a pressure of about 80 volts on each phase, but the larger sizes are arranged for a choice of two voltages, the higher one being used during the melting period and the lower one during the subsequent refining (see fig. 4). On the low-tension side of the transformers each phase is connected to one of the upper electrodes. In this way the arcs between these electrodes and the charge are formed independently of one another, an arrangement which ensures very steady running during the melting period. In all furnaces where the arc plays between the electrode and the metal, the sudden melting of pieces of metal directly under the electrodes causes certain fluctuations of the load, and it often happens that the arcs become temporarily broken in this way. With a single-phase furnace having arcs in series this means that when one arc is broken the whole load is instantly thrown off the mains, but with the Electro-Metals two-phase system, which has the arcs in parallel, the breaking of an arc only results in half the load being momentarily thrown off the system. Thus, violent fluctuations are avoided; the heating is continuous, the melting is accelerated, and, consequently, the energy consumption is reduced.

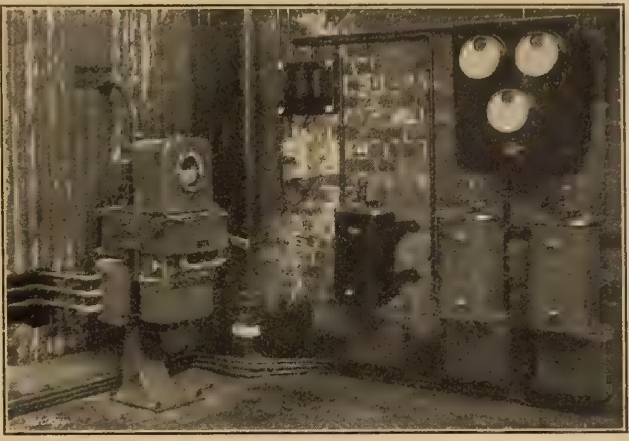


Fig. 3.—Electrical Control Gear for 25-cwt. Furnace.

The electromagnetic effect due to the two-phase arrangement produces a thorough circulation in the bath of molten metal, which facilitates the chemical reactions of refining by bringing all portions of the charge in rapid succession into intimate contact with the slag. This steady circulation results in the rapid melting of the alloy additions which are made in the manufacture of special steels, a condition difficult to obtain with furnaces having purely surface heating.

The circulation has the further very important effect of equally distributing the intense heat from the arc throughout the entire charge, thus protecting the roof and lining of the furnace from local overheating.

The lower or neutral electrode consists of a layer of carbon mixture evenly rammed over the bottom of the furnace tank, and the basic lining is rammed in above this carbon layer. This lining is made of either dolomite or magnetite mixed with tar and thoroughly burnt in, and is, when hot, a good conductor of electricity, offering only a small resistance to the passage of the current. For example, if the pressure on each phase is 75 volts, there will only be a drop of about 3 volts between the metal in the bath and the neutral terminal. The heat developed by this comparatively small resistance serves, however, to keep hot the lower portion of the furnace hearth, thus preventing the solidification of any unrefined metal on the bottom of the bath and ensuring homogeneity of the charge.

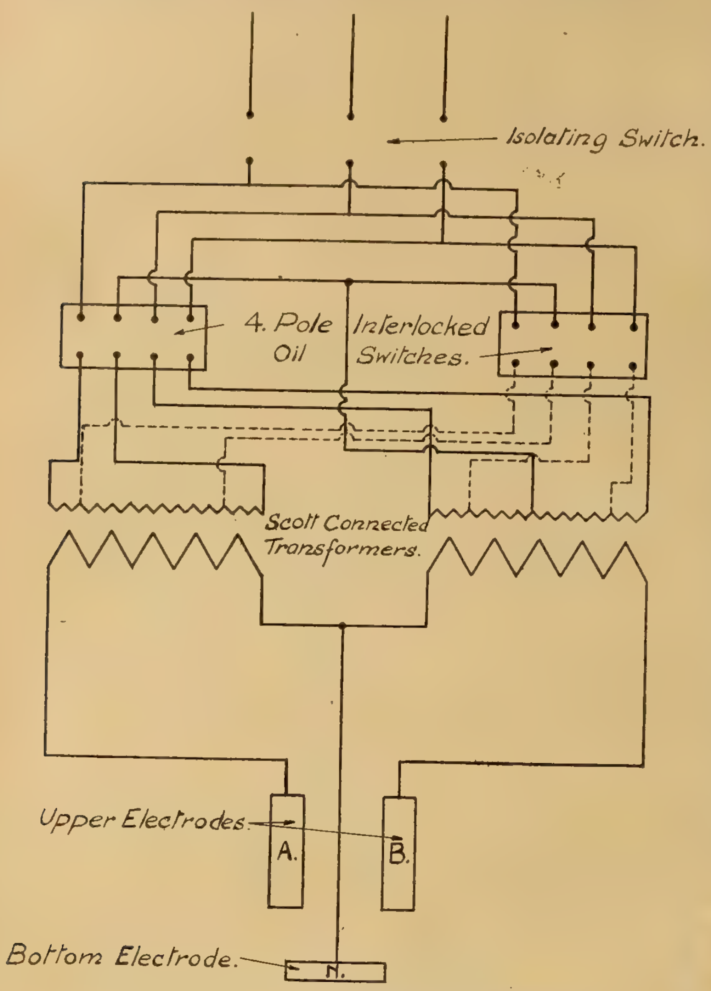


Fig. 4.—Diagram of Electrical Connections.

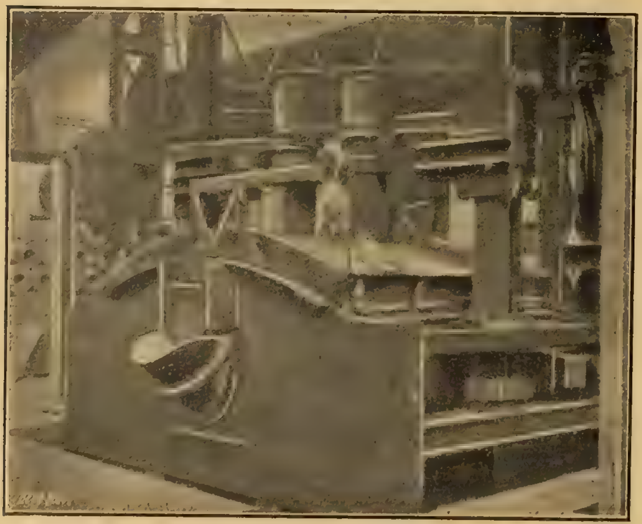


Fig. 5.—Electro-Metals 4-ton Furnace.

The general construction of the furnace varies according to the amount and kind of work which it has to do. In the smaller sizes, the raising and lowering of the electrodes and also the tilting of the furnace may be done by hand-operated gearing. In the larger sizes electrically-driven tilting gear is necessary, and the electrodes, owing to their weight, must be operated by motor-driven gearing, which may be hand-regulated or automatically controlled. Furnaces over 6 tons capacity are arranged for four electrodes, two on each phase, all four being separately controllable.

The body of the furnace itself is of steel plate construction suitably strengthened to avoid bulging when hot. The electrodes are held in specially-designed holders with suitable electrical contacts. Each holder is connected to, and insulated from, a carriage which runs over and between two vertical channels. The carriage is raised and lowered by a vertical screw placed centrally between the channels, the screw being actuated by a worm and worm-wheel or by bevel gearing coupled to a small motor. The furnace roof, which consists of a steel frame holding an arch of silica bricks, is detachable from the shell, and is always provided in duplicate so as to facilitate the replacing of an old roof by a new one. The electrode gear is best placed at the back of the furnace, that is, opposite to the teeming spout, as this arrangement allows for two working doors, one at either end of the furnace. This arrangement is shown in fig. 2. The tilting gear (see fig. 7) is placed below and behind the furnace, and is driven by a suitable motor. The latter, by means of reduction gearing, drives a large bevel wheel mounted on trunnions, in the centre of which is a screwed bronze sleeve. Through this sleeve passes the long screw which is fastened at the upper end to a bracket at the back of the furnace. Turning the bevel wheel either pushes up this screw, and so tilts the furnace forward, or else, when the motor is reversed, the screw is drawn down and the furnace tilted backward. The tilting screw is of such length as to give a forward tilt of 40° and a backward tilt of 5°.

The electrical equipment varies according to the voltage and periodicity of the high-tension supply: according to whether the electrode motors are to be controlled by hand or by automatic regulators: and also according to the working voltages. Sometimes two low-pressure voltages are desired, a higher one for melting and a lower one for refining, in which case two interlocked switches are necessary, so as to be able to change over from one voltage to the other without delay (fig. 4).

Fig. 6.—Switchboard for 4-ton Furnace.

When the electrode motors are controlled by hand, tramway type reversing controllers are installed, operated in accordance with the readings of the ammeter on each phase. Automatic control of the electric motors can be carried out by means of Thury automatic regulators, one for each motor, which are operated by series transformers, mounted on the low-tension leads. A rheostat in the secondary circuit enables the regulator to operate at any desired amperage on the furnace. Reversing controllers are also provided which cut out the automatic regulators and enable the electrodes to be quickly hoisted out of or lowered down into the furnace (see figs. 3 and 6).

The instruments for the control of the furnace are mounted on enamelled slate panels, and consist of an ammeter for each of the upper electrodes and one on the neutral return, all of which are operated from series transformers mounted on the low-tension cables. A voltmeter is provided which has a three-way switch to indicate the voltage on either phase, and also the pressure across the two phases. If desired, integrating, indicating or recording kilowatt meters can be arranged for on the instrument panels.

The following is a description of the working of a typical charge, when melting and refining common scrap to high quality steel.

After the furnace has been fettled from the previous charge, the cold scrap is thrown into the hearth. The scrap is preferably of steel or wrought iron, and is usually of common quality containing up to 0·10 per cent. each of sulphur and phosphorus. When charging is completed the current is switched on and the electrodes are lowered until the arc is struck between them and the upper portion of the charge. The current is then kept constant at the desired amount, either by means of the hand controllers or the automatic regulators.

The heat from the arc soon melts a large hole in the charge underneath and around each electrode, which continues to travel down as these holes become deeper, until a bath of fluid metal is formed in the bottom of the furnace. This bath gradually increases in size and depth owing to other portions of the charge melting into it, and consequently the electrodes commence to rise with the level of the metal.

By the time they have risen to the usual working level of the bath, any unmelted portions of the charge are detached from the sides and pushed within the hot metal in the centre. During the melting the slag is added, consisting of a mixture of lime, fluorspar, sand, and either iron ore or hammer scale. This slag, owing to its lower density, floats on the top of the molten metal, and the chemical actions of refining take place. The carbon in the scrap is oxidised by the iron oxide in the slag, and is given off in the form of carbon-monoxide, which, rising through the metal, gives the appearance of boiling. This boiling serves to bring the slag and metal into more intimate contact. The silicon and manganese in the scrap are oxidised, and their respective oxides dissolve in the slag. The phosphorus is oxidised, and, in the presence of the lime in the oxidising slag, is formed into a phosphate of lime, which enters into the slag. A portion of the sulphur is also oxidised, and passes away as gaseous oxide.

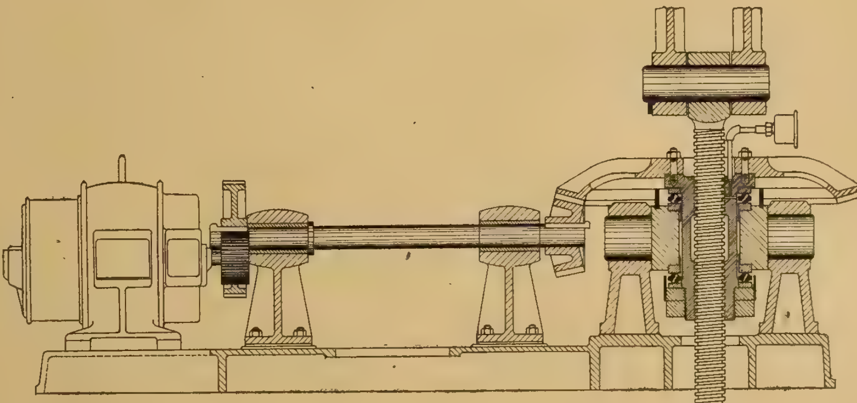


Fig. 7.—Motor-driven Tilting Gear: Section.

When sufficient time for these reactions to take place has elapsed, the current is switched off, and the furnace tilted forward. The bulk of the slag is run off through the tapping spout, and the remainder is pulled off the surface of the metal by means of rabbles, so that in this way the phosphorus is removed from the steel. Recarburising additions are made to give the required carbon to the steel, and another purifying slag is thrown in. This second slag consists of lime, sand and fluorspar, and quickly melts when the current is again switched on. The power used in the furnace during the subsequent refining is only about one-half of that required during the melting period. The phosphorus, as stated above, has been removed, but there remains among the injurious constituents in the metal the bulk of the sulphur, and in addition a certain amount of oxide of iron which has come from the oxidation of the scrap during the melting and from the oxidising slag that is necessary for the removal of the phosphorus. The metal must therefore be freed from this oxide and from the sulphur. The oxide of iron in the metal is also soluble in this new slag, which takes it up until the solvent powers of the two fluids are equal. The oxide is then removed from the slag by means of the addition of finely-divided carbon in the form of powdered anthracite, which reduces the oxide of iron in the slag and at the same time makes a reducing atmosphere of carbon monoxide inside the furnace. Under these circumstances the oxide of iron in the steel is continually passing into the slag as the carbon reduces it, and in this way the whole of the metal is gradually freed from its oxide. At the same time, under the reducing conditions and under the influence of the chemical composition of the slag, the whole of the sulphur is automatically removed from the metal into the slag.

The steel being now purified is ready for "teeming" into the ladle, its composition being adjusted to that required, by the addition of alloys, the quantity of which is based on the result of a test analysis taken from the bath during the refining. A small addition of aluminium or an alloy of aluminium is usually added at the end in order to remove any trace of gases which may remain in the steel.

The ladle is then brought under the tapping spout of the furnace, the small door above this is opened, and the furnace is tilted right over and its contents emptied into the ladle, from which it is teemed into the moulds.

Working Costs for Electro-Metals Furnaces.

(A) *Melting and Refining Common Steel Scrap to High Grade Metal suitable for Steel Castings.*

Size of furnace	25 cwt.	2½ tons.	5 tons.
No. of casts per week (double shifts)	25	20	18
No. of tons per week... ...	31·25	50	90
No. of tons per year (45 working weeks)	1,406	2,250	4,050
Transformer capacity, KW. ...	300	500	900
Energy consumption per ton, KW.-hours	850	800	750
Electrode consumption, lb. per ton	45	40	35

Costs per Ton of Metal in the Ladle.

	£	s.	d.	£	s.	d.	£	s.	d.
1. Scrap at 55s. per ton (allowing 7 per cent. loss)	2	19	3	2	19	3	2	19	3
2. Energy at 0·5d. per unit	1	15	5	1	13	4	1	11	3
3. Electrodes at 1¾d. per lb.		6	7		5	10		5	1
4. Labour		6	6		5	8		4	1
5. Materials for slags ...		1	9		1	6		1	2
6. Alloys adding 0·25 per cent. Si and 0·75 per cent. Mn.		4	6		4	6		4	6
7. Repairs and maintenance		8	7		5	10		4	6
8. Ladle costs		2	11		1	9		1	5
Total... ...	£6	5	6	£5	17	8	£5	11	3

Management, laboratory and overhead charges are not included.

(B) *Melting and Refining Common Steel Scrap and Producing High-Quality Tool Steel.*

Size of furnace...	25 cwt.	2½ tons.	5 tons.
No. of casts per week (double shifts)	22	18	16
No. of tons per week	27·5	45	80
No. of tons per year (45 weeks ...	1,237	2,025	3,600
Energy consumption per ton, KW.-H.	900	850	800
Electrode consumption, lb. per ton ...	50	45	40

Costs per ton ingots.	£	s.	d.	£	s.	d.	£	s.	d.
1. Scrap at 55s. (7 per cent. loss)	2	19	3	2	19	3	2	19	3
2. Energy at 0·5d. per unit	1	17	6	1	15	5	1	13	4
3. Electrodes at 1¾d. per lb.		7	4		6	7		5	10
4. Labour		7	3		6	3		4	7
5. Materials for slags ...		1	9		1	6		1	2
6. Repairs and maintenance		8	10		6	0		4	7
7. Ladle and moulds ...		7	4		5	10		5	1
Total... ...	£6	9	3	£6	0	10	£5	13	10

Management, laboratory, overhead charges, and alloys are not included in the above costs.

The following Electro-Metals furnaces for steel making have been installed, or are in course of construction, at the present time :—

Messrs. Darwin & Milner, Sheffield	2½	tons.
Messrs. Soderfors Bruks A.B., Sweden	2½	"
Messrs. Kayser, Ellison & Co., Ltd., Sheffield ...	4	"
" " "	8	"
Messrs. Swift, Levick & Sons, Sheffield	4	"
Messrs. Jno. A. Crowley Co., Detroit	5	"
Messrs. T. Hackett & Sons, West Bromwich	25	cwt.
Messrs. Robert Hyde & Son, Ltd., Sheffield	25	"
Messrs. Kryn & Lahy Metal Works, Ltd., Letchworth	30	"
The National Steam Car Co., Ltd., Chelmsford ...	2	tons.
Messrs. Altos Homos de Vizcaya, Bilbao	2½	"

The Electro-Metals system is also being used for the manufacture of ferro-alloys.

ELECTRICITY IN SUBMARINE MINING.

In several of our French contemporaries recently the application of electricity to the operation of submarine mines has been described, on the basis of a detailed article by M. Antoulaïeff, professor at the Ecole Militaire Electrotechnique, of Petrograd, which was originally published in *Electritchestvo*.

Free mines, which are not connected with the shore, and are dangerous to all vessels, because they explode at the first contact, are fitted with batteries inside them; stationary mines are connected by submarine cables with stations on the shore, where the batteries are situated. Automatic mines contain an apparatus which closes the circuit when a vessel bumps the mine, sending a signal to the shore, whence, automatically or otherwise, a strong current is transmitted to explode the mine. Observation mines, on the other hand, are moored at known spots which are kept under observation with telescopes, and when a hostile ship passes over a mine, the latter is sprung by the observer. In this case extreme accuracy is essential, if the mines are far from the shore.

The batteries used are in some cases required to maintain a weak current continuously; but, generally, the batteries are intended to give a strong current for a short time. In the case of the batteries in free mines, the exciting liquid is introduced into the cells only at the moment when they are required to operate. Sometimes one needs a cell of low E.M.F. and high internal resistance, to ensure that the current shall never exceed a few milliamperes; for this purpose a piece of submarine cable in sea water has been found suitable, the electrodes being the copper conductor and the galvanised-iron sheathing wires. The E.M.F. is from 0·01 to 1 volt, and the resistance hundreds of ohms.

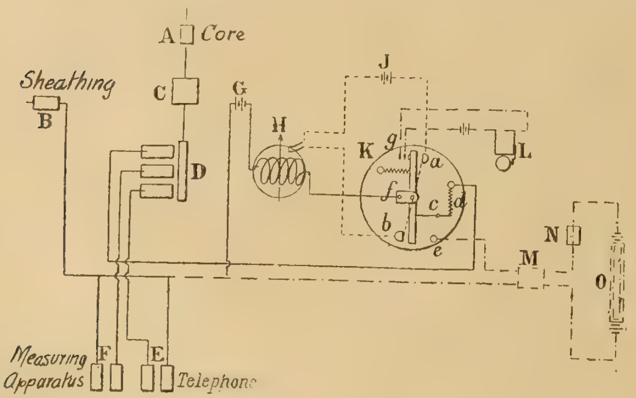


Fig. 1.—Connections for Automatic Firing of Submarine Mines.

The submarine cable used consists of a stranded copper conductor insulated with gutta-percha, several layers of rubber, and several layers of impregnated tape, the whole being sheathed with galvanised-iron. The resistance of the cable is 5 to 12 ohms per km., and the weight up to 500 kg.

The detonators are usually actuated by the heating property of the current. Experience shows that the fuse wire should not exceed 0·025 mm. in diameter, an alloy of platinum being used; the length of the wire and the density of the explosive are important factors in relation to the sensibility of the detonator.

The apparatus at a shore station has to provide for the testing of the circuits and batteries, the reception of a signal when a vessel touches a mine, the transmission of the firing current, so that an elaborate control board is required.

When the operation of the mines is effected automatically, the warning signal simultaneously actuates a relay permitting the firing current to pass to the line. When it is desired to render the mine inoperative, the switch controlling the firing battery is opened.

The connections of the automatic mine are shown in fig. 1, in which A and B are terminals connected respectively to the core and the sheathing of the cable, C is an indicator, D a plug board, E and F two pairs of terminals, H an ordinary galvanoscope, of which the pointer when deflected to a certain extent makes contact between two springs, and K is an electromagnetic relay with poles at *a* and *b*, and an armature which rotates about a fixed axis at *f*. When the armature of this relay is in the position shown by the firm lines, the lever *c* is held against the pull of a spring *d* by a tooth attached to the armature. N registers the number of times the circuit of the battery O is closed.

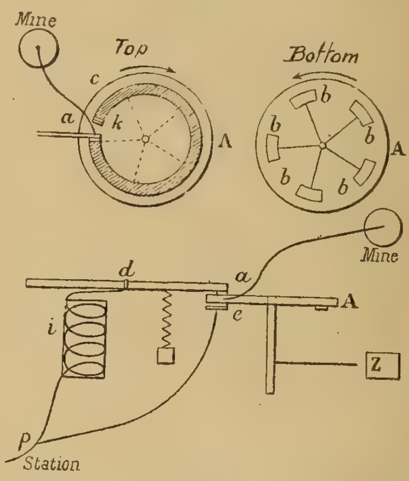


Fig. 2.—Apparatus for Recording the Number of the Mine Exploded.

When a vessel strikes a mine, a connection is produced between the conductor and the sheathing of the cable, and the current from the local battery G increases, so that the pointer of the galvanoscope H is strongly deflected and closes the spring contacts, thus energising the relay K by means of the battery J. The armature of the relay releases the lever *c*, which makes contact with *e*, and at the same time interrupts the circuit through the galvanoscope, so that the pointer of the latter returns to its normal position and the circuit of the relay is opened. The armature of the relay, under the action of a spring, closes the contacts *g* and rings the bell L.

If the double-pole switch M is closed when the lever *c* makes contact with *e*, the firing current at once passes to the line by way of the plug-board D and explodes the mine. If the switch M is left open, the ringing of the bell announces that the mine has been struck by a ship, and it can be fired, if desired, by closing the switch, or reset by replacing the lever *c*.

The mines are usually connected in parallel, and each mine has to be provided with an indicator to show which mine has exploded. This device is illustrated diagrammatically in fig. 2. A disk A turns in the clockwise direction under the action of a spring, and carries on its upper side an ebonite ring *c*, to which is applied a metal tongue *a*; on the lower side are several metal contacts *b*, their number corresponding to that of the mine, less one. These contacts are connected together, and by way of the pivot with the sheathing of the cable. When the mine closes the circuit, the firing current passes from the controlling station by the shunt *p*, through the winding of the electromagnet *i*, into the axis of the armature *d*, and so to the tongue *a* and to the mine. The armature is attracted and releases the disk, which begins to rotate, while the tongue *a* rests upon the ebonite ring and the circuit *p*, *i*, *d*, *a* is thus interrupted; during this rotation the contacts *b* touch the spring *e* in succession, so that the firing current passes (in the case illustrated) five times into the cable by way of *p*, *e*, *b*. Consequently when mine No. 6, to which this apparatus is connected, explodes, the firing current passes six times in all before the circuit is left open, and permits the recorder N to register the number of this mine. The disk A is brought to rest by the stop *k* meeting the tongue *a*, leaving the circuit open.

A detonator much used in Russia is that invented by an engineer officer named Dreyère, and consists of a piece of ebonite *a*, fig. 3, into which are inserted two screws *b* and *c*, with sharp points, separated by a gap of one or two millimetres. Into the space between the points an explosive is introduced, to which graphite is added to increase the conductivity. The apparatus is put in circuit by means of the insulated wires *gd* and *e*, which are connected to the screws. If a source of electrical energy of at least 45 volts A.C., or 65 volts D.C. is applied to the circuit, sparks are produced between the particles of graphite in the priming, and the latter is ignited, bursting the ebonite at the thin upper part so that the flames pass through into the charge. A capsule *h*, filled with fulminate of mercury, is usually attached to the upper end of the detonator and is deflagrated by the ignition of the explosive.

Detonators can be prepared of any desired resistance by varying the composition of the explosive. Usually the resistance is from 10,000 to 20,000 ohms, according to the characteristics of the source of electricity employed, which, in the case of land mines, may be a magneto exploder. Such a machine consists of an armature driven through gearing by a handle, and three steel magnets; the armature is wound with 2,500 turns of insulated wire, of 500 ohms resistance, and makes six revolutions per turn of the handle, which should be turned at least four times per second. The total weight of the machine in a wooden case is 5 kg., and it gives a pressure of 70 volts when the external resistance is 1,000 ohms, 45 volts for 500 ohms, and 35 volts for 250 ohms. Thus it could be used to explode simultaneously 20 detonators of 10,000 ohms resistance.

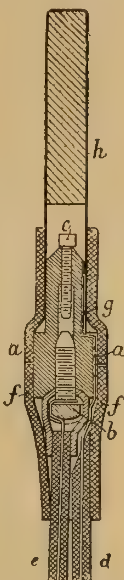


Fig. 3.—Section of Dreyere Detonator.

Another type of exploder is an ordinary D.C. dynamo with series excitation; it is provided with a condenser, and an arrangement which allows the current to pass into the external circuit only once while the crank makes two revolutions (and armature 12 revolutions). A moment before the external circuit is closed, the circuit containing the condenser is opened, and besides the discharge of the condenser, the "extra-current" of opening is thrown into the external circuit. In this machine the armature resistance is 1,100 to 1,300 ohms, that of the field magnets 1,600 ohms, the capacity of the condenser 0·008 to 0·024 mfd., and the voltage 170 volts; the apparatus weighs 27 kg., and can explode 30 detonators in parallel simultaneously. Detonators are always connected in parallel, because they cannot be made precisely alike; if they were in series, the most sensitive would go off first and open the circuit, leaving the other detonators intact.

The Zeppelin and the Lamp.—The unexpected does not always happen. When London was visited by the craft of the Kultured Count recently, and dropped bombs in a certain district, everything around was shattered except one electric lamp which remained, we are informed, "in solitary glory," and that lamp was a "Mazda." We shall hide behind a bank of them next time.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The A.E.G. Meeting.

We think the suggestion made by "No Furtiveness" that firms shall state whether they are or are not supplying the Electrical Company or A.E.G. with machinery, &c., is a good one, and it gives us great pleasure to state that during the past 15 months we have not, directly or indirectly, supplied to the Electrical Company, A.E.G., or any of its agents, any machinery or goods of any kind. We have been approached by them on several occasions, but most of their letters have been ignored, and we have been struck by the attitude of their travellers, all of whom are British, who have visited us endeavouring to sell goods, and openly boasted that they could supply us with anything that their parent company made, and that it was their intention to keep the Charing Cross Road establishment going, so that they would be ready to go straight on with an increased turnover as soon as the war was over. We know the firms, in particular one not far from the centre of England, which is supplying the Electrical Company with motors, and we are sorry that the B.E.A.M.A. has not so far seen its way to answer some of the correspondence, and so clear its members.

E. Brook, Ltd.

Huddersfield, *October 2nd*, 1915.

I am glad to see that my protest in your issue of September 17th has aroused some interest, and I trust that you will allow me some further space in order to drive home my points. Let it be remembered that here is a company, registered in London under a British name, which is merely an offshoot of the A.E.G. of Germany, and which, although not allowed to import goods from, or to export money to, Germany, is, nevertheless, being "nursed" in order that, when the war is over, the A.E.G. may come into its own again. The late head of the A.E.G., Dr. Rathenau, was one of the Kaiser's familiar spirits, like Herr Ballin, and undoubtedly shared the responsibility of forcing on this world-war for German dominion. The present head, Dr. Walther Rathenau, recently made a violent anti-English speech, and his company has been engaged for many months in turning out instruments of destruction against us and our Allies. The Electrical Company is, therefore, merely a nest which is being kept in order, against the time when the gentle German Eagle will lay eggs in it, in the form of dumped German electrical goods, to the detriment of our own manufacturers. Those Englishmen who are at present carrying on this business are, however, no less unpatriotic than those who are helping to keep it alive by trading with it. The former have no excuse that it is their bread and butter; any competent man can find a job nowadays. The latter have not even this excuse. It is difficult to discover all their names, but anyone looking into the window in Charing Cross Road can see examples for himself. . . . . Perhaps the manufacturers of these goods will explain.

Inquisition.

October 5th, 1915.

Receipt Forms on Cheques.

A printed receipt form on all cheques would be particularly useful at a time like the present, when office staffs are depleted through enlistments and increased postage charges are proposed.

Preferably the receipt should be printed on the back of the cheque, for then one signature serves as an endorsement and a receipt. The wording could be:—

"Received from
(Name of firm.)
....
The amount named on the face hereof.
The signature of payee
.... Stamp for £2 or over.
Date.................191
This receipt is also the endorsement of the
cheque and is the only acknowledgment required."

The paid cheques can be pasted on to the counterfoils in the cheque book, and the receipts are thus kept in handy form for audit purposes.

Accountant.

A Transformer Query.

I shall be obliged if one of your readers can offer a solution to the following problem:—Three 3,810-230-volt transformers were connected to a 6,600-volt three-phase alternator (earthed neutral); the transformers were connected in star on the primary and secondary sides and the latter earthed; the voltage between phases on secondary was 400, which, of course, was quite correct, but the voltage across any one phase was 260 (30 volts high).

When the neutral point on primary was connected to earth, the secondary voltage became normal. Is it possible that this was due to a third-harmonic voltage, or was it due to the capacity of the transmission line and transformers?

M. M.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Multiple-Break Tumbler Switch.

We recently described a single-tumbler double-pole switch which Messrs. A. P. Lundberg & Sons, of 477-489, Liverpool Road, London, N., have put on the market; a switch of similar construction has now been introduced by the firm, under the title of the "Quadbreak" switch, it being a single-way switch with four breaks in its circuit.

The switch is designed for pressures up to 250 volts, and is intended for use in circuits where there is a liability to heavy spark wear through high voltage or current, or both, or owing to the inductance of the apparatus controlled.

Surface types are made for 5 and 10 amperes, and a flush pattern for 5 amperes; if the current be reduced, the switch may be used on circuits at proportionately higher voltages—up to 400 volts. In view of the tendency nowadays to put heavier work on tumbler switches, this device should prove very useful. It will deal with currents 50 per cent. above its rated capacity, if the circuit is not very inductive.

Ferranti Bar Fires.

In connection with their electric fires, Messrs. Ferranti, Ltd., of Central House, Kingsway, W.C., have recently issued a new folder, H 75/4, covering the latest patterns.

One of these "bar" fires, type F B D a, is illustrated in fig. 1, and contains two heating elements each of 750 or 1000 watts maximum loading. Each element, fig. 2, is controlled by a separate switch, so that either or any of them can be used as desired; the elements consist of a heating spiral clamped between specially shaped bars of porcelain, which are threaded on to screwed rods fitted with nuts at either end. The ends of the heating wire are clamped under these nuts, the rods or bolts becoming the terminals.

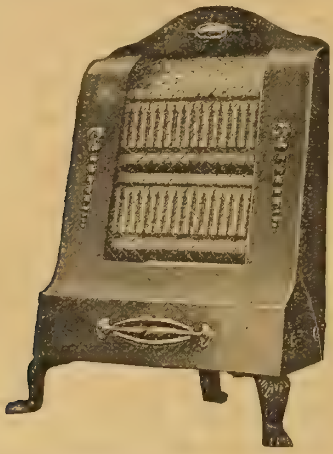


Fig. 1.—Ferranti Fire, Type F B D a.

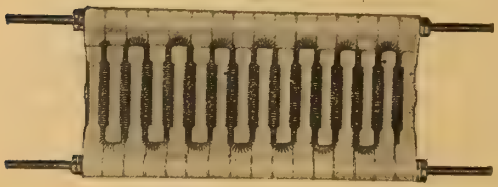


Fig. 2.—Ferranti Heating Bar.

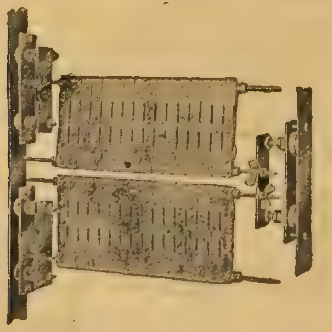


Fig. 3.—Method of Fixing and Connecting Heating Bars, seen from Behind.

Fig. 3 shows the method of carrying the elements in the carcase. The clamping bolts drop into slotted bars, which are connected to the terminals, and thus are alive. To remove an element, it is only necessary to open the main switch and slack back two wing nuts, and it is also only a few minutes' work to slacken the clamping nuts and replace the heating spiral in the porcelain supports.

The front of the fire is protected by a wire screen; the back is enclosed in the carcase, but is accessible by removing a panel.

Large Turbine Gear.

Through the courtesy of the Power Plant Co., Ltd., of West Drayton, Middlesex, we were recently able to inspect a typical turbine speed reduction gear—one of a number passing through the shops—which is intended for driving a direct-current generator and to transmit 2,250 h.p., the speed reduction being from 3,000 to 300 r.p.m.

It will be noted that the complete gear forms a self-contained unit, which is bolted to the turbine bed, an oil-tight joint being made between the caps of the turbine bearing and the adjoining pinion bearing of the gear. The latter consists of a nickel-steel pinion and built-up wheel, running with a tooth velocity of about 6,000 ft. per min; the gear face width is 32 in. and the shaft centres are 42 in. apart.

The two steel rims of the wheel are shrunk on to cast-iron centres and further secured by axial studs, the ends of which are riveted over. The wheels are bolted together at the bosses and through a distance ring near the periphery. The wheel, which is machined all over and perfectly balanced, is pressed on to a steel shaft and secured endwise in position by a collar and nut, and is also double keyed.

The gear case, as well as its base, is made in halves at right angles to the wheel axis, with planed oil-tight joints. The case is of strong box section, and the bearing housings for wheel and pinion form integral parts of the case.

The most interesting feature of the gear is the arrangement of the pinion bearings, of which there are three. The centre bearing is a plain bearing with horizontal flanges, which bolt on to flat seats on the casing. The bolt holes in the bearing flanges are clearance holes. The two outer bearings are of special design, and are arranged with a wedge adjustment for setting the gears to correct centres. When the outside bearings are being adjusted, the bolts fastening the centre bearing to its seats are slackened, so that the centre bearing can follow the movement of the outside bearings. When the latter are finally adjusted, the bolts of the centre bearing are tightened, and the bearing is fixed in its final position by steady pegs.

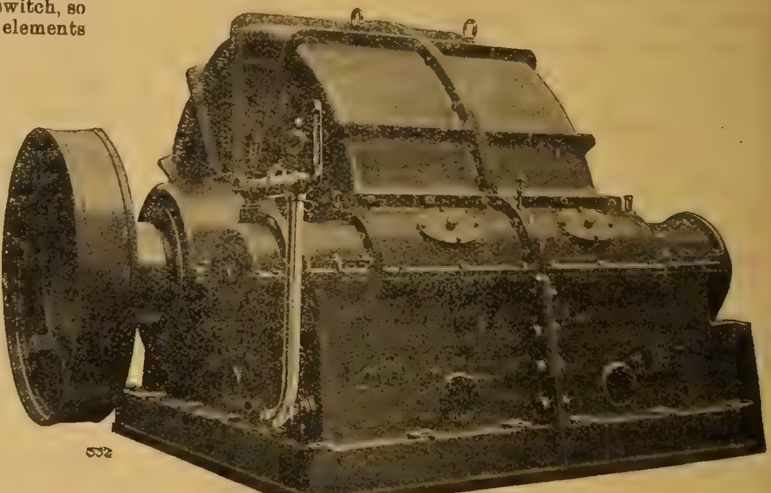


Fig. 4.—Turbine Speed Reduction Gear.

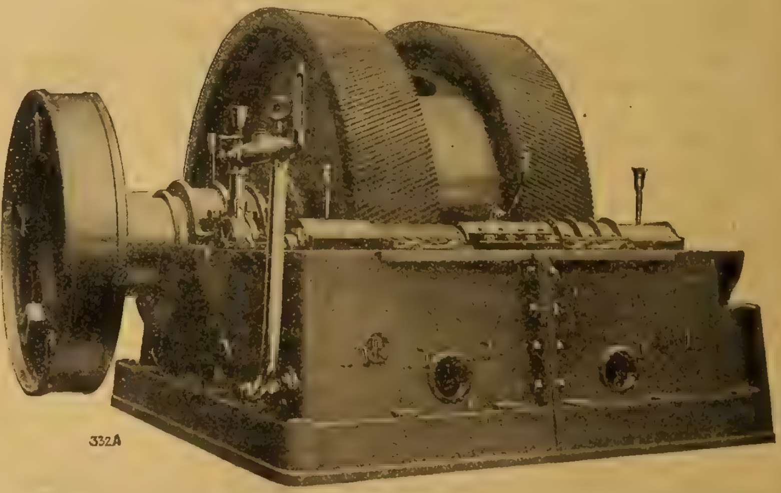


Fig. 5.—View of Speed Reduction Gear with Case Removed.

The bearings, as well as the gear, are lubricated by means of oil under pressure, supplied by a specially designed turbo oil pump coupled to the pinion shaft.

The bearings are fitted with oil-flow indicators, and a most efficient lubrication of the gear is obtained by surrounding the pinion with a closely fitting aluminium oil shield close up to the line of engagement, into which the oil is pumped, so that the spaces between the pinion teeth revolve practically full of oil. The top half of one of these shields is shown in position in fig. 5.

Special attention has been given in the designing to the accessibility of all parts; all bearings can be removed without the main cover having to be lifted, and the whole pinion can be exposed and, if necessary, taken out after removing the light end covers, which are made separate from the main cover, and are fitted with additional inspection doors.

A cast-iron oil trough is formed in the bottom of the gear case, from which the oil drains into a separate oil cooler—a cast-iron tank fitted with suitable baffles, which direct the flow of oil round a grilled copper-cooling coil through which water is circulated. The oil circuit further contains an oil strainer—arranged so that the strainer can be removed without interfering with the oil flow—pressure gauge and thermometer.

The generator is coupled to the gear by means of one of the Power Plant Company's heavy-duty flexible couplings, the flexible medium of which is in compression.

These couplings consist of two facing disks with similar cast projections, which mesh very loosely with each other, the intervening spaces being filled with compressible material. They are adopted for reversing and are insulating. We may add that the firm's works contain many examples of their own reduction gears, which are used between motors and lineshafts, and motors and machines.

Sewing Bench Lighting.

Messrs. Dugdill's Patents, of Failsworth, Manchester, have devised a "sewing bench constellum," which we illustrate herewith.

A and B are arranged for lighting button-hole machines, two lamps to each. A shows the lamps in position for use; B shows the lamps folded back, out of use. C and D are arranged for ordinary sewing machines, one lamp to each—shown in the working position, also folded back out of use. The arms are instantly adjusted, and are self-sustaining in all positions. The pillars may be either screwed to the table top, or carried through felt-lined holes in the table top, and secured to the floor as shown. Constellums are made for any number of machines on one bench, and spaced as required for ordinary double-side sewing benches.

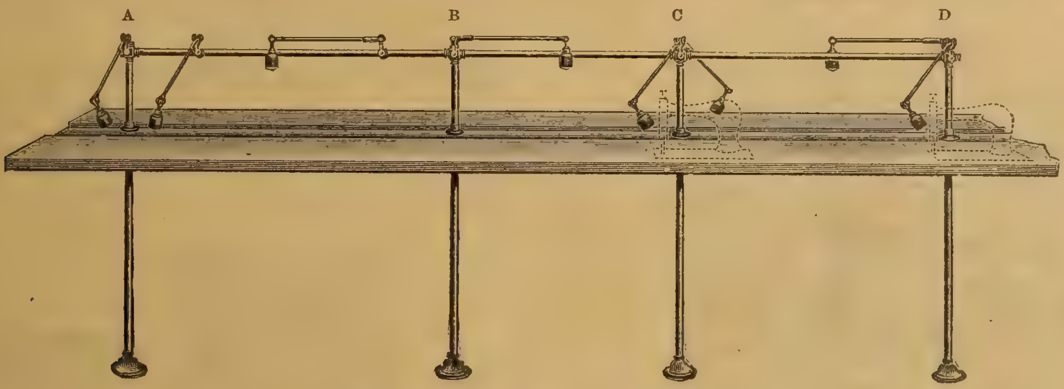


Fig. 6.—Sewing Bench Constellum.

B.T.H. Lighting at West African House.

The accompanying illustrations are chosen as typical of the results obtained by the British Thomson-Houston Co.'s "Eye-Rest" indirect lighting system in one of the new Kingsway Buildings, viz., West African House. The whole of the building, including the ground floor Recruiting office, is lighting throughout on the indirect principle by Mazda lamps, in some 120 "Eye-Rest" fittings.

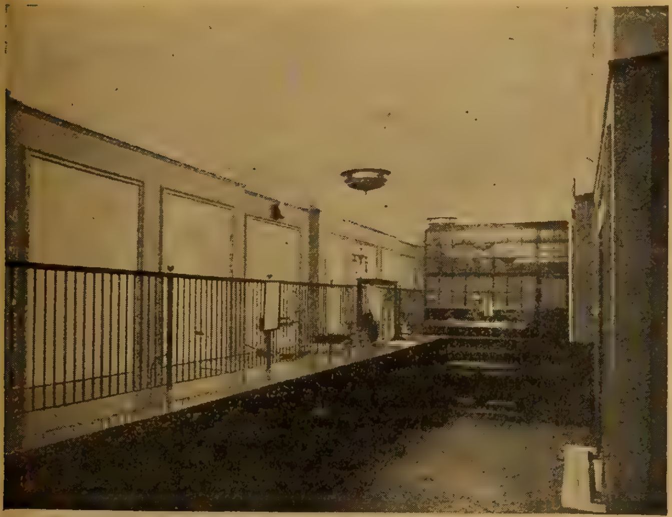


Fig. 7.—"Eye-Rest" Lighting at Martin's Bank, West African House.

Part of the ground floor is occupied by Martin's Bank, fig. 7, in which oxidised silver metal fittings are used.

The wiring in West African House was already installed before the details of the illuminating scheme had been determined, and it was unfortunately arranged that all the lights in each room should be turned on and off by a single switch. To overcome this inflexibility an interesting innovation has been made by providing a three-way pull chain switch in each lighting bowl where required. The pull chain permits flexible lighting from each bowl or permits all the lamps therein to be extinguished, as may be desired.

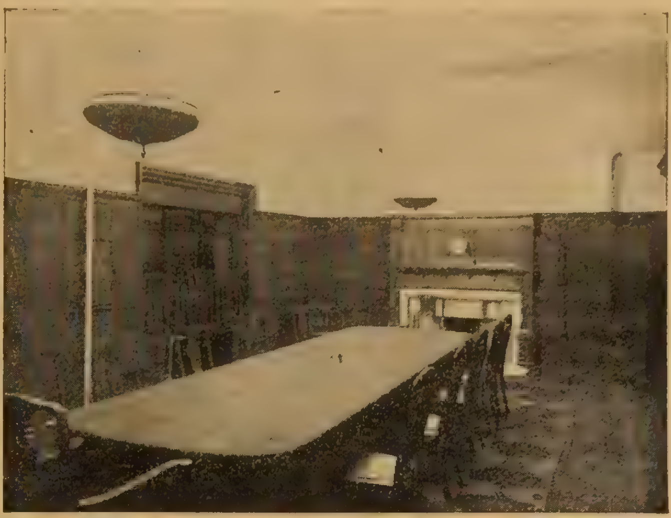


Fig. 8.—Board Room Lighting, West African House.

Appropriate illumination is provided in the secretary's office and agent's office by a single "Eye-Rest" fitting in each case with Mazda lamps and X-ray reflectors. In harmony with the purpose and furnishing of the board room are two handsome "Eye-Rest" fittings used to illuminate this chamber, fig. 8.

The illustrations are reproduced from untouched photographs taken by the unaided light of the Mazda lamps.

"Revo" Electric Fires.

The Cable Accessories Co., Ltd., of Britannia Works, Tividale, Tipton, have recently issued a new list dealing with their "Revo" electric fires, which are made in several patterns and finishes, ranging upwards from quite moderate prices, and which incorporate the firm's patent heating element shown in figs. 9 and 10.

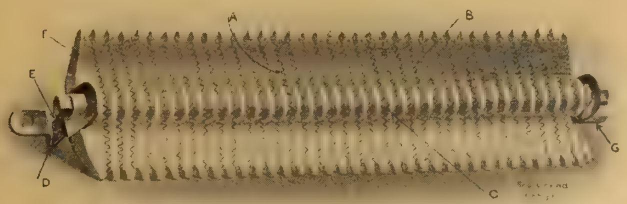


Fig. 9.—Heating Element used in "Revo" Fire.

This possesses several novel features, the heating wire B, being wound entirely on the front face of a specially-designed heat reflector F. There is a free air space round the wire which has no time lag in heating up; moreover, the member C is stated to automatically take up any slackness in the heating wires, thus preventing short circuits. D and E represent a spring device, which takes up expansion of the element and absorbs shocks, &c., in transit. Slotted end brackets G are fitted to facilitate removal.

It will be noted that the design prevents the waste of heat by radiation in a rearward direction.

Fig. 11 shows the "Leader" pattern fire, weighing 35 lb. and built for 2,000, 2,500 or 3,000 watts maximum loading.

Two switches are provided, of tumbler pattern, strongly mounted, and suitable for foot operation; the internal connections are specially insulated; the housings are of fine grained cast-iron stove enamelled and are, with the exception of the smallest fire, large enough to cover the ordinary fire grate.

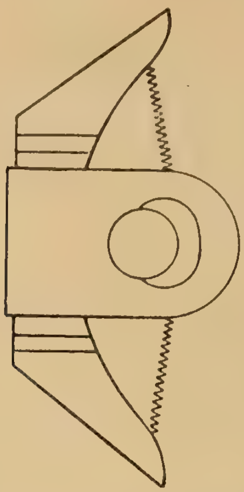


Fig. 10.—Cross Section of "Revo" Element, showing Action of Tautening Member.

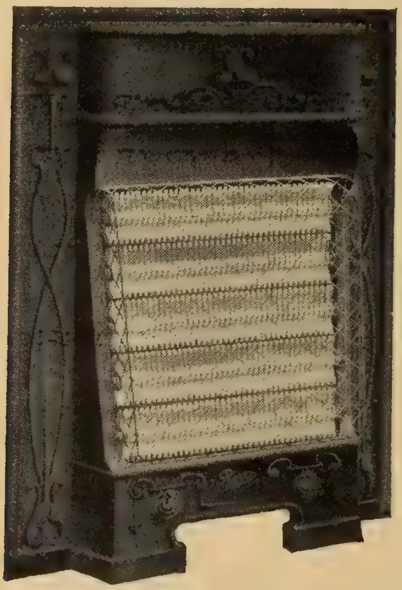


Fig. 11.—"Leader" Pattern "Revo" Electric Fire.

The normal voltages supplied are 100, 200, 220, 240/250.

We note that complete spare elements and wire spirals for renewing them are supplied at trifling cost, and that the elements are guaranteed for three years.

New Electric Laboratory Furnace.

The electric furnace has quickly become an indispensable adjunct to the chemical or physical laboratory, and consequently its construction has rapidly improved. The earlier patterns were usually wound with platinum, and their cost was unduly heavy, but recent types have been made on more economical lines. We illustrate herewith a tube furnace, made by Messrs. A. Gallenkamp & Co., Ltd., of 19-21, Sun Street, Finsbury Square, E.C., which is wound with a special high-resistance alloy, which can be used for temperatures up to 1,000° C., or for short periods up to 1,100° C. The heating chamber is made of fused silica, which is not liable to breakage through sudden changes of temperature, and is a good electrical insulator. The space between the lagging and the winding is packed with finely-powdered quartz, and the lagging consists of slabs of magnesium carbonate mixed with asbestos fibre, which makes an excellent heat insulator. The end walls are also of refractory material, held in place by steel tie-rods, and the casing is of sheet iron. Fig. 13 shows a tube furnace, and fig. 12 the heating tube; fig. 14 shows a crucible furnace, with and without its cover. These furnaces work with A.C. or D.C., and can be wound for any voltage up to 220 volts. The temperature can be accurately controlled, and very little heat is radiated into the room. Muffle furnaces and other patterns are also made.

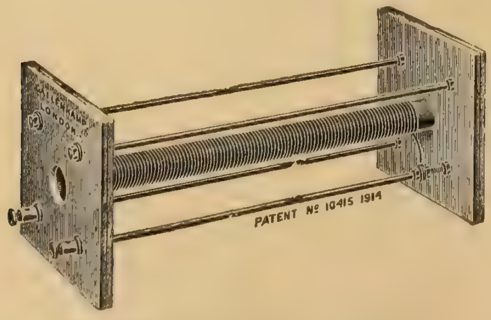


Fig. 12.—Heating Tube for Furnace.

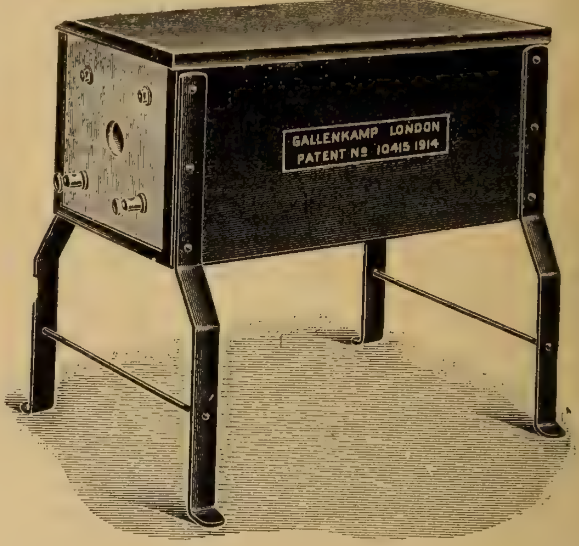


Fig. 13.—Electric Tube Furnace.

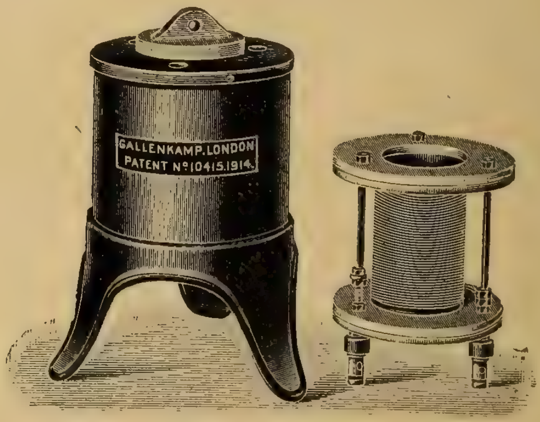


Fig. 14.—Electric Crucible Furnace.

The Electric Vehicle Association of America.—The forthcoming annual convention of the Electric Vehicle Association of America, which is to be held in Cleveland, O., on the 18th and 19th inst., promises to be of an interesting character. Among other subjects of interest that are to be discussed is that of battery exchange systems, several of which are in present, or prospective, operation, and concerning which there is just now considerable discussion in electric vehicle circles. The subject will be opened by Mr. S. Ferguson, vice-president of the Hartford Electric Light Co., of Hartford, Conn., who will deal with "The Hartford Electric Co.'s Experience with the Battery Maintenance and Battery Exchange System." Another important subject is that of the electric taxicab, concerning which high hopes are entertained in some quarters. Mr. I. S. Scrimger, the secretary and general manager of the Detroit Taxicab and Transfer Co., the first concern in America to both build and run electric taxis, will read a paper on "The Electric Taxicab." Other papers to be read at the meeting include one by Mr. R. Macrea, of the Commonwealth Edison Co., of Chicago, on "The Function of the Electric Garage," one on "The Field for the Small Electric Delivery Vehicle," and one on "Electric Vehicles in Municipal Service."

DAMAGES ON BREACH OF A CONTRACT TO SUPPLY MACHINERY.

[FROM A LEGAL CONTRIBUTOR.]

Nice questions occasionally arise as to the proper course for a man to adopt who has bought machinery only to find that it does not do the work required of it. Wholesale rejection may be possible; and he may be compelled to keep the machine, work it to the limit of its capacity, and supplement it with another machine either from the same or a different manufacturer. In these circumstances it may become necessary for him to consider the measure of the damages which he is entitled to claim.

The discussion of a concrete case which may often be paralleled in actual practice should tend to the clear understanding of the legal questions which have to be considered.

A manufacturer in a tropical country where water is scarce and expensive requires a condenser which will condense 10,000 lb. of steam per hour and maintain a vacuum of 25 inches with the barometer reading 30. He buys a condenser with a warranty that it will produce these results, and erects it in accordance with the manufacturer's instructions. He then finds that it will only do half the work required of it. He makes every attempt and incurs expense in trying to put it right. He consults the manufacturers, who suggest various expedients, all of which are put to the test but without avail. If he were to stop his works, and wait for the manufacturers to comply with their guarantees, he might suffer serious loss. He therefore makes the best of a bad job—gets out of the condenser as much work as it will do and buys water to condense the rest of his steam. Finally, in order to effect the necessary condensation, he buys a second condenser from another firm which will do the work left undone by the first machine. In these circumstances—as he has suffered materially from the breach of warranty—the question is, what is the measure of damages which he can recover in an action? It is a general principle of law that "The measure of damages for breach of warranty is the estimated loss directly and naturally resulting in the ordinary course of events from breach of warranty."

What then, is the loss directly and naturally resulting from the breach of warranty? In the well-known case of *Hadley v. Baxendale* (1,854) 9 ex. 341 (at page 354) it is laid down that where two parties have made a contract which one of them has broken, the damages when the other party ought to receive in respect of such breach of contract should be such as may fairly and reasonably be considered either arising naturally—*i.e.*, according to the usual course of things, from such breach itself, or such as may reasonably be supposed to have been in the contemplation of both parties, at the time they made the contract, as the probable result of the breach of it.

But can the cost of installing a new condenser to do the work which the other was unable to do be recovered? It is submitted that it can, on the principle that a party who suffers in consequence of a breach of contract is bound to reduce the damages as far as possible. Had they simply cast out the condenser as supplied they might have been compelled to shut down their works altogether. On the other hand they chose the simpler and cheaper expedient of buying such additional machinery as they were advised to enable them to dispose of their steam.

It is interesting to inquire whether upon the cases decided in England and America damages can be claimed on the above basis. Reference is made to American decisions because notwithstanding the large number of contracts relating to machinery which are made in this country, cases illustrating the question under discussion are very rare. Indeed they mostly have to do with *delay* in the performance of a contract.

In *Cory v. Thames Iron Works Co.* (1,868) L.R. 3, Q.B. 181, the plaintiffs bought from the defendants a patent boom derrick, the first of its kind ever built in this country. It was to be delivered in six months' time, and the defendants knew the plaintiffs were going to use it in their business. It was shown in that case that owing to delay the plaintiffs lost profits which they would have made in a contract with Sir W. Armstrong. These profits the plaintiffs sought to recover when it was pointed out that the special purpose was not known. Chief Justice Cockburn, however, observed, in the course of the argument: "There is one thing which must always be in the knowledge of both parties, which is, that the thing is bought for the purpose of being in some way or other profitably applied." This case, however, is an authority for the statement that the damages are not necessarily confined to that which both parties contemplated. They may be assessed on a larger basis than that. The principle is thus stated by Sir Henry Mayne in his work on "Damages"—"Where in consequence of a change of circumstances the defendant's breach of contract has not produced full damage which the contract originally provided against, only the loss which has actually been incurred can be recovered."

Mayne also says: "As the damages for breach of covenant are measured by the actual loss or inconvenience which the plaintiff has been put to by the breach, his loss or inconvenience may from time to time vary or disappear. If by lapse of time, change of circumstances, or from any other cause, the covenant has ceased to operate, or has wholly or in part lost its beneficial character, or if its breach has been acquiesced in to a degree short of that which would bar an action, a breach may come to be measured by very small or by merely nominal damages."

In *Wigsell v. School for Indigent Blind* (1,882), 8 Q.B.D. 357, certain persons who had bought land upon which to erect a school, covenanted to build a wall seven feet high between it and the land of the vendor. Having failed to build the wall, the grantors brought an action for damages claiming the cost of putting up the wall as damages. It was shown that the fact of the wall not being built had not really affected the price of the plaintiff's land. In these circumstances it was held that, the true measure of damages being the pecuniary amount of the difference between the position of the plaintiffs upon the breach of the contract and what it would have been if the contract had been performed, under the circumstances of the case the amount that it would cost to build the wall was not the true measure of damages. In that case Mr. Justice Field said: "The rule stated in its most general terms is that plaintiff is entitled to have his damages assessed at the pecuniary amount of the difference between the state of the plaintiff upon the breach of the contract and what it would have been if the contract had been performed."

It is to the United States that we have to look for anything like definite authority for the decision of the condenser case above referred to.

In *Jacksons v. Hurlbut* (158 N.Y. 34) an action was brought to recover damages for the breaking of a planing machine while in custody of defendants, who were carriers, for transportation to plaintiffs' factory. There was a verdict of $500 for injury to the machine and loss of plaintiffs' use while being repaired. In the course of the judgment of an appeal court the following passage appears: "It was urged that the judge had admitted evidence to show loss of profits from inability to use the machine after the injury and until it was repaired. But no evidence as to loss of profits was given. Some proof was given that the plaintiff was compelled on account of the injury to the machine to send work out of the shop in order to complete contracts they had in hand at the time of the breaking of the machine. This was not proof of the loss of the profits, but of the loss occasioned to the plaintiff by inability to use the machine on account of the defendant's negligence. We are not prepared to say that this evidence was not entirely competent under the circumstances of the case, but it is not necessary to consider this question, as the expense of restoring machine in a condition to use was a proper element in the estimation of damages, and that item of expense alone exceeds the verdict. The item of the expense of restoring the machine to a condition that would render it fit for use is certainly within the principle that damages must be compensation for the actual loss sustained which was the natural and proximate consequence of defendant's act. The cost of procuring necessary work to be done outside factory in order to enable plaintiff to fill his contracts interfered with through inability to use the machine would seem to be within same principle also."

In *Reynolds v. Braithwaite* (131 Pa. 416) it was held that when one has work done for him under a contract, exercising control of the mode of doing the work, and participating in and approving the acts of the contractor which constitute the cause of action, he is responsible for injuries resulting to another from the lawful acts of the contractor.

In an action for damages for cutting a pipe line upon defendant's land supplying water to plaintiff's premises, it was held to be legitimate to instruct the jury that the plaintiff was entitled to the reasonable cost of obtaining a supply of water, and to the reasonable cost of the depreciation thereof, from the time it was cut off. Nor was it wrong to charge the jury that the case was one in which judgment would not necessarily be limited to mere compensation. It was not a case for punitive damages, but the jury would consider whether compensating damages would be sufficient punishment for the wrong.

In a well-known American text-book, "Sedgwick on Damages" (8th edition), (Vol. 1, p. 45, note (a)), it was stated that in an action *(Davis v. Talcott,* 14 Bart. 114) to recover damages for the defective execution of a contract to reconstruct and put up machinery in a flour mill in a well-finished and workmanlike manner, and of sufficient size and strength to correspond with the cylinders, the proper measure of damages is the difference between the value of the machinery actually put up and that agreed to be constructed. In such an action the plaintiff is entitled to recover, in case the jury find that the machinery was not properly constructed, such sum as would be sufficient to put the same into condition contemplated by the contract; also such sum as the mill would have earned during the time it was necessarily delayed in consequence of the breakage in defects in the machinery, taking the fair ordinary earnings of the mill, after deducting from the gross earnings the expense of running the same, as the net profits. So, in case the contract is not performed in a reasonable time, the jury are to ascertain how long performance was unreasonably delayed, and then if they find the plaintiff was in a condition to work his mill, by having grain to grind, and is prevented from grinding the same by such unreasonable delay, the plaintiff is entitled to damages to the gross amount of the earnings of the mill, after deducting the expenses of the same.

In another American case, *Goodloe v. Rogers* (10 La. Ann. Rep. 631), it was held that in a case where it might be implied to be in the contemplation of the parties to a contract that a sugar mill and engine, which the manufacturer undertook to put up within a given time was for the purpose of getting crop, it was held that a failure to put it up in time entitled the plaintiff to recover for loss of crop and extra wages caused by delay. In another case where the lessors of a saw mill broke their contract to repair the mill, the lessees, who had a large stock of logs in the mill yard, were held entitled to recover the expenses of removing them to another mill and the cost of getting them sawn there. *(Hinckley v. Beckworth,* 13 Wis. 31.)

In another American case it was decided that where defendant breaks his contract to supply property or to do work not by altogether failing to do the thing contracted, but by doing it improperly, the plaintiff can recover no more than the cost of remedying the defect. So upon the sale of a machine which contained defects, where the defendant could have been recompensed by a small expenditure it was held that this must be done and plaintiff could not receive damages based on a recurrence of the injury. *(Frick Co. v. Falk,* 50 Kan. 644.)

Again, where the breach of warranty of machinery makes it impossible to get something necessary for use, the purchaser must minimise damages by procuring it elsewhere. So where a steam pump to be used to pump water for a greenhouse fell short of warranted capacity, the purchaser must avoid loss by procuring water elsewhere. *(Carter v. Fisher,* 121 N.Y. Supp. 614.)

Finally, where a machine was delivered in an unfit condition to do the work it was purchased for, the purchaser was allowed to recover the expenses of a reasonable but unsuccessful attempt to adapt it to the contemplated purpose *(Whitar v. Ryder,* 139 Mass. 366), and so of course of a successful attempt *(Jackson v. Hurlbut,* 158 N.Y. 34.).

Having regard to all these cases it is conceived that in the condenser case suggested at the commencement of the article, the purchaser of the machine would be fully justified in buying the new condenser and charging the cost of so doing to the account of the vendor. His alternative would be to scrap the machine and lose his sugar-crop. In the circumstances he would have chosen the course which was fairest and most economical from the point of view of the vendor.

REVIEWS.

Electrical Engineering. Volume I. Introductory. By T. C. Baillie, M.A., D.Sc. Cambridge University Press. Price 5s. net.

In his preface the author explains that this volume is designed to serve for elementary courses in electrical engineering in technical institutions, and that one of its main purposes being to teach first principles, an endeavour has been made to avoid overloading it with descriptive details which are more appropriate to oral than to written exposition.

Unfortunately, the author's endeavour has been so unsuccessful as to render his text-book exceedingly commonplace. The most flagrant example of the indiscriminate use of catalogue illustrations occurs in Chapter IV, in which, out of 33 figures illustrating "current measurement," 20 are pictures of the outsides of ammeters, voltmeters, etc., which give absolutely no information whatever as to the principles upon which the instruments depend. In fact, the only instruments of which adequate diagrammatic representation is given are of the moving coil type. Pictures of the cases and dials of electrostatic voltmeters and Kelvin's current balance are given, but no diagrams to illustrate the principles upon which they depend, while the hot-wire type of instrument is not illustrated at all. Surely, the proper place for engineering students to familiarise themselves with the appearance of ammeters and voltmeters is in the laboratory and workshop; the function of the text-book is to explain the principles of such instruments.

Nor is this fault confined to one chapter. Throughout the book pictures of apparatus abound, but effective diagrams are sadly lacking. Dynamos are illustrated by some pictures and diagrams of windings which are utterly unsuitable for the instruction of elementary students of electrical engineering. The chapter on the measurement of resistance is much better, but even here there is no need for so many pictures from catalogues.

The chapter on the potentiometer is a very good one, and the author does well to insist on the superiority of potentiometer methods in many of the important types of electrical measurement. It is, however, doubtful whether the precision type of instrument, to which so much attention is given, would be a suitable plaything for a student who needs so many pictures of ammeters and voltmeters before he is sure of them!

Batteries are dealt with in a very satisfactory manner, special attention being given to storage batteries of both lead and Edison types. The treatment is, perhaps, a little more than "introductory," and the same may, perhaps, be said of some portions of the chapter on electric lighting. But this is better than the earlier part of the book, which could be more justly described as an "Elementary Text-book of Electricity with Pictures of some Electrical Instruments" than an introduction to electrical engineering.

Over 100 exercises are given, some completely worked out and some chosen from the C. and G. examinations, and the book is well printed and well bound. But it is not a first-rate book on electrical engineering, and we hope that Dr. Baillie will find time to re-cast some of the earlier chapters in Volume I before he publishes Volume II.—P.H.S.K.

Continuous-current Electrical Engineering. By W. T. Maccall, M.Sc., A.M.I.E.E. London: University Tutorial Press. Price 10s. 6d. net.

The reputation of the University Tutorial Press for high-grade scientific and technical manuals is considerably enhanced by the issue of Mr. Maccall's book on "Electrical Engineering." The ground covered is that of a three years' day course in continuous-current electrical engineering, and the standard reached is approximately that required for final degree examinations in engineering. It, therefore, more than covers the continuous-current section of the Grade II C. & G. examination, and is likely to prove exceedingly useful as a general handbook for shift engineers, as well as a text-book for advanced electrical engineering examinations.

The book is well arranged and well illustrated, most of the diagrams having been specially prepared for this book. The treatment is essentially practical, and many of the recommendations of the Engineering Standards Committee and of the Board of Trade rules have been included, as well as a number of useful tables. In addition to a complete treatment of continuous-current generators and motors, there are chapters on units and standards, conductors and insulators, measuring instruments, secondary cells, lighting, distribution and traction.

The chapter on conductors and insulators is a remarkably good one, the author having collected and set out in quite a short space all the essential facts concerning conducting and insulating materials. Such a complete treatment of insulators in a C.C. text-book is a very rare phenomenon. The section on measuring instruments is also very complete; and here, again, it is interesting to note a very full treatment of the Aron meter, a subject which is very often conspicuous by its absence from such text-books.

The dynamo is dealt with in five chapters, first a chapter on the theory of E.M.F. generation and armature windings, then a chapter on armature reaction and commutation, followed by chapters on characteristics, construction and efficiencies. The treatment in general is sound, but there are cases where points are laboured beyond measure, and other cases where the treatment is unduly brief. For instance, it is ridiculous to devote half a chapter to the discussion of armature reaction and then to dispose of its effect on characteristic curves in ten lines.

Three sections are devoted to electric lighting; a chapter on photometry, one on incandescent lamps, and one on arc lamps—all thoroughly up-to-date and clearly written. The section on photometry is an unusually complete exposition of the theory of illumination, and contrasts favourably with the scanty treatment usually given to this subject. There are also good chapters on cells, distribution and traction.

Throughout the book mathematical work has been kept as simple as possible, consistently with a sufficient and concise exposition of the subject. A large number of worked examples and questions are given on the subject of each chapter. These add considerably to the value of the book, both from the point of view of the teacher and the student. On the whole, we are very favourably impressed by Mr. Maccall's book, and consider that it could be used with equal advantage as a text-book for technical college classes in electrical engineering or as a general practical handbook for C.C. station engineers. —P.H.S.K.

BUSINESS NOTES.

Condensing Plant.—The Mirrlees Watson Co. have recently received the following, among other orders, for condensing plant:—

Greenwood & Batley, Ltd., for Tinsley Park Colliery.—Second set.
Scottish Central Electric Power Co., Ltd., Bonnybridge Power Station.—Second set.
Rossington Main Colliery.—Second set.
Tharsis Sulphur and Copper Co., Ltd.—Two sets.
St. Helens Corporation.—Third set.
Société Anonyme Westinghouse, Paris, for Dieppe.
Fraser & Chalmers, for North Lonsdale Iron Co.

They are also supplying Edwards air pumps for the Compagnie Francaise Thomson-Houston, and dry air pumps for the Houghton Main Colliery Co.

Catalogues and Lists.—British Thomson-Houston Co., Ltd., Rugby.—Two new price lists: No. 4,140 (8 pages) contains descriptive information, prices and weights and dimensions, arranged in the usual B.T.H. manner, of lever starting switches; No. 4,401B (four pages) is devoted to overload relays for A.C. and C.C. circuits.

The Cable Accessories Co., Ltd., Britannia Works, Tividale, Tipton, Staffs.—12-page illustrated catalogue of "Revo" electric fires whose distinctive features and outstanding advantages are described. The unit is shown in detail, and the pictures show a number of designs of these fires for office or home use. Prices are given.

Messrs. Alfred Herbert, Ltd., Coventry.—The September number of the firm's "Monthly Review of Machine Shop Practice" contains, in addition to many other matters, a long article on the machining of 9·2 in. high explosive shells. The monthly stock list of machines is not now included, but a separate weekly one is issued.

Messrs. Ferranti, Ltd., Central House, Kingsway, London, W.C.—Illustrated folder No. H 75/1 giving prices and brief particulars of various types of the firm's electric bar fires and electric cone fires.

The Cressall Manufacturing Co., 40 and 41, Staniforth Street, Birmingham.—Several illustrated descriptive lists relating to controller resistance nets, "cord" resistance material, electric heating nets, &c.

Century Electric Co., St. Louis, Mo. U.S.A.—Illustrated circular showing a number of applications of Century electric motors.

Private Arrangements.—Venner's Electrical Cooking and Heating Appliances, Ltd., 66 and 68, Wandsworth Road, London, S.W.—The following are creditors in this company, which, as already reported, has gone into voluntary liquidation:—

Barker Bros.	£95	Morris & Lister	£16
Duncan Wood, Ltd.	24	Merryweather & Co.	15
B.B. Patents Co.	72	Middleton, S.	27
Clerkenwell Plating Co.	28	Smith, W. H., & Son	29
Cope & Co.	82	Turner & Manville	21
Child & Co.	19	Venner, G.	199
Henley's Telegraph Co.	16	Venner, R. F.	93
Hateley & Bassett	19	Venner Signs	44
Cooper, V.	23	Watlington & Co.	15
Lewis, M.	60		

Another Lamp Test.—One of these days we shall reach the limit, and it will not be possible to find any more records for metal-filament lamps to break. Apparently we are still some distance from that unhappy time, and quite oblivious of the fact that most of the nations are at war, the lamps will persist in performing hitherto unheard-of exploits. We have not yet noted any reference to them either in the reports of Sir John French or in German wireless, but have no doubt whatever that thousands of them are rendering signal service at the Front on both sides, and after the war Victoria Cross and Iron Cross lamps will be greatly in demand. At the moment the Censor is busy, so we are deprived of the tales of heroism that should urge other lamps on to greater effort, and we have to be content with such information as is allowed to leak through from other directions. One of these pieces of information concerns an Osram lamp which gave an exhibition of strength at the Mond Nickel Institute, Clydach-on-Tawe. We have before us a picture of the said lamp shown in the waiting room of that Institute, where, as the flexible gave out, the lamp and shade fell a distance of 4 ft. on to the wooden table. The shade was smashed to pieces, but the lamp was not. Indeed, it even refused to lie on the table, for it stuck upright, neither the bulb nor the filament being broken, and shortly afterwards it was switched on to a new connection and shone with its accustomed brilliance, proud of having added new laurels to the Osram fame. Of course, the point could not be seen, being in the table, but the reader can see the point of this note, namely, that Osram lamps are as strong as ever. Incidentally, it may be added that the lamp was not brought over by a Zeppelin, but is of British make entire.

Trade Announcements.—The address of the Accessories Manufacturing Co. was altered on October 4th, to Dunedin House, Basinghall Avenue, E.C. Telephone No. "City, 7149."

The Swedish General Electric, Ltd., have now moved into more commodious offices at Canada House, Kingsway, London, W.C., where all inquiries should be sent.

Messrs. G. A. Steinthal & Boydell, Ltd., of Bradford, notify that with the sanction of the B. of T. they have changed the name of the company to Jessop & Boydell, Ltd. The whole of the issued capital, excepting 12 £1 shares, is held by Messrs. Jessop, under whose management the business is carried on. The remaining 12 shares are held entirely by natural-born British subjects of British descent.

Dissolutions and Liquidations.—British Wire-Drawn Lamp Co., Ltd.—This company is winding up voluntarily, with Mr. F. J. Markie, 83, Alberta Road, Bush Hill Park, Enfield, as liquidator. A meeting of creditors is called for October 9th, at the office of Mr. O. B. Thomas, 59, Chancery Lane, W.C. Creditors should send particulars of their debts or claims to Mr. F. J. Markie, by October 18th.

Ashton & Holt, electrical and general engineers, 15, Cross Street, Ryde, Isle of Wight.—This partnership has been dissolved. Mr. F. B. Holt will attend to debts, &c.

Book Notices.—"Science Abstracts." Sections A and B. Vol. XXIII, Part 9. September 25th, 1915. London: E. and F. N. Spon, Ltd. Price 1s. 6d. each.

"*Transactions* of the Institute of Marine Engineers," September, 1915, containing a paper on "Solid Fuel from the Technical and Commercial Standpoint," by Mr. A. E. Battle, and an American paper on "The Clinkering of Coal," by Prof. L S. Marks.

"The Royal Engineers' *Journal*." Vol. XXII, No. 4. October, 1915. Chatham: R.E. Institute. Price 1s. 6d.

"The Faraday House *Journal*" for the Michaelmas Term contains an obituary notice of the late Mr. Robert Hammond, Vice-Chairman of the Governors of the College, lists of students who are serving with the Colours, and articles on the standardisation rules of the American I E.E., "The Cooling of Hot Bodies," by Dr. Alex. Russell, and "The Electrical Transmission of Energy," also by Dr. Russell, as well as examination results, &c.

A very comprehensive catalogue of technical and scientific books has recently been issued by the Hill Publishing Co., covering a wide variety of subjects, and giving particulars of the contents of the book in each case. Many of the books listed have been published within the past year or two. Some 35 pp. out of 117 are devoted to purely electrical subjects, but many of the books in other sections deal with matters closely allied to electrical engineering or even inseparable from it. In addition to the classified portion of the book, which ranges from "Agriculture" to "Zinc," there is an index to authors' names. Copies will be sent to readers free on application to the publishers.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXXI. Part 6. September, 1915.

"*Proceedings* of the South Wales Institute of Engineers." Vol. XXXI. September 21st, 1915. Cardiff: The Institute. Price 2s. 6d.

"Applied Mechanics." By E. S. Andrews. Cambridge University Press. Price 4s. 6d. net.

Electric Heating Apparatus.—Having purchased the stock of the late Phœnix Electric Heating Co., the Dowsing Radiant Heat Co., Ltd., are in a position to repair or supply electric heating and cooking apparatus of Phœnix manufacture.

LIGHTING AND POWER NOTES.

Aberdeen.—Station Costs, &c.—We recently referred to the financial results achieved by the electricity department during the year ended July 31st last. In this period the output sold reached 10,463,269 units, as compared with 9,663,054 units in the previous year, the power units sold during the period having increased from 4,692,626 to 5,801,989; the total H.P. of motors supplied is over 10,000. In his report on the year, Mr Bell, the chief engineer, states that, despite the increased output sold, 1,744 tons less of fuel were consumed than in 1913-14, this being due to the use of more efficient generating plant and the better load factor obtained through there being less lighting load. This refers to the 3,000-KW. turbo-alternator installed in December, 1913, which generated 11,631,100 out of the 12 475 920 units output of the year. The fuel consumption per unit sold fell from 4·10 lb. to 3·42 lb., and the fuel cost from ·35d. to ·27d.; the total costs were also reduced from ·66d. to ·61d. per unit. The generating plant capacity was 8,380 KW., and the maximum load, including tramways, was 4 560 KW., as against 4,733 KW. in the previous year, the load factor improving to 26·19 per cent. from 23 31 per cent. The engineer remarks upon the certainty that new plant will require to be installed by the autumn of 1916-17, and on his intention to report on this matter at an early date.

Monthly Report.—The electrical engineer reports that during August 1,028,120 units of electricity were generated, an increase of 150,930 units as compared with the corresponding month last year.

Argentina.—*La Electricidad y la Maquinaria* gives the following particulars regarding electrical undertakings in the Argentine Republic. At Concordia the establishment of an electric installation has been facilitated by the enthusiastic public response to a call for capital, as much as 200,000 pesos having been subscribed in a short time. At Quemu-Quemu, in the department of Parana, a beginning has been made with the construction of the projected electric light station, and at Arequito, in the same department, the inauguration of the new electricity installation will shortly be performed. At San Pedro much dissatisfaction prevails anent the price exacted by the local electric company, so much so that the municipality has applied for a concession with a view to the erection of an opposition installation. At Madariaga also, public dissatisfaction exists on account of the deficiencies of the electric lighting service. At Pigüé (Mendoza department) the equipment of the projected electric station has been delivered, the motors having been supplied by the local agents of the Gasmotorenfabrik Deutz. At Lincoln, in the same department, the electric station which had proved a failure as a municipal undertaking, has been taken over by the Gasmotorenfabrik Deutz, under a concession for 20 years. At La Rioja the electricity installation will shortly be inaugurated, and at La Plata all the arc lamps in use have been displaced by Phillips half-watt lamps, to the number of 6,200, to the great satisfaction of the general public.

Accrington.—Showroom.—The deputy engineer is to present a report next spring upon the advisability of continuing the electrical showroom, which, pending the report, will be kept open.

Australia.—Electric Lighting Scheme.—The Wollongong (N.S.W.) Council has adopted the report of the Committee that the cost of preparing specifications for electric lighting be obtained from the consulting engineer, and that tenders be invited for the installation, on terms of payment in 10 yearly instalments.

The Heidelberg (Victoria) Council has approved of the plans, specifications and estimates for the proposed permanent works and undertaking in connection with the electric light extension, at a cost of £4,000.

The Perth (W.A.) City Council electricity department is making arrangements with the electrical contractors for the supply, and, where advisable, the fixing of new A.C. motors and equipment for elevators, to replace the present D.C. appliances.

Electric Pumping.—The engineer-in-chief of the Sydney (N.S.W.) Water and Sewerage Board has recommended that new electric pumps and motors be installed at Marrickville pumping station, at a cost of £3,850, to deal with flood waters, as the engines formerly in use are not now available; also, that electric power be obtained from the City Council, at 1½d. per unit.—*Tenders.*

The Western Australian Legislative Assembly has passed the second reading of the Bill empowering the Government to override the Fremantle municipality's powers and supply electricity in its territory. Fremantle has spent £150,000 on electric tramway and lighting plant, and claims that it would be involved in a loss of £25,000 if the State competition was authorised.

It is stated that the Government offered to supply current at a cheaper rate than Fremantle could produce it at.

The Queenscliff (Vic) B.C. has decided to borrow £4 500 for an electric light and power plant.

The first annual report of the Nundwading (Vic.) Shire Council electricity undertaking shows total receipts amounting to £1,405, and expenditure of £1,349, leaving a credit balance of £56. The total installation costs amounted to £9,083; 482 private consumers have been connected, although it was estimated that there would only be 150 consumers at the end of the first year.—*Melbourne Age.*

The installation of the Coonamble (N.S.W.) municipal E.L. scheme has been commenced; the plant will consist of a 100-H.P. suction gas engine and generator, with three-wire distribution. A Tudor battery will give a 24-hours' stand-by. The total length of cable to be laid is about 31 miles; street lighting will be provided by 60 lights, ranging from 100 to 200 C.P. in the outskirts and to 1,000 C.P. in the main thoroughfares. The total cost is estimated at £6 000.

Barking.—Loan Sanction.—The U.D.C. has received sanction to loans amounting to £13,654 for extension of the electricity works. As the L.G.B. cannot sanction a loan for buildings until revised estimates based on tenders are submitted, the surveyor has been instructed to prepare plans and specifications, and invite tenders.

Barnet.—Infirmary Lighting.—At the meeting of the Guardians last week as to the electric lighting for the infirmary, it was stated that a saving of £800 might be effected by putting off the execution of works that had been contemplated, and this was agreed to.

Bedford.—Annual Report.—The accounts of the Corporation electricity undertaking, for the year ended March 31st last, show that the total expenditure (including war allowance and bonus, £163) was £14,851; the total income was £28,076, and the gross profit carried to net revenue account was £13,225. After the payment of £6,915 for loan charges, there was a net profit of £3,610, of which £1,610 has been transferred to the reserve fund, and £2,000 to the general district fund for the relief of rates. During the year 3,831,340 units were generated. Of these, 276 794 units were sold for public lighting, 247,416 units for pumping, 670,016 units for private lighting, and 1,871,456 units for power, making the total number of units sold 3,065,682; the maximum load was 800 KW.

Belfast.—Home Office Inquiry.—The Tramways and Electricity Committee has applied to the Home Office to hold an inquiry into the circumstances connected with the recent fire at the power station and the accident to one of the turbo-alternators.

Birkenhead.—Price Increase.—The Electricity Committee has recommended the T.C. to increase the price of current to ordinary consumers for lighting and power by 2½ per cent.; and to prepayment meter consumers outside the borough by ½d. per unit.

Broadstairs.—Price Increase.—The U.D.C. has been informed by the Isle of Thanet Tramways Co. that, from October 1st, the price of electricity will be increased by 10 per cent., owing to the serious increase in the cost of materials. The directors are to consider whether the increase shall apply to current consumed by the Council as well as to private consumers.

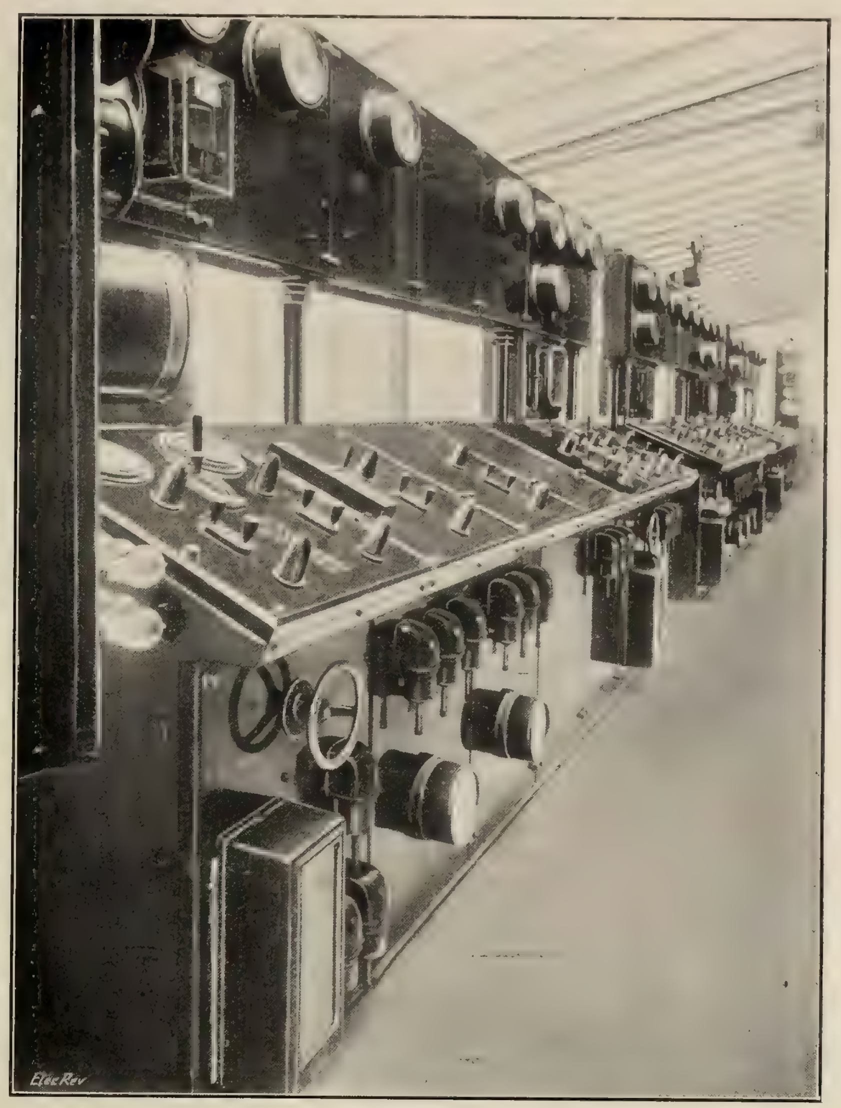
Callan (Co. Kilkenny).—Proposed Workhouse Lighting.—A proposal to install electric lighting in the workhouse has been postponed pending a conference as to the proposed amalgamation of the Union administrative area with neighbouring areas.

(*Continued on page* 467.)

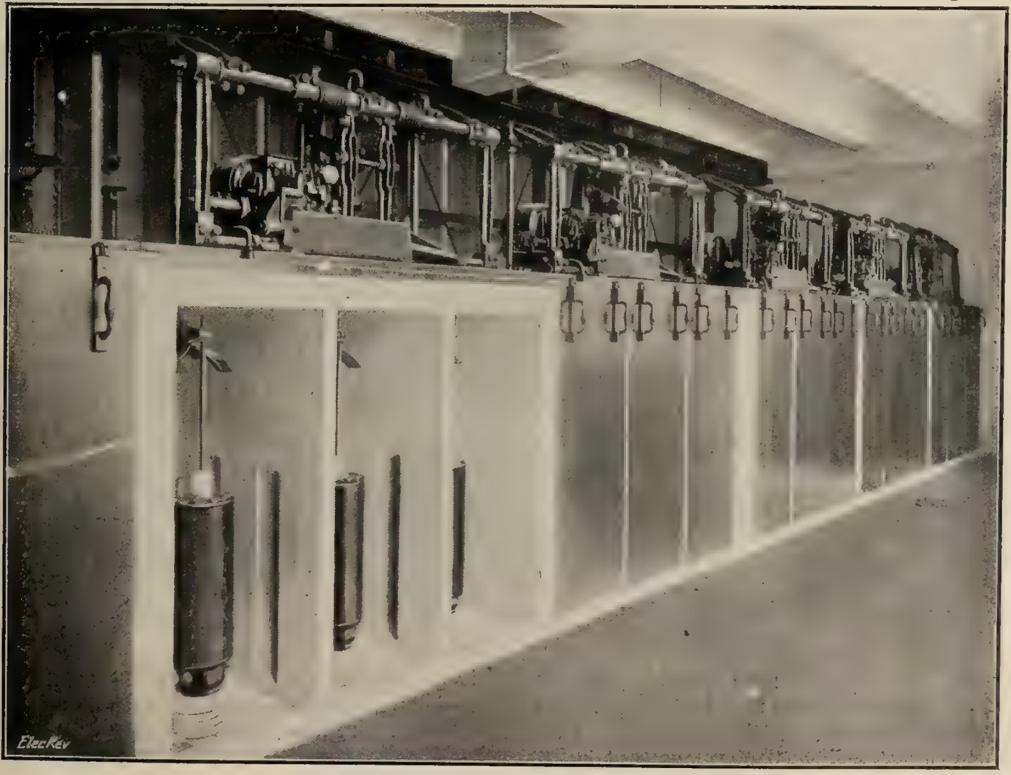
LONDON AND SOUTH-WESTERN RAILWAY ELECTRIFICATION.

(*Continued from page* 432.)

The switchgear is installed in a separate bay, which runs the whole length of the turbine house, and includes accommodation for the engineering staff, offices, stores, &c., at the permanent end of the building. This bay is 21 ft. 6 in. wide, and the switchgear is arranged on three floors. The high-pressure gear is of the remote control type, and is divided into three groups; a view is given herewith of the control board, which is situated on a gallery overlooking the turbine room. The group bus-bars are connected to the main or interconnecting bus-bars through oil-switches, fitted with an automatic maximum release, with a time element. The cable boxes and transformers are on the turbine-house floor level, the oil switches and operating mechanism on the first floor (on which is also the control room), and the bus-bars on the second or top floor. The auxiliary switchboard for the 220-volt D.C. supply is situated in the switch-room adjacent to the main control board, and the feeder panels are illustrated on p. 464, the generator panels being at the right-hand end. The high-pressure oil-switches are enclosed in fire-proof compartments, as shown in the view below, and with the rest of the switchgear were made by the British Thomson-Houston Co., Ltd., of Rugby. In these switches the main current-carrying contacts are outside the oil-tank, only the final break being taken in the latter. The isolating switches can be seen in the background of the view, in compartments guarded by metal gratings. The oil-switches shown include generator, feeder and interconnecting switches. Lightning arresters and earthing resistances are provided on the lower floor.



Control Benchboard.



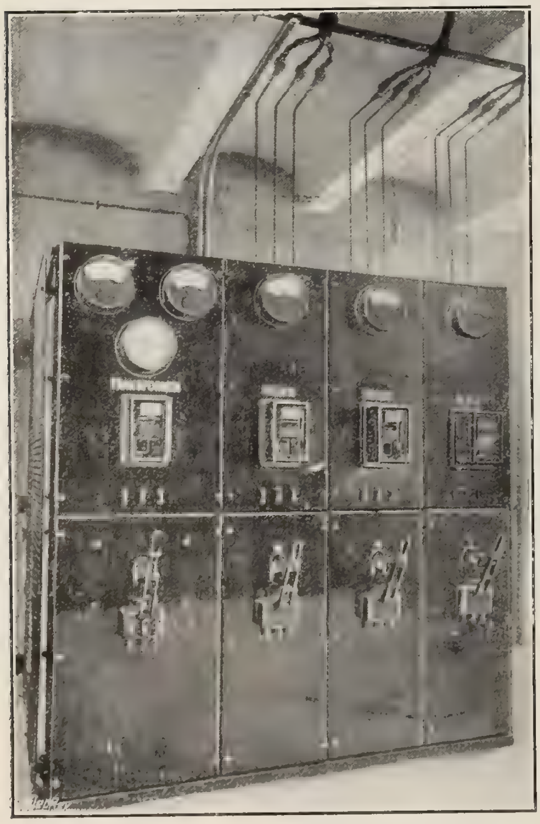
High-Pressure Oil Switches.

Current at 11,000 volts is distributed from the power house to the sub-stations by means of three-phase paper-insulated, lead-cased and heavily wire-armoured cables, manufactured and laid by Messrs. Siemens Bros. & Co., Ltd. The cables are generally run above ground, being hung on cast-iron brackets bolted to creosoted wood posts 5 ft. 6 in. apart. Where the cables cross the running lines at level crossings and other special points, they are laid underground in Howard asphalt troughing.

The fact that the feeders are supported on posts by the side of the track called for special provision to be made to prevent any trouble due to expansion and contraction; change of temperature might cause in this way considerable strain on the joints. The type of joint adopted to meet this was a modification of Messrs. Siemens's standard practice for mining cables, which combines efficient bonding of the wires with mechanical strength and protects the joint from strain.

Direct-current Feeder Switchgear.

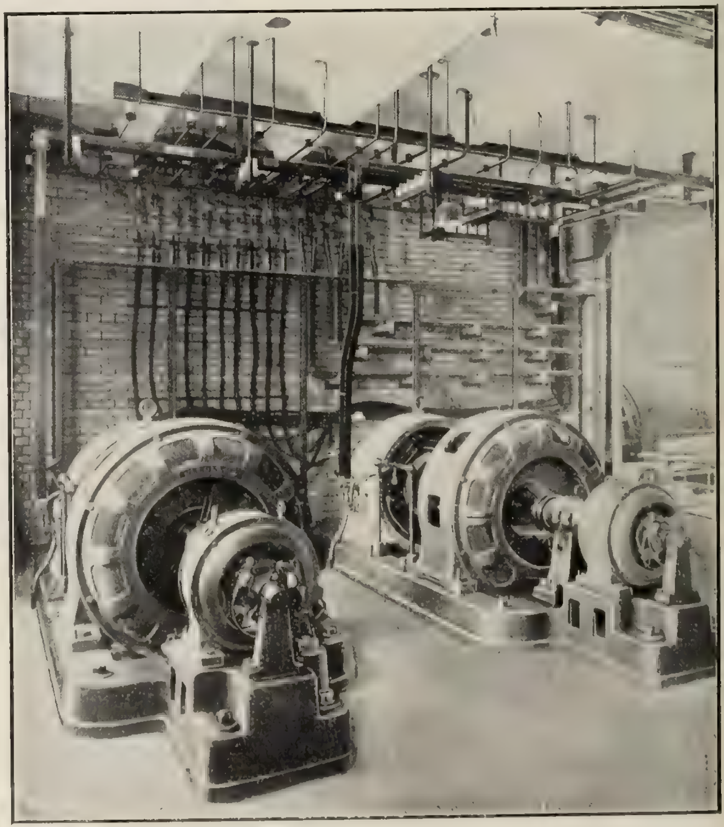
The three cores are connected by extra long copper sleeves, and the joint proper is enclosed in a lead sleeve wiped on to the lead of the cable in the usual manner. This sleeve is protected by a pressed steel cover, made in halves and bolted together. The armour wires are held at each end of the cover by a pair of heavy cast-iron clamps, which are bolted together by two long bolts, the latter being tightened up until all strain is taken off the joint. An additional bonding of the sheathing is effected by tinned brass plates, placed between the cast-iron clamps, and connected by a tinned copper strap.



Transformer and Feeder Panels.

The cables are designed for a working pressure of 11,000 volts, and were tested at the works with a pressure of 25,000 volts for half an hour, and on site after laying and jointing with 20,000 volts for half an hour. Finally, each cable is required to be switched on and off 10 times under any working condition. Altogether upwards of 80 miles of three-phase cables of various section have been supplied by Siemens Bros. & Co., Ltd., the sizes being 0·2, 0·15, 0·1 and 0·06 sq. in.

The sub-stations, passenger stations, goods yards, and sidings between Waterloo and Clapham Junction, and on the "Kingston Roundabout" line, will take their lighting supply through a separate cable, which will also serve for supplying power in connection with the track circuit signalling arrangements. Single-phase alternating current at a pressure of 3,300 volts is supplied through this cable to transformers placed in small brick chambers built at intervals along the route, the pressure being transformed down to 220 volts. The 3,300-volt supply is obtained from frequency-changer sets situated at the power house and at Waterloo, Clapham Junction, Raynes Park and Twickenham. To ensure an absolutely reliable supply, three motor-generator sets are also provided. Those at the power house are driven by 220-volt d.c. motors, supplied from the auxiliary plant and storage battery, and are illustrated herewith. The third set is at Waterloo sub-station, and is supplied from a 600-volt battery.



Motor-Generators for Signalling and Lighting.

(*To be continued.*)

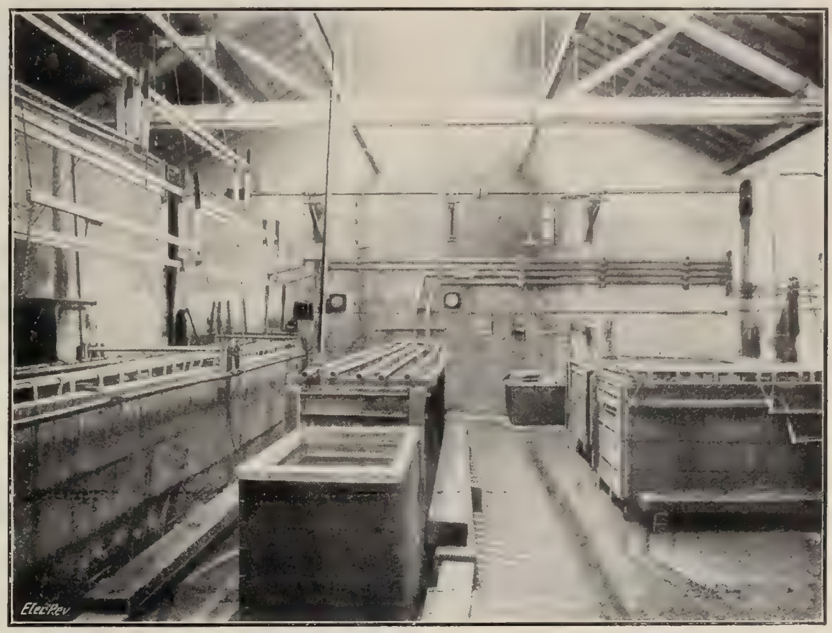
THE WORKS OF ELECTRO-GALVANIZERS, LTD.

For many years the only commercially successful method of applying a rustless protective coating of zinc to iron and steel work was the old dipping process, *i.e.*, hot galvanising. This process has many limitations as compared with modern electrolytic methods of producing the zinc coating, not the least being due to its high temperature, but this difficulty is avoided by the "cold" electrolytic processes. Moreover, electrolytic zinc, properly applied, is denser, tougher, more uniform and more resistant against corrosion.

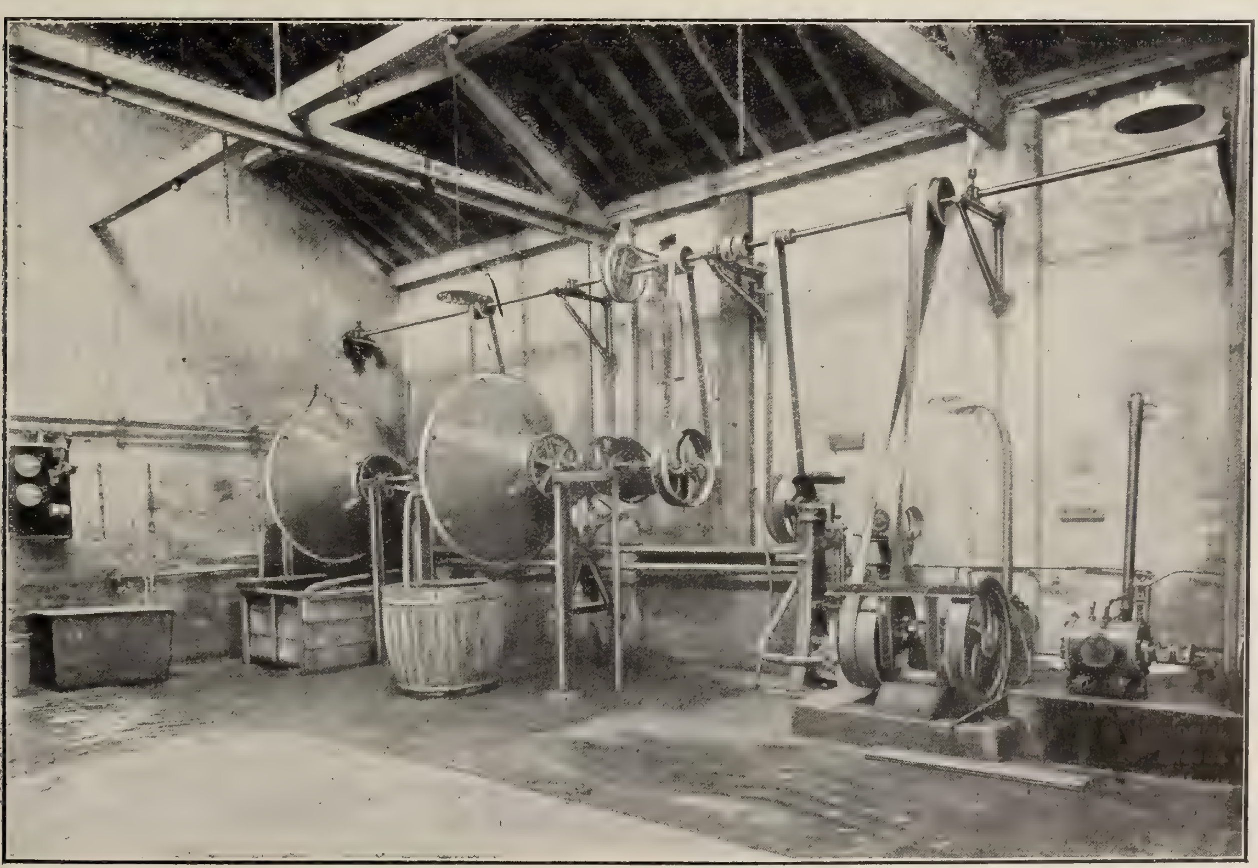
One of the most advanced methods of electro-deposition is that worked by Electro-Galvanizers, Ltd., of Stratford, E., whose works and methods are briefly described in this article.

The preliminary processes—usual in work of this description—are designed to thoroughly clean the surfaces on which deposition is to take place, and consist of pickling in hydrochloric or sulphuric acid, and subsequently sand-blasting the surfaces with silver sand, for which purpose a compressed-air plant and sand apparatus is provided.

The smaller articles are then passed to rotary vats or rumblers, and the larger ones to ordinary stationary vats for the depositing process. The process used by Electro-Galvanizers, Ltd., represents a marked advance on ordinary electrolytic deposition processes, both in time and cost; owing to the special salts used in the bath, the latter is rendered regenerative, the anode being dissolved *pro rata* with the amount of metal deposited from the salts in the bath, a feature which cheapens the cost, as it is less costly to renew the anode than the salts. When there is no current passing the bath is inactive, and there is no dissolution of the anode.



Depositing Shop, Electro-Galvanizers, Ltd.

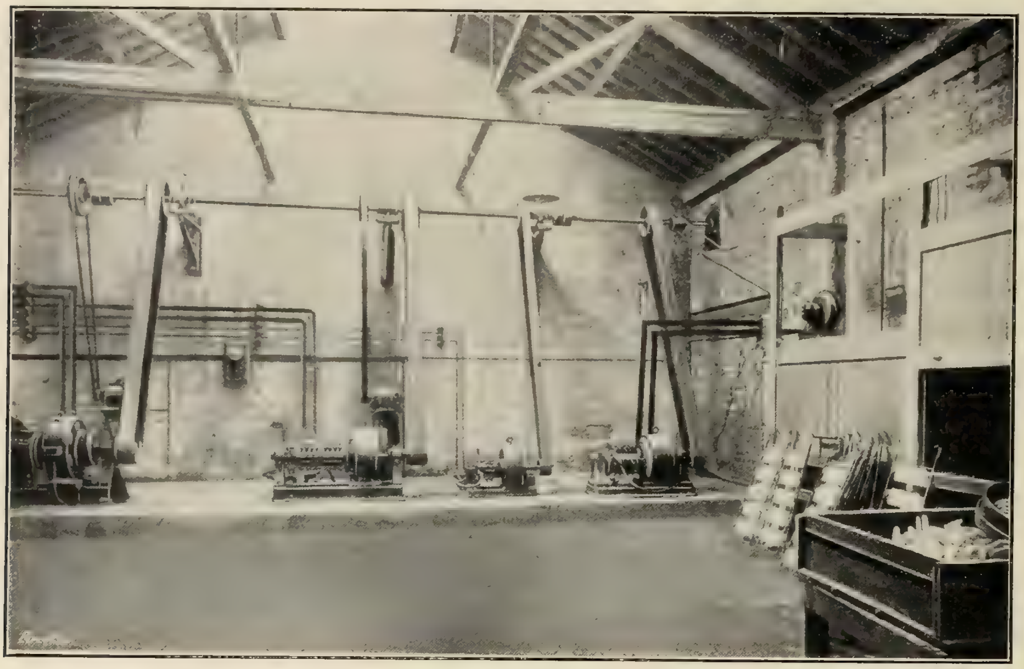


Rotary Depositing Vats at the Works of Electro-Galvanizers, Ltd.

Again, due to the low resistance of the bath and low voltage employed, no electrolysis of water occurs, and no hydrogen is generated on the cathode, on which the metallic deposit is made, and obviously that perfect uniformity of surface, which is the aim of all depositing processes, whether protective or decorative, can be more certainly ensured. By this process it is possible to pass 500 amperes per square yard of surface, while by ordinary processes 100 amperes is a maximum, so that the process attains practically the theoretically possible 1·2119 grm. of zinc per ampere-hour deposit.

A particularly interesting feature of the works is the shop given up to wire and strip galvanising, the strip being used chiefly for sheet-metal stampings, for which it is completely successful owing to the ductility and tenacity of the deposit.

This is a continuous process, the strip or wire being unwound from iron drums, and drawn, at a speed of 2 or 3 ft. per min., through a potash bath, to dissolve any oil or grease; then through a water bath to wash off the potash, and through an acid bath for pickling, from which it passes to a cleaning roller and to a final water bath for cleaning off the acid. The strip or wire then passes into the zincing bath, being drawn between two horizontal anodes; owing to the high rate of deposition, only some three minutes is taken in passing through this bath, and the strip or wire is then passed through a water bath, and finally wound on to "finished" drums.



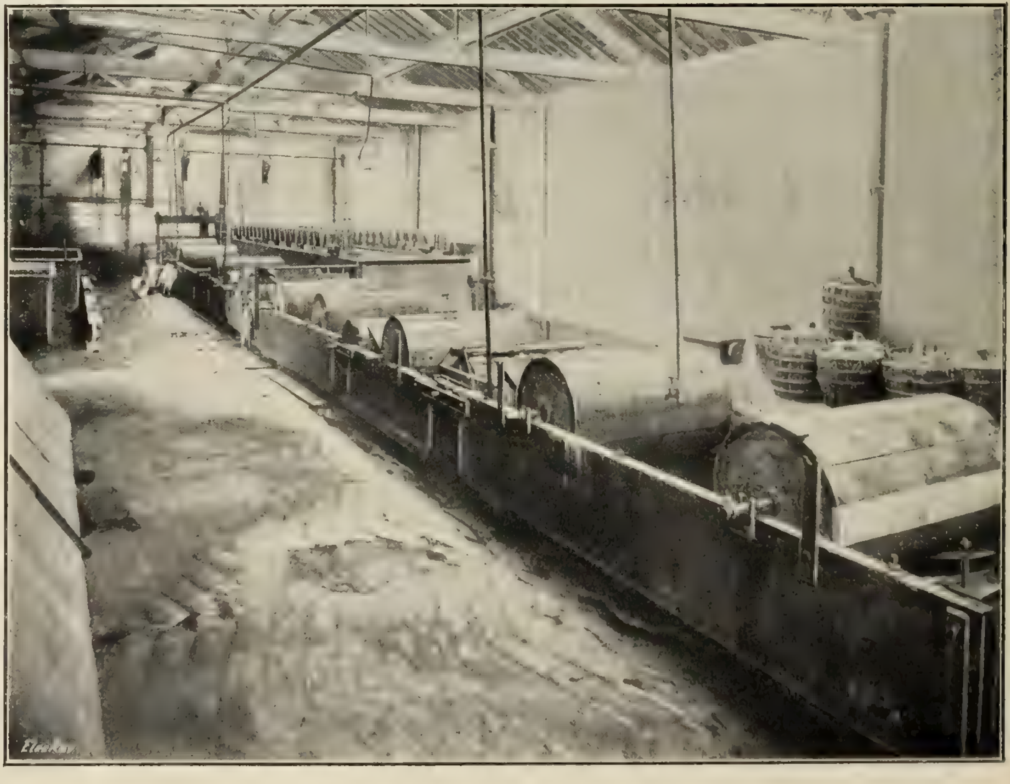
Low-voltage Dynamos, at the Works of Electro-Galvanizers, Ltd.

A special bath is used for large work, and we understand that the firm are prepared to put down special baths if necessary to meet exceptional requirements, and can undertake work up to 20 ft. long.

Five low-voltage generators are employed in the works, driven by motors supplied from the West Ham Corporation's mains; the machines total 67·5 kw., the working voltage being usually 6 volts.

Owing to the very fine surface of deposited metal which can be obtained and the fact that the latter is molecularly combined with the base on which it is deposited, this process of galvanising has already attracted considerable attention for high-grade work—which, in fact, cannot be satisfactorily done by other means.

In particular, mention may be made of the value of this process for screws, bolts, nuts, pipe unions, &c., where it is important that the gauge of the threads shall be unaltered by the deposit, as happens in ordinary galvanising, when, frequently, subsequent use of stocks and dies removes the zinc coating.



Wire and Strip Galvanising Shop.

Owing to its being a cold process, the temper of steel springs is unaffected, and, owing to the fine deposit obtainable, electrical resistance grids can be galvanised without altering their electrical properties.

Although the bulk of the work undertaken at the moment is the deposition of zinc, the firm's patents cover a variety of processes for deposition on all metals, porcelain, wood, &c., in zinc, lead, tin, copper, nickel, silver, aluminium, and various alloys; indeed, we understand that they intend to develop at an early date their patent processes for the nickel plating of zinc, an industry which has in the past been practically in German hands.

Another direction in which one may anticipate extensive developments when industrial conditions again become normal, is in the electroplating of china and glass.

Until recently the provision of a metallic surface on such substances by electrolytic methods has only been possible by establishing conduction through the coating of the surface of the glass or china with graphite or plumbago in a solution of varnish, rubber, &c., in which case, of course, the metal is not in direct contact.

By the firm's processes it is possible to deposit metal direct on the glass, &c., the deposit being an integral part of the base and inseparable from it, which has obvious advantages. The process has also been applied successfully to the deposition of silver-nickel alloy, which combines the whiteness of silver with the durability and non-tarnishable qualities of nickel. Many beautiful examples of this work were exhibited by the company at the recent Board of Trade Exhibition, and we had the opportunity of viewing them at their offices and showrooms, at 16, Green Street, Trafalgar Square, W.C. Our various views give some indication of the operations of the firm at Stratford.

LIGHTING and POWER NOTES.

(Continued from page 462.)

Castletown Berehaven.—The District Council has accepted the tender of Mr. P. H. Nugent, Bantry, for the lighting of Castletown Berehaven by electricity, at £70 per annum, the works to be maintained for 15 years. The initial cost will be about £1,500, and the number of lights will be 14 of 100 C.P. and four of 32 C.P. each.

Continental.—Switzerland.—Statistics published in the *Bulletin Technique de la Suisse Romande* relating to the hydraulic power utilised in that country show that at the end of 1913 there were seven installations of more than 10,000 H.P., having a total mean output of 127,500 H.P.; nine of 5,000 to 10,000 H.P., aggregating 86,840 H.P.; 41 of 1,000 to 5,000 H.P., aggregating 139,020 H.P.; and 214 of 100 to 1,000 H.P., aggregating 90,507 H.P.; as well as no fewer than 6,528 installations of less than 100 H.P. The total average power utilised is given as 518,433 H.P.

Coniston (Lancs.).—E.L. Scheme. — The building of a generating station by the Coniston Electric Supply Co. has commenced, and poles for the overhead lines are being erected.

Darwen.—Loan Application. —The Corporation has decided to apply to the L.G.B. for sanction to the borrowing of £3,000 for mains extensions and services.

Derby.—Loan Application.—The Electric Lighting Committee of the T.C. has recommended application for sanction to a loan of £3,000 for mains and motors required exclusively for Government purposes; the provision of a cable at a cost of £300 for the supply of current to Messrs. Eastwood, Swingler & Co., and the construction of an overhead line to supply current to the London Road branch library.

Ellon.—E.L. Scheme.—The formal inauguration of the electric supply took place on Saturday. Provost Ruxton presided, and said they were under a deep debt of gratitude to Mr. Duncan, of Tillycorthie, for installing the electric light.

Erith.—Loan Sanction.—The U.D.C. has received L.G.B. sanction to a loan of £15,690 for plant at the electricity works (repayable in 16 years), and of £2,400 for buildings (repayable in 30 years).

Faversham.—Price Increase.—The T.C. has increased the price of electricity as from November 1st by ½d. per unit.

Glasgow.—Last week the members of the Corporation inspected the works in progress at Dalmarnock in connection with the new power station. The inspection was mainly confined to the arrangements for the intake of water from the Clyde to the screening house. Six screens have been constructed, each capable of passing 50,000 gallons of water per minute. The foundations of the turbine room and boiler house were also inspected. Owing to the war, difficulty in obtaining workmen had to some extent arrested the progress of the work, but sufficient advance had been made to indicate the vast proportions of the undertaking and of the intricate nature of the operations involved. It is proposed to complete the undertaking in two sections; the portion now under construction was contracted for prior to the war, the cost including £50,000 for excavations and £25,000 for coal-handling plant. It is not intended to place the contract for the building or issue specifications for the first instalment of the machinery until after the war.

The electricity department, with the co-operation of the local electrical contractors, has opened showrooms opposite the Royal Glasgow Institute of Fine Arts in Sauchiehall Street, for the display of electric cooking, heating and domestic appliances; daily demonstrations of cooking by electricity will be given.

Halifax.—Loan Application.—The L.G.B. is to be asked to sanction the borrowing of £2,000 for expenditure on new electricity mains to factories engaged on Government contracts.

The Halifax Y.M.C.A. (Military) is to be supplied by the Corporation with electricity for the hut at Ward's End for a further period of six months at half price.

Heckmondwike.—Bulk Supply.—Owing to the increased cost of coal, &c., there is likely to be a big deficit as a result of the year's working of the Corporation electricity department, and, with a view to reducing this as far as possible, an arrangement has been made by the authorities with the Yorkshire Electric Power Co. for the purchase, during a given period, of two-thirds of the current used by the Council. It is believed that a substantial saving to the electricity department will result.

Houghton-le-Spring.—Overhead Line.—The U.D.C. has consented, subject to adequate guarding, to an overhead electrical transmission line being erected at Rainton Bridge by the Lambton and Hetton Collieries, Ltd.

Ingleton.—Village Lighting.—In connection with the new model village which is springing up around the new colliery at Ingleton, a request has been made to the local Council that the houses—of which there are at present 60, to be increased to over 100 soon after Christmas—should be lighted, and the Council has appointed a deputation to wait upon the local Electric Lighting Co. in regard to the matter.

Ipswich.—Year's Working.—The annual report of Mr. Frank Ayton, chief engineer, on the working of the Council's electricity undertaking shows that this has suffered considerably from the prevailing conditions, due to loss of staff, delay to completion of the extension in the Eastern district, falling off in lighting and power business, and failure to realise the benefit of more efficient working, due to the increased cost of fuel, &c. The year's revenue, £27,886, was rather higher than in the previous year, and the gross profit, £10,601, compared with £10,309 in 1914. The capital charges were on an increased scale, but after meeting the usual charges, a net balance of £342 remained. Actually, however, the department paid £1,199 extra out of revenue on capital items, the net result being a call on the reserve fund of £857. The total units sold were 2,966,968, as against 2,829,086 in 1914, power units—the largest item—totalling 1,514,351, as against 1,392,203. The maximum lighting and power load was 1,400 KW., and traction load 445 KW.; 616 motors of 3,264 H.P. were connected to the mains. The station plant capacity was 3,511 KW., and 5·39 lb. (as against 5·47 in 1914) of fuel were used per unit sold. A further 50 street gas lamps were changed over during the year to electric light, making a total of 236 street lamps lighted electrically.

Keighley.—Year's Working.—The borough electrical engineer's report on the last year's working of the electricity department, showed a net profit of £1,024. The cost of fuel had been £5,180, an increase of £1,020 as compared with 1913-14, the extra expenditure being accounted for by the Yorkshire miners' strike and the increased cost of cartage. The revenue from the undertaking during the year amounted to £18,393, as against £15,741 during the previous 12 months. The works costs totalled £10,380 (£6,739), and standing costs were £6,988 (£1,775). There was a gross profit of £8,013 (£7,277), and a net profit of £1,024 (£1,204). The average price obtained from sale of current was ·82d. per unit.

Llandudno.—A Lighting Prosecution.—Recently the assistant electrical engineer and the deputy chairman of the Council were charged under the Defence of the Realm Act, the former with switching on certain public lamps, visible from the sea, and the latter with procuring the commission of the offence. The evidence showed that the lamps were lighted in response to a request of the Commanding Officer of a battalion which had to march along the dark road to the railway station; and that the deputy chairman telephoned the engineer to light a few lamps. The lamps being in series, it was necessary to light more than those specified. The case was dismissed; the chief constable of the county explained that neither the Council nor military Commanding Officers could order lighting visible from the sea, but only a special military officer appointed for the district.

London.—Hackney.—The accounts of the Council's electricity undertaking for the year ended March 31st last show a total income of £59,003, as against £58,939 in the previous year; and total expenditure of £27,118, as compared with £27,816, leaving a gross profit of £31,885, as compared with £31,122. The gross profit represents 7·1 per cent. upon the mean capital expenditure employed during the year. After meeting loan and bank interest charges amounting to £26,047, there remains a surplus of £5,838, which, compared with £8,124 for the previous year, shows a decrease of £2,286. Of the surplus, £1,460 has been expended on meters, £887 for war allowances, and the balance with £120, the profit from the sales department making £3,611, is available for the relief of rates. The balance is greater by £1,659 than anticipated in the amended estimates, and is largely accounted for by the fact that the final meter readings were recorded later than usual owing to the shortage of staff; in view of this fact and the increased cost of coal, &c., the Electricity Committee considers that £1,500 of the profit should be carried forward to meet contingencies in 1915-16. The reserve fund now stands at £30,680. The average price per unit obtained for private lighting and other domestic uses was 2·85d.; power and factory lighting, 1·01d.; destructor supply, 0·75d.; public lighting, 1·13d.; all purposes, 1·50d. The total generating and distributing cost per unit was ·67d., as against ·70d. in 1914. The total number of motors installed at the end of March, 1915, was 1,270 of 7,868 H.P., an increase of 15 per cent.; the number of units generated during the year was 10,402,380, of which 669,051 units were used for public lighting, 158,615 units for the refuse destructor, 2,371,670 units for private lighting, heating, &c., 5,737,460 for power; the total units sold were 8,936,796. The maximum load was 4,597 KW., and the load factor 22·19 per cent.

Islington.—Workhouse Lighting. — The Guardians have decided to take the current for lighting their institutions from the B.C., instead of manufacturing it themselves. The price quoted by the Council is a flat rate of 2d. per unit, as against the Guardians' claim that they made their own current at under 1½d. per unit. To install the supply from the Council will cost £500, as against £700 for putting the existing battery and plant at the infirmary into order.

St. Marylebone.—Price Increase.—The Electricity Committee of the B.C. recommends that the charges for the supply of electricity to consumers be increased by 10 per cent., to take effect from the date of the readings of the meters for the September quarter.

Northampton.—Price Increase.—The local E.L. and Power Co. announces that from Michaelmas Day the price of energy will be temporarily advanced by 7½ per cent. for power, and by 10 per cent. for lighting and heating.

Manchester.—Barton Scheme.—The Rivers Committee recently appointed a special Sub-Committee to formulate a complete scheme for the provision of cooling water at the new electricity generating station at Barton. The report has now been prepared and approved by the Rivers Committee, and has been presented to the Corporation Finance Committee.

Sanction has been received to the borrowing of £10,750, repayable within 15 years, and £4,730 repayable within 10 years, in connection with the new Barton generating station.

The E.L. Committee has entered into an agreement with the British carbide factory for a supply of electricity to the works.

New Zealand.—The Napier B.C., on the recommendation of its engineer, has decided to increase the plant at the electricity works by the installation of two 400-H.P. producer-gas engines; at the present time the overload sometimes reaches 40 per cent., and there is no stand-by. The new plant is expected to be running by April next.

Preston.—The B. of G. has decided to accept an offer of £500 for one of the electric generators at Fulwood Workhouse.

Rotherham.—Proposed New Plant.—Additional plant to the extent of 5,000 KW. is needed at the Corporation electricity works, and the Government has been asked what assistance can be given if the additional plant, estimated to cost £20,000, is purchased.

Stretford.—Price Increase.—Owing to the increased cost of coal and other materials the charges for electricity are to be increased by 15 per cent. from November 1st.

Wimbledon.—Proposed Loan.—The Electricity Committee has recommended the B.C. to apply to the L.G.B. for sanction to borrowing £5,020, to meet excess expenditure and to provide for the estimated expenditure on mains, house services, meters, and transformer sub-station, during the period ending March 31st, 1916.

The Committee also recommends that notice be given to consumers of electrical energy who are supplied at special contract rates, of the Council's intention to terminate the existing arrangements as to the supply.

Worthing.—Price Increase.—The Electricity Committee of the T.C. has decided, owing to the situation caused by decreased consumption due to restricted lighting, to increase the charges for current by 10 per cent., making a charge of 5½d. per unit for private houses, shops, &c. This will, it is estimated, produce £500 additional revenue.

Yarmouth.—Price Increase.—The T.C. has increased the price of current for lighting from 5d. to 5½d. per unit, and has decided that all current supplied for power will be strictly net.

TRAMWAY and RAILWAY NOTES.

Accrington.—The Tramways Committee has considered an application from the tramway employés for an increase of wages, and has recommended an increase of ¼d. per hour, commencing with the first week in October. A similar application from the electricity department has been referred to a Sub-Committee.

The Rawtenstall Corporation has informed the Council of its willingness to continue the existing through-running arrangements for a further period of 12 months. The agreement is to be continued.

Argentina.—Difficulties have arisen in connection with the 50 years' municipal concession to the Compania Italo-Argentina de Electricidad for the installation of electric tramways in the city of Dolores. In the first place, the Municipality not having power to make a concession for a longer period than 20 years, sought confirmation for the longer term from the Legislative Council at Buenos Ayres. In the course of the consideration of the petition, it transpired that the company was pledged to make a refund of 2 per cent. of the receipts at the end of 20 years for the electric tramways alone, whereas the concession also included the right to supply power and light in Dolores. This, the Legislative Council held, argued lack of business perception on the part of the Municipality, and in the upshot the concession was relegated to the Commission of Public Works for investigation and report.

Australia.—According to the *Melbourne Age*, the Greater Melbourne Council Bill which has passed the second reading, is not to be proceeded with at present owing to the diversity of opinion amongst members of the Legislative Assembly as to whether the tramways should be under municipal management or be nationalised. It is proposed to provide for the carrying on of the present tramway systems after the expiry of the company's lease on July 1st, 1916, and a temporary Tramways Bill is to be introduced appointing a Government Tramways Trust to expire on October 31st, 1917, or at such earlier date as Parliament should determine.

The estimated cost of the White Bay power house when fully equipped with machinery is £1,360,000; the sum already expended amounts to £475,386.

Bradford.—Year's Working.—The annual accounts of the Corporation tramways, the financial results of which have been previously referred to in these columns, show that the route mileage open was 59 miles of tramways and 9½ miles of trailless traction. The car-mileage for the year was 6,371,710, being an increase on the previous year, as also were the passengers carried and total receipts, 70,077,271 and £329.888 respectively. The ratio of expenses to receipts increased from 73·138 to 74·6 per cent., but the net profit reached £32,442, as against £29,447 in 1914. During the year the Bingley extension was opened for traffic; the Baildon extension is being held up till after the war. The report refers to the trailless traction routes, pointing out that these act as feeders to the tramways, and that tramways could not have been adopted because of the heavy capital expense. The average working expenses per car-mile were 6·557d., as compared with 7·286d. in 1914; the traffic revenue was 5·83d., as compared with 7·281d.; about 178,000 miles were run during the year, the average fare charged being ·65d. per mile. Plans have been submitted and approved for a central tramway terminus in Forster Square, with an island platform and shelter. The report refers to the new power brake which has been fitted to 75 cars, and points out that the average cost of drivers' accidents on all cars over a period of four years amounts to £3 11s. per car per annum, while the cost in the case of cars fitted with the new brake is 3s. per car per annum; there is no reason to think that maintenance cost will be seriously in excess of the mechanical brake which has been displaced. The increased life of steel tires is about 85 per cent. The department owns 252 tramway and 20 trailless traction cars, as well as 31 other vehicles. We note that in the building of new, and reconstruction of old track, ferro-concrete foundations have been largely used.

Bolton.—At the quarterly meeting of the Bolton branch of the Tramway and Vehicle Workers' Association, held on Sunday, it was decided to send a circular to each non-Unionist, asking him to join before November 7th, and that a general meeting be held on that date to consider what action to take with regard to the men who refused to join.

Halifax.—Year's Working.—During the year ended March 31st last, the Corporation Tramways carried, roughly, 20¾ million passengers, as against 20¼ millions the year before. The total revenue was £113,170, and the gross profit £39,666, as against £36,377 in 1913-14. After deducting financial charges, &c., the net profit for the year was £16,211, an improvement on the previous year's figure of £13,643. The parcels receipts were £2,164, as against £2,147 and 225,443 parcels were carried. The route mileage worked by the Corporation is about 38 miles, 24 being inside and 14 outside the borough. The rolling stock now comprises 101 cars, which includes 3 motor-'buses. The working costs per c.m. for the tramways were 7·57d., while the total revenue per c.m. was 11·66d. The motor-'bus accounts show working costs amounting to over 8d. per mile run, exclusive of interest and sinking fund charges, the 'buses having been purchased out of tramway profits.

The Tramways Committee has decided to ask for an extension of time for the construction of the tramways authorised by the Halifax Corporation Act, 1911.

The Committee has decided not to take any action at present with regard to fixing collapsible gates on all the cars at an estimated cost of £300.

Ipswich.—Year's Working.—The accounts of the Corporation tramway department for the year ended March 31st last show that 5,610,332 passengers were carried, as compared with 5,715,035 in the previous year, the car-mileage being considerably reduced. The total revenue was £23,288, and the gross profit £3,999, an improvement on the £3,937 of 1913-14. After meeting capital charges there was a net deficit of £2,105 on the year, as against £1,828 in the previous year. During the year the percentage of working expenses to receipts fell from 83·47 to 82·83 per cent., and the average traffic revenue per car-mile increased from 8·32d. to 8·52d. The manager, Mr. Ayton, suggests that the Council should consider the doubling of the track from the centre of the town to the Eastern termini, in the future, instead of undertaking this work on small sections.

Keighley.—Annual Report.—The borough electrical engineer's report upon the working of the Corporation tramways for the 12 months ended March 31st, shows that the revenue was £9,253, as compared with £9,380 during 1913-14. Working expenses accounted for £6,744 (£6,105), and other charges brought the expenditure during the year to £112 in excess of the amount of the revenue. The number of passengers carried showed a decrease of 54,202 at 3,552,016, though the number of car-miles run had increased from 241,917 to 247,791. Twenty-four of the department's employés had enlisted, but up to the present it had not been found necessary to employ female labour on the cars. In regard to the trailless trolley system, the past 12 months had been satisfactory, the total revenue being £1,754, whilst the total mileage run was 37,775, and the number of passengers carried 225,617. During the present year the motor-omnibus undertaking had been wound up, figures relating to this concern for the year ending March 31st being:—Revenue, £1,939; working expenses, £2,678; miles run, 40,823; passengers carried, 222,881. The engineer points out the necessity of building up a substantial reserve fund—this standing at 2s. 6½d. at present—and suggests that consideration be given to the advisability of increasing the fares in the near future.

Rawtenstall.—Female Labour.—A number of women conductors commenced duty on the Crawshaw Booth section of the Corporation tramways last week-end.

TELEGRAPH and TELEPHONE NOTES.

A Telegraphic Blockade.—On Friday last the Postmaster-General announced that telegrams for all neutral countries in Europe, for Russia *via* Great Northern lines, and for Serbia, would be subject to 48 hours' delay until further notice. Telegraphic communication between Switzerland and Italy was interrupted, and private telegrams between France and neutral countries were subjected to 48 hours' delay. The notice was withdrawn on Monday.

Telegraphist's Cramp.—In the City of London Court a telegraphist named Lawbuary, living at South Norwood, was awarded £400 as compensation for incurring telegraphist's cramp while in the service of the Postmaster-General. He is also in receipt of a pension of £52 a year, and has received £153 as an additional allowance under the Superannuation Act.—*Times.*

The Telephone Service.—For trunk messages to the Isle of Wight and Ireland respectively, extra charges of 4d. and 2s. are now levied.

Wireless Telephony.—It is reported from Washington, U.S.A., that the Navy Department has successfully experimented with wireless telephony from Arlington, Virginia, to Mare Island, California, a distance of 2,500 miles. Conversation was plainly heard. Successful experiments were also made in telephonic conversation over the regular wire from New York to Arlington, where the conversation was automatically transferred to the wireless apparatus and transmitted to Mare Island instantaneously.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—December 6th. Municipal Council. 33,000-volt outdoor transformers and switchgear. Specifications (10s. 6d.) from Electric Light Department, Town Hall.

November 4th. Deputy P.M.G. 100 miles of two-twisted and 75 miles of three-twisted, rubber-insulated, tinned copper wire. Specification No. 463, N.S.W.*

January 12th, 1916. N.S.W. Railway and Tramway Department. Two water-tube boilers, each 8,000 sq. ft. heating surface, complete with economisers, superheaters and chimney stack, for the Zara Street power house, Newcastle. Particulars, Electrical Engineer's Office, 61, Hunter Street, Sydney.—Specification (No. 468), 20s. each.—*Tenders.*

January 31st, 1916. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

Melbourne.—December 14th. Deputy P.M.G. Eleven sections of a lamp-signalling trunk-line switchboard, and other material necessary for increasing the equipment of Melbourne trunk exchange from 108 to 240 lines. Schedule 1,207.*

Victoria.—December 14th. P.M.G. For delivery in all States, 18 670 common-battery wall pattern telephones, manufactured in Australia. Sched. No. 1 264.

Victorian Railways.—January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

Brisbane.—November 17th. P.M.G.'s Department. Switchboard parts, schedule 343; telegraph instruments, schedule No. 345.

Perth.—December 8th. 294 accumulators, and power board complete, for P.M.G.'s Dept. See "Official Notices" to-day.

Birkenhead.—October 14th. Electrical sundries, and metallic and carbon filament lamps and fittings, for the Mersey Railway Co. Mr. J. Shaw, General Manager and Secretary, Central Station.

Bootle.—October 13th. Slack coal for the Corporation electric light stations, for six months from January 1st. Forms from the Electricity Offices, Pine Grove.

Darlington.—October 22nd. Corporation. 3,000-KW. turbo-alternator; surface condensing plant. See "Official Notices" to-day.

Greystones (Co. Wicklow).—One 60-B.H.P. gas engine, alternator, switchboard panel for Greystones Electric Light and Power Co. See "Official Notices" October 1st.

Littleborough.—October 22nd. U.D.C. H.T. cables, road-work, &c., transformers and switchgear for sub-station. See "Official Notices" October 1st.

London.—October 15th. Asylum and Mental Deficiency Committee of the L.C.C. Supply of electric lamps and electrical sundries. Forms of tender from Mr. R. F. Keene, Clerk, 6, Waterloo Place, Pall Mall, S.W.

Hammersmith.—October 14th. Air-cooled transformers, for the Borough Electricity Dept. See "Official Notices" to-day.

New Zealand.—Dunedin.—November 3rd. City Council. Insulated and bare copper wire for a period of two years.*

November 3rd. City Council. One 3,000-volt regulator.*

Spain.—October 17th. Municipal authorities of Fontiveros (Province of Avila). Concession for the electric lighting of the town during a period of 10 years.

Tenders have just been invited by the municipal authorities of Cullera (Province of Valencia) for the concession for the electric lighting of the town during a period of ten years.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The following contracts have been accepted:

P.M.G.'s Department, Adelaide.

Ten tons of H.D. copper wire, 200 lb. per ton, £1,155; five tons do., 100 lb. per ton, £577 10s.—R. Johnson, Clapham & Morris, Ltd.

P.M.G.'s Department, Hobart.

Five miles twisted pair O.S. distributing wire, No. 18 L.W.G., £17 12s. 9d. per mile; five miles do., No. 16, £25 9s. per mile; three miles twisted pair O.S. distributing copper-clad steel wire, £16 per mile.—Western Electric Co. (Australia), Ltd.

Five miles twisted pair tinned copper V.I.R. wire, £19 1s. per mile; five miles tinned copper wire, V.I.R. insulated, £11 14s. per mile.—British General Electric Co., Ltd.

Three miles paper-insulated lead-covered cable; 12½ lb. conductors, £130 per mile.—Callenders' Cable and Construction Co., Ltd.

Three miles do. do., 26 pairs, £215 per mile.—Western Electric Co. (Aust.), Ltd.

Five tons copper wire, 100 lb. per mile, £116 per ton; two tons bronze wire, 70 lb. per mile, £142 per ton; five tons, do., 40 lb. per mile, £142 per ton.—F. S. Lee.

Victoria Railways.

Electro-mechanical interlocking apparatus and spare parts at rates.—R. W. Cameron & Co.

N.S.W. Metropolitan Board of Water Supply and Sewerage.

Electric meters for low-level pumping stations.—Australian General Electric Co., Ltd.

West Australia Government Tender Board.

Metal-filament lamps (schedule 97A, item 1).—30 and 60 watt, 1s. 11d.; 100 watt, 2s.; 200 watt, 4s. 6d. Electric desk fans for Public Works Dept., £1,295.—C. Atkins & Co. —*Australian Mining Standard.*

Sydney City Council.

D.C. meters (Ferranti); single-phase A.C. meters (Ferranti).—Noyes Bros.

Maximum demand indicators (Reason Mfg. Co.)—W. G. Watson & Co.

5,000-volt panels for sub-station, No. 2, Lang Park.—Australian General Electric Co., £291.

Five 5,000/415-volt 100 K.V.A. transformers with switchgear, £1,014; three 10,000/415-volt 100-K.V.A. do., £716.—Australian General Electric Co.

Ten 5,000/415-volt 50 K.V.A. transformers, with switchgear, £980; four 10,000/415-volt 50-K.V.A. ditto, £392.—N. Guthridge, Ltd.

24 three-pole outdoor pole-type switches, £717.—Aust. General Electric Co.

Ten 5,000/415-volt 100-K.V.A. indoor-type transformers, £1,320; three 1,000/415-volt ditto, £396; eight 5,000/415-volt 200-K.V.A. ditto, £1,520; five 10,000/415-volt 200-K.V.A. ditto, £950.—N. Guthridge, Ltd.

Sub-station switchgear.—Ten 5,000-volt feeder panels without voltmeters, £1,355; four 10,000-volt ditto, £601; six 5,000-volt transformer panels, £688; four 10,000-volt ditto, £483.—N. Guthridge, Ltd.

Two 5,000-volt feeder panels without voltmeters, £255; four 5,000-volt transformer panels, £526; two 10,000-volt feeder panels without voltmeters, £311; four 10,000-volt transformer panels, £658.—Noyes Bros., Ltd.

Two 5,000-volt transformer panels, £264; two 10,000-volt ditto, £266.—Aust. General Electric Co.

Three 5,000-volt feeder panels without voltmeters, £403; six 5,000-volt transformer panels, £834; six 10,000-volt ditto, £1,191; two 10,000-volt feeder panels without voltmeters, £290. Standard Waygood Hercules, Ltd.

Melbourne City Council.

One D.C. generator with accessories, £1,484.—Aust. General Electric Co.

Insulated cables, £2,505.—Western Electric Co.

Electric freight lift at Toorak, £595.—Edmiston & Co.

The Sydney City electrical engineer recommends that, as the whole of the tenders for a 12,000-KW. turbo-generator were informal, the deposits be returned, and that consideration of the extensions of the electrical plant be postponed. —*Tenders.*

Barrow.—On Monday the T.C. accepted the tender of Mr. J. Neal for the lining of the chimney and extension of flue at the Electricity Works, at £206; also the tenders of Messrs. G. H. Huthwaite and R. Balfour for washed small coals, at 18s. 3d. and 18s. per ton. It was decided to give formal notice to Mr. O. M. Huartson that the Corporation desired to take advantage of the provisions of the Price of Coal (Limitation) Act, 1915, and trusted that they would be able to come to terms in a friendly manner.

Burnley.—The B. of G. has accepted the tender of Messrs. F. Thornton & Co. for the supply of electrical requirements for the Workhouse.

Derby.—The Tramways Committee of the T.C. has accepted the following tenders:—

B.I. & Helsby Cables, Ltd.—Copper wire, £53.

Millar's Trading Co., Ltd.—Wood blocks, £136.

The Electric Lighting Committee has accepted the tender of Messrs. Parsons & Co., Ltd., at £800, for repairs to a steam turbin

Erith.—The U.D.C. has accepted the tender of Messrs. Fraser & Chalmers, Ltd., for extensions to the electricity station, at £10,432.

Glamorgan.—Messrs. Haslam & Stretton, Ltd., of Cardiff, have again received the County Council's contracts for Britannia metal filament lamps.

Glasgow.—The T.C. City Improvements Committee has accepted the offer by Messrs. Bennet & Rutherford, at £104, for the electric wiring of the new Corporation tenements at Calton.

Halifax.—The Tramways and Electricity Committee has accepted the following tenders:—

Babcock & Wilcox, Ltd.—One water-tube boiler and superheater, £2,940.

Underfeed Stoker Co., Ltd.—Two underfeed stokers, £538.

Premier Cooler & Engineering Co., Ltd.—Two water cooling towers, £2,450.

The Guardians have accepted the tender of the Gath Electrical Co. for electrical fittings (except lamps), and that of the Rugby Lamp Co. for lamps.

Keighley.—The T.C. has accepted the following tenders:

John Smith (Keighley), Ltd.—40-ton hand travelling crane, together with a fixed gantry, £783.

Rees Roturbo Manufacturing Co., Ltd.—Electrical centrifugal pump to deliver 800,000 gallons of water per hour, at £850.

Manchester.—The Sanitary Committee has accepted the tender of Messrs. L. E. Wilson & Co. for an installation of telephones and electric bells at Baguley Sanatorium.

The Electricity Committee has accepted the following tenders:—

Sub-station switchgear (to June 30th next).—Ferranti, Ltd.

H.T. and L.T. sub-station switchboards. Ferguson, Pailin & Co., Ltd.

Two 200-K.V.A. oil-cooled sub-station transformers.—Ferranti, Ltd.

One 200-K.V.A. oil-cooled sub-station transformer.—B.W. Electric and Mfg. Co., Ltd.

Circuit breakers.—B.T.H. Co., Ltd., and Switchgear & Cowans, Ltd.

Auto-balancers and auto-transformers (to June 30th next).—British Electric Transformer Co., Ltd.

Cable.—Pirelli-General Cable Co., Ltd., and Siemens Bros. & Co., Ltd.

Paper-insulated service cables (to June 30th next).—B.I. & Helsby Cables, Ltd.

Paper-insulated cable.—L. H. Morshead & Co.

Wooden cable troughing, capping and boards (to June 30th next).—C. Jennings & Co.

Steam and gas fittings (to December 31st next).—James Russell & Sons, Ltd., and John Russell & Co., Ltd.

One 15,000-KW. turbo-alternator.—Richardsons, Westgarth & Co., Ltd., with licence to sublet the alternator to Brown, Boveri & Co., Ltd.

Water-tube boilers.—Babcock & Wilcox, Ltd., with licences to sub-let as follows:—E. Green & Sons, Ltd., economisers; The Newalls Insulation Co., lagging; and Bradley & Lonsdale, brickwork.

Salford.—The Electricity Committee has accepted the tender of Messrs. J. Wolstenholme & Son, of Radcliffe, for wrought iron piping required in connection with the additional 5,000-KW. turbo-alternator, for £70 10s.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, October 8th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

North of England Institute of Mining and Mechanical Engineers.—Saturday, October 9th. At 2 p.m. At Wood Memorial Hall, Newcastle-on-Tyne. Presidential Address by Mr. T. Y. Greener; Paper on "Modern American Coal-Mining Methods, with Some Comparisons," by Mr. S. Dean.

Association of Electrical Station Engineers.—Wednesday, October 13th. At 7.30 p.m. At Victoria Café, Shields Road, Byker, Newcastle-on-Tyne. Special Meeting for Control District and Mains Engineers only.

At 8 p.m. At 55 Market Street, Manchester. Paper on "Testing Electrical Machinery"

Association of Engineers-in-Charge.—Wednesday, October 13th. At 8 p.m. At St. Bride's Institute, E.C. Presidential Address by Mr. F. Bailey.

Institution of Mechanical Engineers.—Friday, October 15th. At 8 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "The Theory of Grinding, with Reference to the Selection of Speeds in Plain and Internal Work," by Mr. J. J. Guest.

NOTES.

The Electrochemical Industry in Russia.—According to the statement of the Director of the Deutsche Bank, Herr Gwinner, at the recent general meeting of the shareholders of the Bank, Germany took in the last year before the war 180,000 000 marks' worth of Chile saltpetre. As the importation of Chile saltpetre has been completely stopped by the war, the production of smokeless powder and other explosives requiring a large quantity of nitric acid produced from saltpetre has been made very difficult, and as all the stocks were requisitioned by the Government, the agriculturists of Germany were in their turn put into serious difficulties for want of chemical fertilisers. In order to solve the question of the production of fertilisers the Government decided to build two factories for the production of nitrogen from the air, one in the centre of Germany and the other in Silesia. How important this matter was considered may be judged from the fact that the work was not confided to private hands; but was retained by the Government as a monopoly. For one great factory in Germany recourse will be had to an extensive deposit of lignite as a fuel. This factory was intended originally to supply Berlin and its suburbs with electricity, and the utilisation of such deposits was one of the motives for the purchase by Berlin of the electricity works belonging to the A.E.G. Experience has shown in Germany that even from small rivers with limited fall, good results can be obtained, and as there are many such rivers in Russia, there is no reason why, with the high price of saltpetre now ruling, the production of nitric acid for explosives and of calcium nitrate for fertilisers from the air should not prove very successful in Russia. Unfortunately, however, the electro-chemical industry has hardly developed at all in Russia. In 1913 the exportation of manganese ore into Germany from Russia was valued at 17,500,000 marks. The importation into Russia of aluminium and of aluminium manufactures from Germany alone in that year amounted to 2 721,000 marks, according to the German Custom House statement, and ferro-alloys were imported to the value of 2,150,000 marks; the production of these alloys in the Caucasus, near the manganese mines, with the abundant cheap water power there, might lead Russia from being an exporter of the raw material to being an exporter of the finished products. But, for this purpose, more capital, more initiative and more technical knowledge, are indispensable.

In recent years the Germans have begun to use peat for this purpose, which is of considerable interest to Russia in view of her large reserves of this fuel. Near Hanover turf is used at the 5,000-H.P. electric station, and the original consumption of 4 kg. of peat per KW.-hour has gradually been reduced to 2 kg.

With the high prices ruling for fuel, and the shortage of foreign coal and coke, the importation of which amounted in 1913 to 527 million poods, and the value to 86,600,000 roubles, the development of the electrochemical industry in Russia can only be effected by using the natural water-power of the country, the extensive lignite deposits, and the numerous peat formations; for it is only with cheap electric power that competition can be maintained with foreign countries, the cost of production in which, for many reasons—cheaper equipment, better technical staff, and an immense scale of production, &c.—is very low.

With high protective duties alone it is impossible to build up an electrochemical industry in Russia. As the experience of foreign electrochemical factories has shown, the basis of all such production is cheap electric power, and in this direction the assistance of the Government should first of all be given.

Electricity Works Apprenticeship Scheme.—The Marylebone Electricity Supply Committee has this week reported to the Council as follows:—

"We have considered a scheme of apprenticeship submitted by the chairman, after consultation with the Council's engineers. By this scheme a limited number of apprentices could be admitted, who, after a period of probation, would be indentured. They would be given facilities for gaining a thorough training in the various branches of the department's work. After the first year's training they would gradually become very useful, and towards the end of their period of apprenticeship they would be able to fill responsible positions. This would relieve the Council of the great difficulty they now experience in retaining the services of improvers, and would minimise such troubles as were recently experienced in connection with the 'running staff.' Applications would be received only from youths over 15, who had shown special qualifications or talent for engineering work, and who had received a good technical education. During apprenticeship they would be given every possible facility for attending evening classes and technical colleges. Their remuneration would be on a progressive scale, beginning at as little as 5s. per week for the first year, and gradually rising to 20s. per week. All who showed special diligence and ability would be given every opportunity for filling vacancies on the permanent staff. We recommend that the Council approve, generally, of the adoption of a scheme of apprenticeship in connection with the electrical undertaking."

Fatalities.—A verdict of "Accidental death" was returned on Monday at an inquest on Edwin Nield (33), of Stockport, who was killed on Saturday afternoon at the works of the Lancashire Ordnance Co., Heaton Norris. A workman named Sampson Cadman stated that they were lifting an electric motor with chain blocks from a bogie on the ground floor when Nield, who was pulling the chain, suddenly swerved from side to side. The witness snatched him off the chain, and himself received a shock which rendered him semi-conscious. Another workman said that an electric cable ran alongside the joist over which the chain passed, and he found the insulation frayed at the place where it came into contact with the chain. The electric current had run down the chain and passed through Nield, who received a shock at about 286 volts.

Institution and Lecture Notes.—Faraday House.—Dr. W. H. Eccles, M.I.E.E., began a course of lectures on "Wireless Telegraphy" to the senior students of Faraday House on Tuesday, 5th inst.

Institution of Electrical Engineers.—At the time when the Institution took possession of the building on the Victoria Embankment, it was supplied with electricity at 100 volts, two-wire, from the private plant belonging to the Savoy Hotel close by, and until recently this arrangement was maintained in operation. Messrs. Handcock & Dykes, consulting engineers to the Institution, inform us that the supply has been changed over to a public source, being now derived from the mains of the Metropolitan Electric Supply Co., Ltd., at 100 volts as before, but on the three-wire system. The change over applies both to the I.E.E. itself and to its tenants in the same building.

Society of Engineers (Inc.).—On Monday last Mr. S. G. Turner, A.M.Inst.C.E., Barrister-at-Law, read a paper entitled "Law and Engineering—Some Points of Contact." The general object of the author was to show that in almost every branch of engineering practice the provinces of the engineer and the lawyer overlap, and to advocate the establishment of some periodical meeting, open to the members of both professions, at which subjects of common interest could be discussed.

Inquiries.—Buyers of magnesite for lining electric steel furnaces are inquiring for a substitute.

Mexican Tramways.—Two Managements.—Almost immediately after the departure of ex-President Huerta from the capital, the general manager and his staff were unceremoniously relieved of their duties and their places taken by nominees of the Revolutionary Government. But even that Government had the sense not to expel these Englishmen from the city. On the contrary, I understand they were invited to remain, and they have remained to very good purpose. The position now appears to be in this wise :—There are two sets of officials, including the general manager. One—the Mexicans—draw salaries or anything they can get from the Government, and are principally occupied in watching the English staff and in smoking cigarettes. The others —the English—give all necessary instructions and exercise their best endeavours to protect the tramway and rolling stock from misuse and deterioration. They are allowed to draw their salaries from England. The arrangement, grotesque as it is, might be worse. The proprietors of the company have at least the slight satisfaction of knowing that their own officials are looking after their property so far as they are permitted. As to the net result, there appears to be only one word applicable to the situation—patience.—*The Financier.*

Appointments Vacant.—Working electrical engineer (£2 5s.) for Holmfirth U.D.C. ; works superintendent for Tramways Department, for duration of war (£150), for Southampton ; shift engineer for Pontypridd U.D.C. Electric Light and Tramways Department ; chief assistant in electrotechnics (£250) for Borough Polytechnic Institute. Particulars are given in our advertisement pages.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—

Company Orders.—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week commencing October 11th, 1915 :—

Drills, 6.30 to 7.30 ; 7.30 to 8.30 p.m.

Saturday, October 9th.—Company Parade, 2.30 p.m. Route march.

Monday, October 11th.—Section 1, Technical ; Section 3, Squad signalling class.

Tuesday, October 12th.—Section 2, Technical ; Section 4, Shooting.

Thursday, October 14th.—Section 3, Technical ; Section 1, Shooting.

Friday, October 15th.—Section 4, Technical ; Section 2, Squad signalling class.

Mr. C. G. Spiers has been appointed Acting Company Sergeant-Major, vice H. N. Fullarton resigned.

In consequence of the great Recruiting March Out on Saturday, October 2nd, the Route March arranged for that day was postponed until Saturday, October 9th, at 2.30 p.m.

The work in connection with the new Headquarters at Chester House, Eccleston Place, S.W., has been commenced, and it is proposed that drills shall start there on Monday, October 18th.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, October 7th, 1915 :—

Week-end Parades.—Saturday.—The Battalion will parade at Liverpool Street Station (low-level entrance, G.E.R.) at 1.50 p.m. for Entrenching, under the Commandant. Dress : Uniform, complete with Brassard. Arms will not be carried. The Battalion will return at 6.46 p.m.

Sunday.—7 a.m., Réveillé ; 10 a.m., Church Parade ; 10.20 a.m., Battalion Parade. Inter-Company Bridging Competition. Instructions will be issued to Company Officers, later ; 2.30 p.m., Battalion Parade.

Musketry.—Saturday, 9th inst., Shooting at Acton and Bisley, as usual.

Sunday, 10th inst.—Targets have been arranged at Bisley for a limited number of Officers and N.C.O.'s. Those intending to shoot should report to Sergeant Cotter, at the Barrier of No. 9 Platform, Waterloo Station, at 10.55 a.m.

A. G. JOINER, *Major and Adjutant*, O.B.C.

London Electrical Engineers (Territorial Force).—The Corps of London Electrical Engineers was the first engineering unit formed in the British Army to make use of the services of electrical engineers. It was first started as the Electrical Engineers (Volunteers) in the year 1897 by the late Dr. John Hopkinson, and the name was changed to the present title on the formation of the Territorial Force. Numerous other units utilising the services of electrical engineers have since been formed, but the largest unit is still the London Electrical Engineers.

Owing to the expansion of the Corps, the opportunity now exists for men of suitable age and training to enlist in the unit. Men of the following professions and trades are specially required :—Electricians, mechanical and electrical engineers, engine drivers, engine erectors, instrument repairers, metal turners, fitters, telephonists and telegraphists.

There is a limited number of vacancies for carpenters, cabinet makers, pattern makers, draughtsmen, joiners and wood turners. Forms of particulars can be obtained from the Officer Commanding at 46, Regency Street, Westminster, S.W.

German Trade.—Sir William Mather, President of the Textile Institute, in opening an exhibition of textile fabrics of foreign origin at Manchester on Tuesday, declared that inquiries instituted by the Government and by various business agencies to ascertain the extent and scope of the trading operations of our enemies, had revealed a marvellous development of the trade and industry of our chief rival—Germany. During the past quarter of a century the German people had devoted themselves to the manufacture of many things of which, in former times, we had considered ourselves to have a manufacturing monopoly, and they had thrown into their work all that enterprise and organisation which had since been seen manifested in their conduct of the war. As a wise and understanding people, we ought to gain such knowledge during this period of war as would be of assistance to us in facing the rivalry of Germany, and of nations allied with Germany, in the peaceful development of commerce after the war. The first step to enable British manufacturers to reckon with them was to get to know at this present time to what extent the enemy had, before the war, permeated and penetrated the whole civilised world with their products. For that reason exhibitions such as the one he now declared open were of the greatest advantage.

Mining Engineers.—The President of the Institution of Mining Engineers has been asked by the Army Council to nominate a number of suitable mining engineers for commissions in the Tunnelling Companies of the Royal Engineers. The gentlemen appointed will receive temporary commissions, and, after short training, will get an opportunity of service at the Front. Those who have had sufficient experience of conducting underground driving operations, and would like to have their names considered, should apply at once for details of the conditions of appointment, pay, &c., to Mr. John H. Merivale, Neville Hall, Newcastle-upon-Tyne.

Catalogues Wanted.—The Eastern Electrical Co., who have recently commenced business at 111, Cleethorpe Road, Grimsby, invite manufacturers to send copies of catalogues and price lists of electrical accessories, heating and cooking appliances, &c.

Messrs. F. Paine & Son, of Connaught Avenue, Frinton-on-Sea, have taken over the Frinton branch of Messrs. Tyler & Freeman's electric lighting business. Mr. Paine has represented them for some time. Manufacturers are invited to forward lists, &c.

For Sale.—The plant, stock-in-trade, &c., of an electrical engineer will be sold by auction on October 14th, at 7, Crown Street, Bolton, by Mr. E. Haslam. Particulars are given in our advertisement pages to-day.

The Merton Case.—Sir Samuel Evans on Wednesday delivered his considered judgment in the Prize Court in the case of the Crown claim respecting 4,732 tons of zinc concentrates seized at Swansea on board the *Bilbster*. Messrs. H. R. Merton claimed the repayment of £5,000 freight. Sir Samuel condemned the cargo in question, and disallowed Messrs. Merton's claim. He said that the evidence went to show that the money was paid to the shippers on behalf of the Metallgesellschaft, and that the reason for its payment was to retain the goods for the German owners. Messrs. Merton did not hesitate to engage in commercial intercourse with the enemies of this country in their desire to get the goods for an enemy firm.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. F. E. COUPE, chief draughtsman in the Manchester electricity department, has resigned his position to take up an appointment under the Government. MR. H. W. SANDERS, who has been senior draughtsman, has been promoted to the position of chief draughtsman, at a commencing salary of £260 per annum. The Electricity Committee has decided that the vacancy caused by his promotion shall not be filled at present.

The Bridlington Electricity Committee has granted leave of absence to MR. J. L. OSTICK, junior engineer at the electricity works, for the purpose of joining His Majesty's Forces.

MR. WHITWORTH, of Southend-on-Sea, has been appointed (for the period of the war) shift engineer at the electricity works of the Barnes U.D.C., vice MR. KEIFFER resigned, at a salary of £120 per annum.

MR. A. E. WILSON has resigned his position as deputy electrical engineer at Bristol on appointment by the War Office to the position of electrical engineer to the chief engineer of the Southern Command. MR. A. J. NEWMAN, who has been in the service of the Electrical Committee for 11 years, has been promoted to the position of deputy electrical engineer, at £350, rising to £400. Mr. A. J. Ostler, who has been in the employ of the Committee for 14 years, has been promoted to the office of sub-station engineer, at £200, rising to £250; and Mr. J. A. D. Pedler, who has been with the Committee for 15½ years, has been promoted to the position of mains engineer, at £175, rising to £250. Owing to the growth of the undertaking, a boiler house superintendent is to be engaged, at £200 per annum.

Wimbledon B.C. has increased the salary of Mr. W. J. Oswald, acting chief assistant electrical engineer, from £182 to £200 per annum, as from October 1st, 1915.

Tramway Officials.—Mr. Robert Simpson, engineer and manager of the Tynemouth and Whitley Tramways, Ltd., has been appointed to a similar position in connection with the Worcester Electric Tramways. Mr. Simpson has had charge of the Tynemouth Tramways for about 25 years.

Mr. J. W. Groves, tramway manager at Worcester, whose new appointment at Gravesend was notified in the last issue of the Electrical Review, has been presented by the employés of the Worcester Electric Traction Co. with an inscribed silver-plated cruet, with pickle jars, a case of pipes and tobacco, and an album containing the names of the subscribers.

General.—At Pagani's Restaurant, on Saturday evening, the staff of the American Supplies Co., Ltd.—distributors in Great Britain of "Dixie" magnetos—met to do honour to their manager, Mr. F. Farquhar, who has temporarily given up his position to take up a commission as Lieutenant in the Army Service Corps M.T.S. His colleagues presented him with a gold watch, accompanied by a testimonial on vellum. The chair was taken by Mr. H. J. Hinley, who will carry on Mr. Farquhar's duties during his absence.

Mr. A. I. Graham, A.M.Inst.C.E., M.I.E.E., &c., has relinquished his appointment with Messrs. Thermit, Ltd., London, with whom he has been as engineer and assistant to managing director for the past 10 years.

In the list of aliens to whom certificates of naturalisation were granted during September the following entry appears:—Oscar Dinerman (Roumania), electrical engineer, Ferndale, Upton Heath, Cheshire. Date of oath of allegiance, August 30th, 1915.

The foremen of Messrs. Willans & Robinson, Ltd., electrical engineers, of Rugby, have presented an inscribed oak clock to Mr. Frederick Wm. Shaw, assistant works manager, on his marriage.

An Australian newspaper states that the Federal Executive Council has appointed Mr. Thomas M'Dougell Mundell electrical engineer at the Naval Dock Yard, Cockatoo Island, at a salary of £400, with a house at Cockatoo Island.

Sir T. Salter Pyne, C.S.I., M.Inst.C.E., M.Inst.M.E., whose work as chief engineer to the Government of Afghanistan is so well known, has been appointed staff captain (temporary) at the Ministry of Munitions.

We read in the *Times* that the Nottingham Corporation has resolved to confer the freedom of the city on Alderman Sir John Turney, who has been a member of the Council for 42 years. Sir John has been actively interested in the electricity undertaking and many other local enterprises.

Roll of Honour.—In connection with Manchester's effort to stimulate recruiting, a march past of 10,000 troops took place on Saturday in the city, and General Sir Henry Mackinnon, Chief of the Western Command, took the opportunity of referring to the feat of Private Walter Walker, of the 2nd East Lancashire Regiment, who, prior to his enlistment, was employed at Messrs. Glover's cable works, Trafford Park. During the fierce fighting at Neuve Chapelle a non-commissioned officer appealed for help while an advance was being made, and as soon as there came a lull, Private Walker, along with a comrade, succeeded in rescuing the N.C.O under heavy fire. Both men have received the D.C.M., and, following General Mackinnon's statement on Saturday, the Lord Mayor of Manchester (Ald. McCabe) presented the medal to Walker. At present Private Walker is an inmate of the Crumpsall Military Hospital, Manchester, where he is receiving treatment for wounds received at La Bassee.

Private T. W. Barrett, of the 7th Lancs. Fusiliers, formerly employed at the British Westinghouse Works, Trafford Park, is in hospital in Sussex suffering from wounds received at the Dardanelles.

Private D. Crook, of the 8th Lancs. Fusiliers, who has been wounded at the Dardanelles, and is now in hospital at Exeter, was formerly employed by Messrs. Ferranti, Ltd., of Hollinwood.

Private J. C. Wooster, a member of the staff of the Richmond (Surrey) Electric Light and Power Co., Ltd., who joined the 6th Wilts. Regiment shortly after the outbreak of war, was killed in France on August 24th.

Private Henry Saxon, of the 11th Manchester Regiment, who was engaged with the Tudor Accumulator Co., Ltd., at Dukinfield, has been killed in action at the Dardanelles. He took part in the landing at Suvla Bay on August 15th, and he was later shot through the head by a sniper.

Captain Vernon W. Newman, who was attached to the Loyal North Lancashire Regiment, and who was killed in the heavy fighting in France between September 26th and 27th, was trained as an electrical engineer, and was for some time on the staff of the Central Engineering College, South Kensington. When war broke out he held a technical appointment with the Government, and obtained his commission in the 4th West Yorkshire Regiment.

We regret to record that Captain William Casson was killed in France on September 25th. He will be remembered by many of our readers as the chief assistant to the mechanical engineer of the District, London Electric and Central London Railways. He was member of both the Institution of Electrical Engineers and of the Institution of Mechanical Engineers, and was 42 years of age. He was in the London Regiment (T.F.), and according to the *Times* got his company in 1903.

Rifleman Tom West, of the King's Royal Rifles, who has been killed in action, was formerly employed at the Rochdale Corporation electricity works. He was 33 years of age.

Private A. Forsyth, 1/4th Gordons, who was killed in action, was before the war in the employment of the G.N.S. Railway electrical department.

NEW COMPANIES REGISTERED.

Ilford Dry Battery Co., Ltd. (141,694).—This company was registered on September 28th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers of and dealers in dry and electrical batteries and apparatus and equipment of all kinds, electricians, engineers, metallurgists, chemists, etc. The subscribers (with one share each) are: A S. Chetwood, 7, St. Helens Place, E.C., solicitor; G. E. Bird, 223, West End Lane, Hampstead, N.W., solicitor's clerk. Private company. The number of directors is not to be less than two or more than seven; the first are W. C. Thick and R. Harvey. Qualification, 100 shares. Remuneration as fixed by the company. Solicitors: Minet Pering, Smith & Co., 7, St. Helens Place, E.C.

H. S. M. Patent Belt Fastening Co., Ltd. (141,732).—This company was registered on October 1st, with a capital of £500 in £1 shares, to carry on the business of manufacturers of and dealers in belt fastening devices, engineers, founders, machinists, metal workers, electricians, etc., and to adopt an agreement with H. K. Mackay, C. H. Sherwood, and W. W. Hartley. The subscribers (with one share each) are: H. K. Mackay, 106, Burton Road, West Didsbury, Manchester, wine and spirit merchant; B. E. Broome, "Mayfield," St. Anne's Road, South Shore, Blackpool, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are H. K. Mackay, C. H. Sherwood, and W. W. Hartley. H. K. Mackay signs as "managing director." Qualification, £50. Remuneration as fixed by the company. Registered office: 25, Clarence Chambers, 4, Piccadilly, Manchester.

C.E.C., Ltd. (141,711).—This company was registered on September 29th, with a capital of £5,000 in £1 shares, to carry on the business of electrical, constructional, mechanical, and general engineers, founders, smiths, machinists, constructors of wharves, docks, piers, railways, tramways, railway carriages and wagons, ships, vessels, and gas, electric, drainage, sewage, and other works, etc., and to enter into an agreement with H. E. Ellis. The subscribers (with one share each) are: H. E. Ellis, 38, Fairholt Road, N., engineer; H. V. Ellis, 38, Fairholt Road, N., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are H. E. Ellis (permanent governor) and H E. O. Ellis. Qualification, £1. Registered office: 96, Ironmonger Row, Old Street, E.C.

Cresol Chemicals, Ltd. (141,728).—This company was registered on October 1st, with a capital of £10,000 in £1 shares, to carry on the business of manufacturers of and dealers in explosives and other chemicals and munitions of war, gas makers, metallurgists, electrical and mechanical engineers, manufacturers of and dealers in electrical and scientific apparatus and materials, etc. The subscribers (with one share each) are: Auguste Oddenino, 60-62, Regent Street, W., restaurateur; Henri Terrisse, 629, Eccles New Road, Weaste, Manchester, D.Sc.; Walter Budd, 60-62, Regent Street, W., secretary. Private company. The number of directors is not to be less than three or more than five; the first are Auguste Oddenino (chairman), Henri Terrisse, and Walter Budd. Remuneration of chairman, £1,200; of W. Budd, as director and secretary, £300 per annum. Registered office: 62, Regent Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Urban Electric Supply Co., Ltd.—Subdemise to trustees for £490,000 4½ per cent. debenture stock of certain land, etc., at Illogan, dated September 16th, 1915, by way of additional or substituted security. Trustees: Merchants Trust, Ltd.

Delabole Electric Lighting and Supply Co., Ltd.—Mortgage dated September 18th, 1915, securing £200, charged on certain chattels, comprising dynamo, switchboard, pulley and driving belt, accumulators, posts, main wiring and lamps. Holders: E. Bant and Miss E. A. Bant, both of Helstone, near Camelford, Cornwall.

T. H. Brooker and Co., Ltd.—Equitable mortgage by deposit, charged on all sums due or to become due to the company under a Munitions Office contract for supply of clinometers, dated September 23rd, 1915, to secure all moneys due or to become due from the company to London and South-Western Bank, Ltd.

Ferranti, Ltd.—Mortgage and charge, dated September 10th, 1915, to secure £100,125, charged on land, buildings, etc., at Stakeleach or Stephenson Fold, Failsworth, Manchester. Holder: H.M. Secretary of State for War.

Dynamic Electrical Co., Ltd. (104,436).—Capital, £100,000 in £1 shares. Return dated December 31st, 1914 (filed June 30th, 1915). Seven shares taken up; £7 paid. Mortgages and charges: Nil.

Auto-Electric Transmission, Ltd. (124,446).—Capital, £10,000 in £1 shares. Return dated July 27th, 1915. 9,918 shares taken up; £3,806 paid; £6,112 considered as paid. Mortgages and charges: £200.

Birmingham District Power and Traction Co., Ltd. (19,077). Capital, £1,050,000 in 35,000 cum. pref., 35,000 pref. ord., and 35,000 def. ord. shares, all of £10 each. Return dated July 5th, 1915. 20,978 cum. pref., 35,000 pref. ord., and 35,000 def. ord. shares taken up. £10 per share called up on 20,978 cum. pref., 27,000 pref. ord., and 35,000 def. ord.; £829,780 paid; £80,000 considered as paid on 8,000 pref. ord. Mortgages and charges: £411,260.

CITY NOTES.

The Swiss Brown, Boveri Co.

The report of Brown, Boveri & Co., of Baden, Switzerland, for the year ended with March 31st, 1915, states that notwithstanding, or partly in consequence of, the greatly reduced number of workmen owing to Swiss mobilisation, it was at first impossible after the outbreak of the war even fully to employ the decreased number of men, and the working time had, therefore, to be substantially diminished. The production experienced an extraordinary decline in so far as output could be spoken of at all. On the other hand, the cost of manufacturing rose beyond all comparison. It was only in the new year that the conditions to some extent approached the normal state, and in the final quarter of the financial year the arrival of orders was even satisfactory, but the production remained constantly in a very unfavourable ratio to the expenses, and it scarcely exceeded at present one half of the normal output. That the financial results were not very much behind those of the preceding year was due to the large amount brought forward from 1913-14, to the circumstance that the extraordinary provision made for depreciation could be omitted on this occasion, and to the fact that one-third of the year fell in the period of peace, and the dividends of the subsidiary companies, and other important items of revenue arising from trading with them, were always accustomed to be brought into account in the following year. As a consequence of the very careful valuation of the investments, the company was able to restrict the amount set aside for war risks to £20,000, notwithstanding the fall in values owing to the war. Nevertheless, it was not out of the question that in the future course of events losses might still occur which could not be foreseen now. The investments amounted to £1,127,000, as compared with £1,099,000 in 1913-14, the increase being due to the payment of fresh instalments on existing obligations, and £736,000 of the first-mentioned total represented interests in manufacturing undertakings. The accounts show the following figures for the two years:—

	1913-14.	1914-15.
Share capital	£1,280,000	£1,280,000
Loan capital	880,000	880,000
Gross profits	475,000	388,000
General expenses	191,000	171,000
Depreciation	104,000	67,000
Net profits and balance forward ...	123,000	94,000
Placed to war risks' fund	40,000	20,000
Dividend percentage	5	5
Carried forward	17,000	4,800

The report mentions, further, that the branches of manufacture remained entirely unchanged during the past year. In particular, the company took up no new branches of any kind during the war and in connection with it. The company strictly refrained from any manufacture of war material in so far as the question was not to concern orders for the Swiss confederation. It is added that it was impossible at present to give any expression as to the future prospects, as everything depended upon the deliveries of raw materials, and to a further degree on the duration of the warlike complications.

Chilian Electric Tramway and Light Co., Ltd.

The result of operations for the year ended December 31st, 1914, after deducting interest and redemption of debentures, London office and other charges, shows a balance to the credit of profit and loss account of £106,086, plus £9,438 brought forward, making a total net balance to credit of £115,524. From this £60,000 has been placed to renewals reserve account, and £7,000 to insurance suspense account. There remains a balance of £48,524, which it is proposed to carry forward to next year, as having regard to war conditions, the directors do not recommend the payment of any dividend. During the year the tramways carried 108,282,117 passengers, earning 9,704,088 dol., as against 109,444,597 passengers, earning 9,765,669 dol. in 1913, but again owing to the increase in the working expenditure, and the fall in the exchange, the result is a decrease in the profit of 308,400 dol. The progress of the lighting department continues; the receipts during 1914 amounting to 8,614,258 dol., as against 7,658,983 dol. in 1913. Various items of construction have been proceeded with during the year, and the capital expenditure has been increased by the sum of £156,824.

The Board regret the death of Mr. S. W. Jameson, who held the appointment of secretary of the company since its formation, and was only elected a director in February of last year. His loss at a most critical time is deeply felt. Mr. W. B. Rommel has been elected to fill the vacancy.

Mr. C. Middleton Kemp, of Messrs. Kemp, Sendell & Co., has been appointed under the Trading with the Enemy Act, 1914, supervisor of the company's business by the Board of Trade.

Mr. Carl Edler, who was appointed to fill the office of local auditor, was unable to attend to his duties owing to the war, and Mr. R. Neveling was nominated local auditor in his place by the management in Santiago with the approval of the Board.

The annual meeting was held in London on September 29th.

Amalgamated Wireless (Australia), Ltd. — The report for the six months ended June 30th showed a profit of £1,672, which, with £4,328 brought forward, made £6,001 available. A dividend of 3½ per cent. absorbs £4,900, making the dividend for the year 6 per cent., and £1,101 is carried forward. Trading (says the *Sydney Morning Herald*) has been seriously interfered with by the war, and profits have suffered. The ships' message traffic, though still subject to disabilities, has improved, and the subsidy ships operated by the company have been increased by five in the six months, and now number 85. The company is now manufacturing the greater part of its requirements. Positions are kept vacant without loss of seniority for all permanent employés on active service, and over 80 trained men have already been supplied by the company to the defence authorities in Australia, New Zealand, and the United Kingdom.

Direct United States Cable Co., Ltd. — Interim dividend 2s. per share, less income-tax at 3s. 2d. in the £, making a total distribution of 4 per cent. for the half-year ended September 30th.

Calcutta Electric Supply Corporation, Ltd.—The directors have declared an interim dividend on the ordinary share capital at the rate of 7 per cent. per annum for the six months ended June 30th, 1915, payable November 15th.

Sao Paulo Tram, Light and Power Co., Ltd.—The directors have declared a dividend of 2½ per cent. on the issued common stock, payable on November 1st.

Babcock & Wilcox, Ltd.—Interim dividend, 6 per cent. on the ordinary shares, free of income-tax.

STOCKS AND SHARES.

Tuesday Evening.

Bulgaria is the baffling factor in Stock Exchange markets just at the moment, but the possibility of her taking active sides with the Central European Powers—which possibility may be translated into something more definite before our day of publication—has had little material effect upon quotations. In point of fact, the War Loan retains the strong tone which set in towards the end of last week; and as the War Loan for the time being is the index to all the markets in the Stock Exchange, it may be said that the Bulgarian attitude has had surprisingly little influence in the markets. Hopes are high and strong that the advance of 10 days ago in Flanders will be steadily continued; and although there must necessarily be spaces of time between one "thrust" and the next, all the news which is allowed to come through is taken to indicate such pressure upon the part of the Allies that the enemy lines will be thrown back with a run when the next order for a general progressive movement is given.

Meanwhile, the casualty lists contain many well-known City names; and the Stock Exchange, like most other large bodies, has to mourn the loss of sons whose names now stand enrolled upon the highest Lists of Honour.

The telegraph market is the firmest amongst the electrical sections. No doubt the fact that dividends are paid free of tax on several of the best class shares has much to do with the demand for these. Some weeks ago, it was not easy to sell stock; to-day, it is just as difficult to buy it. Deceased accounts which were overhanging the market have been absorbed with ease just lately. Other holders are not eager to sell.

Directors of these undertakings now stand abundantly justified in the conservative policy which they have pursued for many years past, in the way of buttressing their companies' reserves and entrenching them in a position of great financial strength. Criticisms have been levelled at the boards for what was called their conservatism—sometimes a harder word was used—in refusing to pay more substantial dividends; and if they had yielded to the demands made upon them for distributing the greater part of the profits, it is as likely as not that the dividends could not have been maintained in days like these. Thanks to the strength of the financial positions, however, the companies are able to continue their usual distributions, and proprietors have every reason to be grateful to their directors for the manner in which they have withstood the temptation to divide more closely to the hilt the earnings in many years past.

The Eastern group is one of the firmest; and Globe Ordinary, with Western Telegraphs, are amongst those which the public want to buy. Anglo-American Telegraphs are also wanted, owing principally to the prosperity that has fallen upon the United States in consequence of the war. The striking success of the Anglo-French Loan has had the effect of bringing into request the stocks and shares of most of the companies doing an inter-ocean trade. This success is the more gratifying in view of the failure of the attempts made by Germany to raise money in the United States, American bankers refusing to look at German proposals unless they were accompanied by guarantees of collateral security, and undertakings that borrowed money should be spent in the States. But with Great Britain holding the seas, it was impossible for Germany to make sure of getting her goods from the States, even if she spent the money there, and so the negotiations came to an abrupt and an untimely end.

A recovery of 5 points has lifted Indo-European shares to 45, wiping out half the loss of last week; so that the people who bought the shares at 34½ have now an excellent profit. New York Telephone bonds have risen to 99½, at which the return to the British investor is obviously too small, compared with that on the War Loan. It is with this last that the intending buyer should carefully match his prospective purchases, always bearing in mind the probability that, upon the issue of the next War Loan, the interest on the existing 4½ per cent. Loan will in all likelihood be raised automatically to the same as that provided by the new comer. Anticipation looks for a 5 per cent. Loan somewhere about Christmas-time, and also for the present 4½ per cents. to become straight away a similar-interest security. New York Telephone 4½ per cents., taking these as our text, pay £4 10s. 6d. per cent. on the money; whereas the War Loan yields £4 14s., and this will probably be raised to 5 per cent., which will have the effect of emphasising the disparity.

British Westinghouse Preference have risen another shilling, and the 4 per cent. Debenture stock is once more 2 points higher, these rises being due to sympathy with the boomlet in Westinghouse shares which are dealt in by New York. American Marconis recovered to 19s. 9d. on Tuesday morning, reacting a few pence later on in the day, which still left them 1s. 6d. higher than they were towards the end of last week. Canadian Marconis are a little firmer at 6s. 3d., and the parent shares braced up to $1\frac{5}{16}$.

Movements in the prices of Home Electricity shares are few, but they trend mostly in the downward direction. The latest Police Order, regulating London's lighting, and the Nubian blackness which nightly envelops so many of the London suburban streets, are not "bull" points for electric lighting shares. In some few cases the prices of these are standing sufficiently, if not too, high when tested by the principle of the War Loan referred to above; these, doubtless, will be adjusted gradually. According to Stock Exchange authorities, the leading companies are now able to operate at a steadily lowered ratio of expenditure, thanks to the introduction of labour-saving machinery; but the increased cost of coal and the decreased consumption of current are bound to tell upon dividends in the near future.

Metropolitan Railway Consolidated stock regained its recent small loss, but Districts are dull at 13. Underground Electric Ordinary £10 shares shed half-a-crown, although the Company's income bonds at 71½ are the fraction to the good. The bonds are in request on behalf of investors to whom the payment of dividend free of tax offers a decided attraction.

In the foreign list, Brazilian Tractions have risen to 50, the Rio Exchange recovering to $12\frac{11}{32}$d. The Preference shares have also hardened; in view of the satisfactory earnings of the Company, they begin to look an attractive speculative investment at the present price of 86½, at which the return is nearly 7 per cent. on the money. Shawinigan Water shares are also firm, as are most of the companies connected with Canadian industries. The immense orders being placed for war material in Canada and the United States are forcing a good deal of money into these stocks. In the Mexican group there is nothing fresh to mention. Argentine Tramways issues have again declined, and the Company's Second Preference shares are now back to 3. Consolidated Gas, Electric Light and Power of Baltimore shares have had substantial rises to 111 for the Common shares, and 115 for the Preferred. The British Columbia group is attracting no attention.

Armament shares remain steady, and rubber shares are well held, in consequence of improvement in the price of the raw material to 2s. 5¼d. per lb. Mr. McKenna has abandoned his intention of taxing imported motor tires, and this is regarded as something of a bull factor, although there is still a good deal of discussion going on as to whether the rubber companies will be required to hand over 50 per cent. of their extra earnings this year by way of Excess Profits tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Blackpool-Fleetw'd	Sept. 25	7,035	+2,182	38	33,886	— 458	8	..
Bristol	„ 24	40,359	+5,135	38	366,098	+82,729	30·5	..
Chatham and Dist.	..	..	..	..	..	..		..
Cork	„ 25	2,248	+ 270	38	19,285	— 58	54·25	..
Dublin	„ 24	25,930	+2,599	38	284,398	+ 8,849	9·89	..
Hastings	„ 23	5,551	+ 989	..	..	— 2	19·8	..
Lancashire United	„ 29	8,029	+1,468	42	68,737	+ 3,968	42	..
Llandudno-Col. Bay	„ 24	2,210	+ 532	43	15,139	+ 1,272	6·5	..
Tyneside	„ 22	2,573	— 462	12	8,033	— 73	11	..
Anglo-Argentine ..	„ 30	197,858	−5,788	39	1,980,825	−187,719	..	..
Auckland	Aug. 27	19,876	−1,170	8.2	42,029	— 2,828	25·42	1·06
Calcutta	Sept. 27	17,493	— 864	..	..	— 6,982	..	..
Kalgoorlie, W.A. ..	July	2,775	..	31	18,954	..	..	..
Madras	Sept. 15	2,053	+ 289	37	33,819	+ 458	..	..
Montevideo ..	Sept.	25,070	— 156	39	808,417	−81,548	..	..
Dublin-Lucan Rly.	Sept. 24	706	+ 114	12	2,096	+ 33	7	..

SHARE LIST OF ELECTRICAL COMPANIES.

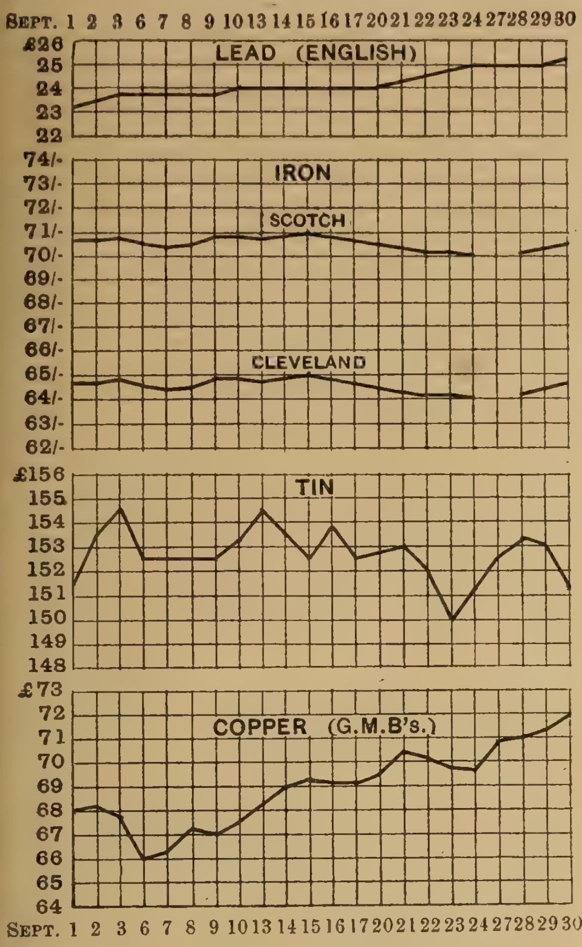
	Dividend, 1914.	Price Oct. 4, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	7¼	— ¼	£6 18 4
do. 7 per cent. Pref.	7	7	— ¼	5 0 0
Charing Cross Ordinary	5	8¾	—	6 18 4
do. do. do. 4½ Pref. ..	4½	8¾	—	6 0 0
do. do. City Pref.	4½	8½	— ¼	6 8 7
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4½	—	6 17 8
do. 4½ Deb.	4½	87	−1	5 8 6
City of London	9	12½	—	7 7 0
do. do. 6 per cent. Pref. ..	6	10¾	—	5 11 [illegible]
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10½	—	6 16 7
do. do. 6 per cent. Pref. ..	6	10¼	— ¼	5 17 [illegible]
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6¼	—	7 4 0
London Electric	4	1⅜	—	8 8 [illegible]
do. do. 6 per cent. Pref. ..	6	4¾	—	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	8½	2¼	—	7 15 7
do. 4½ per cent. Pref. ..	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6¾	—	7 8 2
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	$1\frac{1}{16}$	—	6 14 0
Westminster Ordinary	9	6¾	—	6 18 [illegible]
do. 4½ Pref.	4½	4¼	—	5 9 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	99½	+1	6 0 7
do. Def.	1½	22	—	6 16 [illegible]
Chile Telephone	8	6½	—	6 8 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	12	—	*6 13 4
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord...	7	118	+2	*6 15 7
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	80	—	5 0 0
Globe Tel. and T. Ord.	6	9¾	—	*7 0 8
do. Pref.	6	9¾	—	6 8 0
Gt. Northern Tel.	22	33	—	6 13 [illegible]
Indo-European	13	45	+5	7 4 5
Marconi	10	$1\frac{15}{16}$	+ $\frac{1}{16}$	5 3 1
New York Tel. 4½..	4½	99½	+ ½	4 10 [illegible]
Oriental Telephone Ord.	10	$1\frac{15}{16}$	—	5 3 1
do. Pref.	6	1	— ⅛	6 0 0
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5⅝	+ ⅛	*8 2 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12	—	*6 13 4
do. 4 Deb.	4	80	—	5 0 0
Home Rails.				
Central London, Ord. Assented ..	4	70	—	5 14 4
Metropolitan	1½	28½	+ ½	5 6 8
do. District	Nil	13	— ½	Nil
Underground Electric Ordinary ..	Nil	1⅝	— ⅛	Nil
do. do. "A"	Nil	5/6	—	Nil
do. do. Income ..	6	71½	+½	*9 11 8
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref. ..	5½	8½	— ¼	7 17 2
do. 2nd Pref.	5½	8	— ¼	5 3 4
do. 4 Deb.	4	73	—	5 9 7
do. 4½ Deb.	4½	72	—	6 5 0
do. 5 Deb.	5	74	—	6 15 2
Bra Tractions	3½	50	+ ½	7 0 0
Bombay Electric Pref.	6	10½	—	5 17 1
do. 4½ Deb.	4½	87	—	5 8 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds ..	—	40	—	Nil
do. 6 per cent. Bonds ..	—	35	—	Nil
Mexican Light Common	Nil	25	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	40	—	—
Adelaide Sup. 6 per cent. Pref. ..	6	5	—	6 0 0
do. 5 Deb.	5	98	—	5 2 0
Manufacturing Companies.				
Babcock & Wilcox	14	$2\frac{3}{16}$	—	6 8 5
British Aluminium Ord.	5	$1\frac{1}{16}$	—	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	10⅝	—	7 1 2
do. Pref.	6	5⅞	—	5 2 2
British Westinghouse Pref.	7½	34/-	+1/-	8 10 8
do. 4 Deb.	4	72	+2	5 11 1
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref...	5	4½	—	5 11 3
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	61/-	—	4 18 6
Edison & Swan, £3 pd.	Nil	10/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	58	—	6 18 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/9	+9d.	7 1 4
Gen. Elec. Pref.	6	9⅛	—	6 6 4
Henley	20	12½	—	*9 2 0
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	8	—	6 5 0
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

Tucuman Tramways, Light and Power Co., Ltd.—A financial daily states that the accounts for the period from March 26th, 1914, to June 30th, 1915, after providing for interest on debenture stock, show a debit balance at profit and loss account of £42,517. The meeting of the company was held in London yesterday.

METAL MARKET.

Fluctuations in September.



Glasgow market closed September 27th.

Standards in Trade Journalism.—We note that the recent Convention of the Federation of Trade Press Associations of America adopted a set of "Standards of Practice for Business Papers," a few of which we quote :—

"The publisher of a business paper should dedicate his best efforts to the cause of business and social service, and to this end should pledge himself :—

1. To consider, first, the interests of the subscriber.
2. To subscribe to and work for truth and honesty in all departments.
3. To eliminate, in so far as possible, his personal opinions from his news columns, but to be a leader of thought in his editorial columns, and to make his criticisms constructive.
4. To refuse to publish "puffs," free reading notices or paid "write-ups;" to keep his reading columns independent of advertising considerations, and to measure all news by this standard : "Is it real news?"
5. To decline any advertisement which has a tendency to mislead or which does not conform to business integrity.
6. To solicit subscriptions and advertising solely upon the merits of the publication."

We are not sufficiently acquainted with the factors in the American situation, which have rendered necessary the adoption of such a standard of conduct in the sphere of trade journalism. There are a few journals on this side, one of which is well known to our readers (its natural modesty forbids us to name it!), which have endeavoured to act up to this high standard for many years past. We are glad to find our American contemporaries adopting a lofty ideal, and wish them every success in their organised efforts to attain to it.

Newcastle-on-Tyne.—Volunteer Motormen.—The shortage of employés on the Corporation system has created a serious difficulty, especially with regard to the early morning cars. To assist in relieving the situation, 75 volunteers, including 40 members of the Volunteer Training Corps, have offered their services as motormen and conductors. This has been of immense assistance, and has proved so satisfactory, that 11 other members of the V.T.C. are in training. Several members of the clerical staff of the tramways department have given assistance, and a dozen ex-motormen and conductors who had spare time in the morning, have been engaged.

AMERICAN EXPORTS OF ELECTRICAL GOODS.

The following figures, showing the exports of electrical goods from the United States during the year ended June, 1914, are taken from the recently-issued trade statistics; where possible figures for 1912-13 have been added for purposes of comparison, and notes of any increases or decreases given :—

	1912-13. Dollars.	1913-14. Dollars.	Inc. or dec. Dollars.
Telegraph instruments.—			
To Canada	37,000	16,000	− 21,000
,, Central America ...	6,000	14,000	+ 8,000
,, Mexico	15,000	9,000	− 6,000
,, Colombia	33,000	6,000	− 27,000
,, Argentina	—	1,000	+ 1,000
,, Cuba	66,000	1,000	− 65,000
,, Brazil	18,000	29,000	+ 11,000
,, Other countries	40,000	61,000	+ 21,000
Total	215,000	137,000	− 78,000
Telephone instruments.—			
To United Kingdom ...	151,000	55,000	− 96,000
,, Canada	779,000	432,000	− 347,000
,, Central America ...	7,000	38,000	+ 31,000
,, Mexico	42,000	23,000	− 19,000
,, Cuba	79,000	82,000	+ 3,000
,, Brazil	107,000	336,000	+ 229,000
,, other S. America ...	37,000	140,000	+ 103,000
,, Japan	30,000	14,000	− 16,000
,, Australia	5,000	277,000	+ 272,000
,, Other countries	135,000	156,000	+ 21,000
Total	1,372,000	1,553,000	+ 181,000
*Other electrical instruments and appliances.**—			
To Canada	5,968,000	3,760,000	− 2,208,000
,, Mexico	1,153,000	326,000	− 827,000
,, Panama	1,012,000	566,000	− 446,000
,, Cuba	610,000	374,000	− 236,000
,, Argentina	362,000	358,000	− 4,000
,, Brazil	2,375,000	947,000	− 1,428,000
,, Japan	1,067,000	483,000	− 584,000
,, Philippine Islands ...	344,000	244,000	− 100,000
,, Australia	672,000	516,000	− 156,000
,, United Kingdom ...	781,000	574,000	− 207,000
,, Other countries	3,103,000	2,292,000	− 811,000
Total	17,447,000	10,440,000	− 7,007,000

* Included *Insulated wire and cables* in 1912-13.

	1912-13. Dollars.	1913-14. Dollars.	Inc. or dec. Dollars.
Gas engines, stationary.—			
To Canada	150,000	144,000	− 6,000
,, Argentina	23,000	26,000	+ 3,000
,, Australia	28,000	13,000	− 15,000
,, Europe	104,000	111,000	+ 7,000
,, Other countries	107,000	89,000	− 18,000
Total	412,000	383,000	− 29,000
Electric motors.—			
To United Kingdom ...	150,000	461,000	+ 311,000
,, Canada	1,033,000	833,000	− 200,000
,, Panama	233,000	221,000	− 12,000
,, Mexico	441,000	264,000	− 177,000
,, Cuba	148,000	131,000	− 17,000
,, Argentina	82,000	109,000	+ 27,000
,, Brazil	272,000	179,000	− 93,000
,, Chile	104,000	93,000	− 11,000
,, British India	105,000	99,000	− 6,000
,, Japan	399,000	829,000	+ 430,000
,, Australia	264,000	268,000	+ 4,000
,, Other countries	567,000	1,055,000	+ 488,000
Total	3,798,000	4,542,000	+ 744,000
Petrol engines, stationary.—			
To Canada	1,269,000	1,009,000	− 260,000
,, Argentina	334,000	200,000	− 134,000
,, Australia	341,000	290,000	− 51,000
,, Mexico	40,000	34,000	− 6,000
,, United Kingdom ...	100,000	89,000	− 11,000
,, Other countries	793,000	709,000	− 84,000
Total	2,877,000	2,331,000	− 546,000
Steam engines, stationary.—			
To Canada	260,000	190,000	+ 70,000
,, Cuba	100,000	38,000	− 62,000
,, Mexico	51,000	40,000	− 11,000
,, Brazil	78,000	4,000	− 74,000
,, Philippine Islands ...	20,000	29,000	+ 9,000
,, Other countries	199,000	437,000	+ 238,000
Total	708,000	738,000	+ 30,000

	1912-13. Dollars.	1913-14. Dollars.		Inc. or dec. Dollars.
Electric locomotives.—				
To Canada	146,000	28,000	–	118,000
,, Panama	25,000	354,000	+	329,000
,, Cuba	43,000	—	–	43,000
,, Haiti	21,000	—	–	21,000
,, Chile	17,000	4,000	–	13,000
,, China	—	34,000	+	34,000
,, Other countries	22,000	17,000	–	5,000
Total	274,000	437,000	+	163,000
Dynamos and generators.—				
To Canada	585,000	397,000	–	188,000
,, United Kingdom ...	342,000	333,000	–	9,000
,, Panama	121,000	43,000	–	78,000
,, Mexico	166,000	26,000	–	140,000
,, Cuba	122,000	235,000	+	113,000
,, Brazil	114,000	136,000	+	22,000
,, Peru	109,000	12,000	+	97,000
,, Japan	848,000	869,000	+	21,000
,, Australia	117,000	92,000	–	25,000
,, Spain	24,000	182,000	+	158,000
,, Other countries	225,000	309,000	+	84,000
Total	2,773,000	2,634,000	–	139,000
Fans.—				
To Canada	133,000	70,000	–	63,000
,, Argentina	53,000	87,000	+	34,000
,, Brazil	20,000	26,000	+	6,000
,, China	25,000	27,000	+	2,000
,, British India	37,000	47,000	+	10,000
,, Japan	10,000	25,000	+	15,000
,, Australia	6,000	10,000	+	4,000
,, Uruguay	6,000	17,000	+	11,000
,, Other countries	69,000	124,000	+	55,000
Total	359,000	433,000	+	74,000
Arc lamps.—				
To Canada	91,000	35,000	–	56,000
,, Brazil	52,000	14,000	–	38,000
,, Other countries	43,000	28,000	–	15,000
Total	186,000	77,000	–	109,000
Carbon filament lamps.—				
To Canada	13,000	7,000	–	6,000
,, Mexico	113,000	98,000	–	15,000
,, Brazil	28,000	10,000	–	18,000
,, Other countries	74,000	57,000	–	17,000
Total	228,000	172,000	–	56,000
Metal filament lamps.—				
To Canada	56,000	26,000	–	30,000
,, Mexico	55,000	31,000	–	24,000
,, Cuba	38,000	18,000	–	20,000
,, Argentina	42,000	13,000	–	29,000
,, Brazil	53,000	25,000	–	28,000
,, Australia	34,000	13,000	–	21,000
,, Other countries	117,000	93,000	–	24,000
Total	395,000	219,000	–	176,000

Insulated wire and cables.—	1912-13.	1913-14.
To United Kingdom ...		133,000
,, Spain	*Included in Other electrical instruments and appliances.*	112,000
,, Canada		267,000
,, Panama		273,000
,, Mexico		100,000
,, Cuba		215,000
,, Brazil		323,000
,, Australia		121,000
,, Other countries		448,000
Total		1,992,000

Static transformers.—	1912-13.	1913-14.
To United Kingdom ...		35,000
,, Spain		422,000
,, Canada		106,000
,, Panama		137,000
,, Mexico	Not shown separately.	99,000
,, Cuba		55,000
,, Brazil		148,000
,, Chile		38,000
,, Japan		23,000
,, Australia		47,000
,, Other countries		345,000
Total		1,455,000

THE PROBLEM OF THE "POINT-FIVE" TARIFF.

[COMMUNICATED.]

(*Concluded from page* 444.)

Figs. 3 and 4 show that neither on a basis of rateable value nor of units sold per annum, do the mean prices per unit charged to various groups of consumers in the above-mentioned statistics, show continuity or equity. In fig. 3 the points relating to each undertaking are linked together, but except in the cases of Blackpool and Sunderland the resulting curves are wildly erratic. Though not varying consistently, the Blackpool mean prices per unit consumed lie within a relatively small range. The definite upward character of the Sunderland curve (No. 5) is due to the increasing percentage charge on R.V. in that town as the actual rateable value increases. In all the other instances consumers living in houses of a certain R.V. may pay more or less for their energy than the average per unit paid by dwellers in smaller or larger houses.

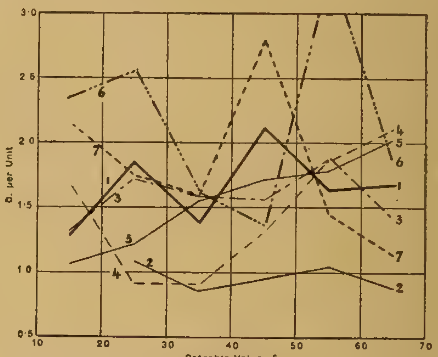


Fig. 3.—Mean Price per Unit for Houses of Different Rateable Values.

Plotting the average price paid per unit against the average units consumption per annum (fig. 4) we obtain points which cannot be linked to form a curve for each town. Taken *en masse* the prices show a tendency to decrease with increasing annual consumption (at first rapidly then more slowly) but for each particular town the points are very erratic. Once again the Sunderland points show the most "character," and for the same reason as before, but whereas the Sunderland prices *rise* considerably with the average annual consumption of the several groups, the Blackpool prices *decrease* moderately, and the Wrexham prices very considerably, and with fair consistency. Where such contradictory results exist it is not safe to carry deductions too far, but the main purpose of figs. 3 and 4 is already served by emphasising the extraordinary fluctuations in mean price with both rateable value and annual consumption. The points plotted representing averages for groups of consumers, the results for individual consumers are probably far more erratic.

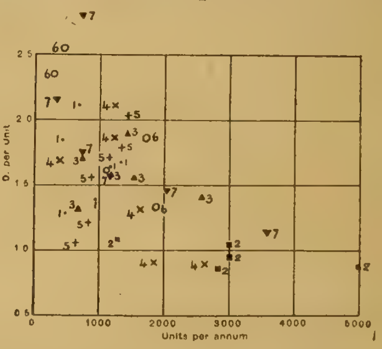


Fig. 4.—Showing Inequitable Mean Price per Unit (Plotted against Units per Annum).

Perhaps the most disturbing feature of fig. 4 is the considerable distance between points of the same series on the same ordinate, *i.e.*, the considerable difference in average price per unit paid by consumers taking the same amount of energy but using it in houses of different rateable value.

Nor can this discrepancy be justified by attributing it to differences in load factor, for sometimes the difference is in one direction and sometimes in the other. It may be contended that these wide fluctuations are only temporary, and would be smoothed out if every householder developed to the full his "electricity consuming capacity." Undoubtedly that is so, to a considerable extent. The rateable value tariff, like any tariff based on a minimum fixed charge, encourages free consumption, since the average price per unit then decreases rapidly, though the total amount of the bill increases.

For example, a consumer subjected to 12½ per cent. fixed charge on £50 rateable value and charged ½d. a unit, for all consumption, would have his total liability fixed on the following scale :—

Consumption per annum.		Energy charge.	Total charge.	Mean price per unit.
500 units	...	250d.	1,750d.	3·5d.
1,000 ,,	...	500d.	2,000d.	2·0d.
1,500 ,,	...	750d.	2,250d.	1·5d.
2.500 ,,	...	1,250d.	2,750d.	1·1d.
5,000 ,,	...	2,500d.	4,000d.	0·8d.

This table shows several things. It helps to explain the extraordinary fluctuations visible in the preceding curves, for though consumption of extra units increases the total bill but slowly, it reduces the mean price per unit rapidly. If a consumer chooses to consume more energy without exceeding a certain maximum demand, there is every reason why he should receive his whole supply at an appreciably lower average price, but there is no justification for charging Messrs. A, B, and C at the average rate of 1·1d., 1·5d., and 1·9d. per unit respectively for equal annual consumption of 1,500 units in each case, just because they live in houses assessed at £30, £50 and £70 respectively.

If the maximum demand in the several cases were related definitely to the rateable value, the latter would be a reasonable basis, but it is only too well known to the average citizen that the rateable value of his house bears no relation to the number of his household or the domestic utility of the building. District, size of garden, and assessor's whim are a few of the factors determining the rateable value. Number and position of windows, nature of surroundings, number and habits of household are factors influencing the consumption of electricity for lighting and other domestic purposes. Where is the connecting link between these groups of factors? Admittedly, in a general way, higher rateable value means a larger house and larger maximum demand, but is there, in the first place, any definite relation between the two, and ought, in the second place, a consumer to be penalised just because, for one reason or another, he does not develop his electrical consumption in the manner, and to the extent which his rateable value indicates as possible? Surely the answer to both questions is in the negative.

On the average for a whole district the rateable value tariff may be equitable, and in most cases where it is working it *is* equitable as between supply authorities and consumers as a body, but is this altogether unconnected with the facts that the tariff has only been in vogue a few years, and when it was put into force it was deliberately arranged to give what might be called "average equity?" In other words, is not the tariff very largely artificial—with just that basis of reason sufficient to make it plausible and workable for the nonce?

The rateable value tariff must already be responsible for grave anomalies between the current consumption and bills of individual consumers, and such anomalies cannot be good for the development of the industry as a whole. In many cases the consumer has alternative tariffs which he can adopt if he feels himself aggrieved, but the alternatives are usually—if not invariably—such as to place either them or electric heating and cooking out of the question. The "point-five" tariff is essential to healthy heating and cooking development, and some form of supplementary fixed charge is necessary if all units are to be sold at the same rate and through the same wiring. The maximum demand system in a modified form is, in the writer's opinion, the best and fairest possible. Every consumer is entitled to special consideration of his case, since, after all, it is to meet the electrical engineers' difficulties and limitations that any departure at all from the flat rate is required.

The ordinary exposition of the Wright system: "So much a unit for the first hour's use per diem of maximum demand and so much a unit afterwards," is muddling to the layman. Of course it is, and it is safe to say that a good percentage of canvassers who rattle out the phrase so glibly are unable to explain it. It is not necessary to raise the householder's suspicions by this formula, nor is it necessary to install maximum demand indicators. It is, at this date, quite easy to estimate what will be the average maximum demand for any proposed equipment, and so to determine a fixed charge which shall be fairer to the consumer than the R.V. charge can be, whilst being, for the district as a whole, equally satisfactory to the station.

Naturally, some consumers will take higher power at times than that to which they are strictly entitled, but, in the aggregate, this will not constitute a serious problem, and, over a year's working, all consumers will have benefited to much the same extent by this concession without the station having experienced any particular inconvenience. No doubt, basing the fixed charge on kilowatts installed, will check installation to some extent, but this consideration cannot be held to justify imposition of an unfairly high fixed charge on a section of the consumers, as is necessarily the case where the rateable value basis is adopted. The latter has the effect of checking any installation at all! The R.V. basis amounts to saying to the consumer: "living in a house like this, with a garden like this, and in a district like this, you ought to consume so much current. If you don't, you will have to pay dearly for what we do supply; and, anyhow, your bill can't be less than so much, and will be so much more before the average price is really cheap." Expressing in words what the tariff does in fact, renders it sufficiently clear that whatever the "business getting" merits of the R.V. tariff, due to its being so simply expressed and understood, it cannot be regarded as a system likely to produce continuous and permanent development and satisfaction.

In the Marylebone district of London the initial charge under the "point-five" tariff is based on £18 13s. 4d. per calculated maximum demand of lighting, this calculated maximum being 70 per cent. of the watts installed (less purely "convenience" lights). The average annual consumption of consumers, subject to annual charges, ranging from £3 to £20, is then as shown in fig. 5, curve A, the mean price per unit ascending gradually and fairly smoothly as shown by curve B. Without dilating further upon this particular tariff, it is mentioned in illustration of the rationality of making the fixed charge depend directly on maximum demand.

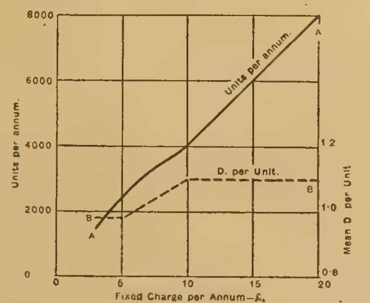


Fig. 5.—"Point-Five" Tariff based on Calculated Maximum Demand.

Whether the maximum demand be that for all purposes or that for lighting alone, or whether discrimination be made between the maximum demand for lighting and that for heating and cooking (each being charged at a separate rate) is a matter for the supply engineer to decide in each particular case. To achieve a satisfactory solution in the particular case is much easier than in the general or purely abstract case, where tariffs are concerned. The difficulty of explaining maximum demand systems to consumers has been much exaggerated; the whole problem can be much simplified, while maintaining sufficient practical accuracy, by substituting estimated maximum demand (as a definite percentage of installation) for actual maximum demand as measured by demand indicators.

Though much has already been written concerning the rateable-value tariff, the writer believes this further contribution to be justified by the apparent tendency to consider an R.V. percentage the standard initial charge under a "point-five" tariff. This tendency could hardly fail to be inimical to the best development of electrical heating and cooking, and the present temporary check in these fields, and in the introduction of cheapened tariffs, affords an excellent opportunity to discuss whether recent developments have really been along sound lines. No consideration of avoiding risk and worry at the time of introducing a fresh tariff ought to be taken as justifying one which will not prove permanently satisfactory.

LEGAL.

An Interesting Wages Claim.

Judge Mellor, at the Manchester County Court on Thursday of last week, had before him a case in which an employer sued a workman, whom he had engaged, but who subsequently wrote that he could not fulfil the engagement, for one week's wages, and for a further week's wages in lieu of notice. The defendant agreed to enter plaintiff's service in August, but a fortnight before he should have started he sent plaintiff a postcard to the effect that he could not fulfil the engagement. Plaintiff thereupon tried to get another workman to take the place of defendant, but he was unsuccessful. Defendant now pleaded that the engagement was not definitely concluded, and declared his belief that he was not liable, since he never entered on the work and gave notice that he did not intend to do so a fortnight earlier.

His **Honour** found that there had been a breach of contract as the engagement had been made and not kept, but held that plaintiff was entitled to one week's wages only, and gave judgment to that effect, with costs.

Dublin Electricians Fined.

The Dublin Munitions Court has imposed a fine of £1 each on nine electricians for leaving work. It was complained against the men that they took part in a strike without having first had the matter of difference referred to the Board of Trade. Messrs. Edmundson's Electrical Corporation, the employers, are contractors for Government work, and defendants were employed under them at a certain factory. The Court overruled an objection which had been raised that Mr. Bruty, Messrs. Edmundsons' manager, the complainant in the summonses, was not the aggrieved party, and announced that if a settlement were made, and the men returned to work, the fines would not be enforced.

WAR ITEMS.

The War and Station Engineers.—Like kindred organisations, the Association of Electrical Station Engineers has been adversely affected by the war. Approximately 250 members have joined His Majesty's Forces, and many members have left station work to take up more remunerative work in other sections of the engineering industry, the majority going into the factories for munitions work. A large number of station engineers have taken advantage of this opportunity for transferring their services to other departments of activity, where the opportunities for advancement and the remuneration are better than in station work. These men have been a great loss to the A.E.S.E., as they have been, we are informed, men of energy and spirit; the same may be said of those who have joined H.M. Forces, though it is anticipated that they will resume their active membership when hostilities cease. Owing to the loss of men from the stations, chief engineers are, it is said, putting difficulties in the way of further men leaving, and in some cases there have been certain instances of injustice which the A.E.S.E. is at present actively investigating. At the end of May last a meeting was held of the A.E.S.E. London Committee and representatives of the Associated Municipal Electrical Engineers (Greater London), when the A.E.S.E. again put forward the suggestion for the forming of a combined committee to which all differences which occurred in stations in the London district could be referred, and the matter is still under consideration by the A.M.E.E. The set-back which the A.E.S.E. had to contend with in the early months of the war has been practically overcome, and new members are joining at a satisfactory rate. The greatest progress has been made in the Newcastle-on-Tyne Branch, which has lately become very active and has been successful in obtaining some concessions with regard to cancelled holidays, etc., for the members. Negotiations are still proceeding with regard to increased salaries. Since January of this year a monthly circular, entitled "Progress," has been sent to all members of the Association, in which discussions on subjects of interest are published. This circular was started chiefly for the benefit of members who are scattered in different parts of the country and are a long distance from the important centres, and, in consequence, cannot attend meetings. The A.E.S.E. is continually making efforts to better conditions in individual stations and has generally effected some improvement in each case.

The War Spirit in Australia.—Mr. P. J. Pringle, chief engineer and general manager of the Electric Supply Company of Victoria, Ltd., Ballarat, who, as most electric supply men will remember, left these islands some years ago to take up his present position in Australia, has sent us a large poster card which has been designed by a prominent Melbourne engineer, who is circulating it at his own expense. The object of this poster, which we reproduce below, is obvious. As our readers will have gathered from our frequent references to the anti-enemy attitude in Australia, feeling runs extremely high out there in regard to trading with the enemy, both now and after the war. The very prospect of ever again finding it necessary to deal with German firms or their representatives and handling German-made goods is as the effective administering of an emetic in its consequences. Therefore, it is not surprising that this very plain-speaking poster is being freely adopted in Australia by business firms. Mr. Pringle expresses the hope that the sentiments that it sets forth will be approved of by the Home firms, and judging from what we hear them say, and the correspondence that reaches us, he is not far wrong in regard to many of them. The last clause of the policy, as printed on the right-hand side of the poster, is not strong enough for Mr. Pringle. In his opinion nothing short of a "national appeal" should ever again allow enemy goods to enter Australia, and that he is not by any means alone in this idea may be gathered from the following resolution which he moved at, and secured the adoption of by, a recently held meeting of employers:—"That in the interests of the Empire this Association supports and approves of prohibitive restrictions being placed by the Federal Government on the importations of enemy goods into Australia, and urges that such restrictions remain in force until a national appeal calls for reconsideration of the matter." Mr. Pringle voices Australian feeling thus:—"The indecision of the Home Government much surprises us out here."

REMEMBER

Louvain
Rheims
Ypres
Rape
Murder
Loot
Poisonous
Gases
Burning
Petrol
Poisoned
Wells
Starving
Prisoners
"Falaba"
"Lusitania"
Etc.
Etc.

NO ORDERS

EXCEPT

"GET OUT"

FOR

GERMANS

German Agents
OR
Representatives
OF
German Firms
OR
Goods.

A NATIONAL POLICY FOR AUSTRALIANS.

Germans in this country should have no vote in Commonwealth, State, or Municipal elections.

No German, whether naturalised or otherwise, should be eligible during the continuance of the war for election to either Federal or State Parliaments, to any municipal body, or to any Water Trust.

No men of German birth should be permitted to hold commissions as Magistrates, or as Justices of the Peace.

No German firm should be permitted, now or hereafter, to trade here under a title that conceals its nationality.

Heavy duties should be imposed on all Enemy goods, and should be made irremovable by statute for a period of 10 years after the conclusion of the war.

Foreign Electrical Firms and the Manufacture of Munitions.—It has become an exceedingly bitter pill for the Germans to swallow that certain electrical and other firms in the United States have manufactured munitions of war for the British Allies—a fact which has been discussed in this country and is well known throughout the world. But an instance has arisen in Europe which has been eagerly seized upon by a Frankfort newspaper (the leading commercial and industrial organ in Germany) as a glorious example of "industrial neutrality," as it is termed. The case in question is that of the Swiss firm of Brown, Boveri & Co., from whose annual report for 1914-15 a sentence has been extracted which, it is said, will be read with equal attention in Germany and the United States, although with very different sentiments. The sentence runs:—"The branches of manufacture remained entirely unchanged during the past year. In particular, the company took up no new branches of any kind during the war and in connection with it. The company strictly refrained from any manufacture of war material in so far as the question was not to concern orders for the Swiss confederation." Such a statement, the Frankfort newspaper declares, is all the more noteworthy because the matter affects an undertaking of the heavy electrical industry which is specially suitable for being transformed into one for the production of war material. The newspaper proceeds to remark that the possibility was open to earn large war profits—it was open to all—for the Swiss company would not at all have needed to favour one party of belligerents at the cost of the other, as war material could have been delivered to all (!) yet the company "strictly refrained from any manufacture of war material." This point of view is held by the German newspaper to be "highly un-American," as is sought to be shown by the quotation of a second case, where a certain neutral country's orders, offered in the United States, are stated to be only acceptable provided that the country in question is on the side of Great Britain and her Allies. Yet it was reported about two months ago that German contracts for munitions were being executed in the United States and the deliveries forwarded to South America for re-exportation to the Fatherland via Holland and Denmark. We are, however, not particularly concerned with this side of the problem. What is, however, of great importance is the fact that comparatively small nations which are co-terminous with Germany have the fate of Belgium before their eyes, and they have been frequently warned to be circumspect in their attitude towards Germany. Under the circumstances these small nations, or their engineering firms, for obvious reasons would not undertake to manufacture munitions for the use of the central powers, whilst their proximity to the latter would act as a deterrent to any production of war material for the British Allies, even if the engineering firms in the comparatively little countries were willing to contract for work of this kind. It is far from our intention to suggest that the Swiss company in question would work for either one combination of nations or the other. No doubt all Swiss firms, having regard to the enormous consumption of small arms and gun ammunition in the present war, together with the part played by heavy guns, are strained to the utmost of their capacity in meeting the requirements of their own Government in munitions so as to provide against any possibilities of the future, and in so far as labour, which is extremely scarce owing to the mobilisation, is available. Apart, however, from this point of view, it has to be remembered that the Baden company possesses extensive interests in Germany, including the subsidiary company of the same name at Mannheim, and material interests may be expected to carry a considerable weight in the present times. It is scarcely necessary to state that the German newspaper does not inform its readers whether the Mannheim company is or is not producing war material; nor does it say that it would be possible for long-range guns on German territory to reach Baden, provided that no mountain chain offering an adequate obstacle intervened between the two districts. As a consequence the German contention that the Swiss company could have delivered war material to all the belligerents falls to the ground. It would have been possible to forward supplies to Germany or Austria, but for the reasons stated any such deliveries to the other group of nations would have been out of the question.

Osram-Robertson Red Cross Van.—The illustration herewith shows the ambulance van presented to the St. John's Ambulance Association by the Osram-Robertson Lamp Works, Ltd. This van is designed to carry eight patients, the driver and an attendant, and the design of every detail of the equipment conforms to the latest and best practice. The van was photographed outside the Osram-Robertson Lamp Works at Hammersmith, but it is now doing valuable service.

The German War Loan.—The "Ironmonger" states that the following were subscribers to the third war loan to the amounts stated:—

Siemens & Siemens Schuckert Companies ...	£650,000
The War Metal Co.	250,000
Auer Incandescent Gas Light Co., Berlin ...	125,000
Duisburg Cable Works	100,000
Hackethal Cable & Wire Works, Hanover ...	50,000
Engineering Works, Ehrhardt & Sehmer, Saarbrücken	20,500

Electricity Works Employés.—Three workmen employed at the Eccles Corporation's electricity works resigned recently, and the Electricity Committee has directed the Town Clerk to communicate with the Minister of Munitions with a view to preventing its workpeople going to other employment except by consent of the Corporation.

Controlled Establishments.—The Minister of Munitions has declared 264 additional factories as controlled establishments, bringing up the total to 979 on October 4th.

OUR LEGAL QUERY COLUMN.

"Interested" writes:—"A local authority having power to wire consumers' premises, sell and hire electrical apparatus, etc., appoint a selling agent. The agent, who lives within the borough boundary, purchases a number of second-hand motors, at an agreed price, from the Corporation in question for the purpose of re-selling. Is it essential for the authority to whom these powers have been granted to satisfy themselves that their agent only re-sells to persons residing inside the borough, and for use on their supply?"

***Without knowing the exact terms of the Provisional Order under which the lighting authority in question sell and hire apparatus, it is difficult to say whether the proceeding referred to in the query is legal or not. If they were authorised "to sell" generally, without qualification, it does not appear that their right to do so can be limited to consumers or other persons within the area of supply. If they have power to sell at all, it would not seem to be illegal for them to supply motors, second-hand or new, to an agent within the district wholly irrespective of the use to which he proposed to put them afterwards.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

RUSSIA.—As a result of negotiations between the British Ambassador in Petrograd and the Imperial Russian Government, it has been decided that Russian Consular Officers in the United Kingdom and in British oversea territories will, as from August 1st, issue visa and legalise free of charge certificates of origin covering goods of British origin exported to Russia.

The Russian Government have decided that the prohibition of the exportation of steel and lead by all land and sea frontiers of European Russia applies also to manufactures and alloys of these metals.

BRITISH HONDURAS.—Under a new tariff which has recently been put into force a duty of 15 per cent. *ad valorem* is levied on all goods not separately mentioned in the tariff; this rate will apply to a considerable number of electrical and similar goods.

SIBERIA.—It has been decided that importation of the following goods into Siberia *via* Yenesei River may be allowed free of duty:—Cast-iron in pigs, scrap and filings; manufactured iron (bar iron, etc., ingots, pigs, iron rails, sheet and plate iron, shaped iron, etc.); tinplate and sheet iron painted, varnished, galvanised, or coated with common metals; steel (in bars, billets, scrap, sheets, shaped steel, etc.); tin (in pigs, rods, scrap, sheets, even polished and amalgam); boilermakers' wares of iron or steel, and pipes and connected parts of iron or steel; wire of iron or steel; machines and apparatus complete or incomplete, fitted together or in parts, of cast-iron, wrought-iron or steel, with or without parts composed of other materials, even if combined with copper to an extent not exceeding 25 per cent. of the total weight of the machine; also spare parts of such machines and apparatus composed of the same materials imported together with the machines and apparatus.

NORWAY.—The Norwegian Customs Department have decided with reference to their prohibited exports that alloys of metal are not prohibited to be exported unless they are specially mentioned in the list of prohibited exports, as, for example, "antimony and alloys" and "copper and alloys of copper with common metals." This decision, however, only applies to cases in which the constitution of the alloys is normal. In cases where a metallic alloy contains an unusual amount of a metal of which the exportation is prohibited, the prohibition is to be applied to such alloy also. In doubtful cases, the exporter will be required to prove that the constitution of the alloy is normal.

AUSTRALIA.—The Board of Trade has received from the High Commissioner for Australia a statement as to the method of paying duty under the new Australian Customs Tariff on advertising matter sent to Australia through the post. This matter, which is taken to include catalogues, prospectuses, billheads, labels, etc., etc., is dutiable if of United Kingdom production at the rate of 8d. per lb., or 35 per cent. *ad valorem*; or, if produced elsewhere, at the rate of 10d. per lb., or 40 per cent. *ad valorem*. In each case the rate applicable is that which produces the higher duty, but it will be found that, with very rare exceptions, the duty may be properly assessed at the specific rate (8d. or 10d. per lb.) on such matter imported through the post.

2. The rates mentioned apply to all the advertising matter and other articles referred to above, whether introduced through the post or otherwise, and even when forwarded in single copies per post addressed to individuals, except in cases coming under paragraph 5.

3. In the case of advertising matter sent through the post to individuals the duty may be paid by any of the methods specified hereunder:—

(*a*) The total weight of any one mail may be ascertained by a consignor, and the duty payable as mentioned in paragraph 1 may be remitted in one sum to the Deputy Postmaster-General of the State to which the advertising matter is addressed. In such cases a notification that such remittance has been made should appear on each packet.

(*b*) The duty may be paid on the same basis as in (*a*) by the consignor's agents in the Commonwealth.

(*c*) Duty stamps may be affixed to each package covering the amount of duty payable on same. These stamps may be purchased in denominations of ½d., 1d., 2d., 3d., 4d., 5d., 6d., 7d., 8d., 9d., 10d., 11d., and 1s., from the offices of the Commonwealth of Australia in London, 72, Victoria Street, London, S.W. The Duty Stamps must be cancelled by the sender before dispatch by writing or stamping the date across the face.

(*d*) If none of the above methods be followed, postal surcharges will be made in the Commonwealth to cover the duty due on each packet.

4. For the purpose of paragraph 3 (*c*) and (*d*) the following scale of charges on fractions of a pound weight has been approved:—

Amount.	If of United Kingdom production.	Otherwise.
½d.	Up to 1 oz.	Up to ¾ oz.
1d.	,, 2 ,,	,, 1½ ,,
1½d.	,, 3 ,,	,, 2½ ,,
2d.	,, 4 ,,	,, 3¼ ,,
2½d.	,, 5 ,,	,, 4 ,,
3d.	,, 6 ,,	,, 4¾ ,,
3½d.	,, 7 ,,	,, 5½ ,,
4d.	,, 8 ,,	,, 6½ ,,
4½d.	,, 9 ,,	,, 7¼ ,,
5d.	,, 10 ,,	,, 8 ,,
5½d.	,, 11 ,,	,, 8¾ ,,
6d.	,, 12 ,,	,, 9½ ,,
6½d.	,, 13 ,,	,, 10½ ,,
7d.	,, 14 ,,	,, 11¼ ,,
7½d.	,, 15 ,,	,, 12 ,,
8d.	,, 16 ,,	,, 12¾ ,,
8½d.		,, 13½ ,,
9d.		,, 14½ ,,
9½d.		,, 15¼ ,,
10d.		,, 16 ,,

5. In cases where the total duty on any one mail addressed by any one consignor to any one State of the Commonwealth does not exceed 1s., the payment of duty is waived. If there is reasonable ground for belief that this concession is being abused by the distribution of a consignment over more than one mail, the whole of the matter affected is to be charged duty. When this exemption is claimed for any consignment each package should bear an intimation that the total duty does not exceed 1s.

6. As the Imperial postage regulations do not allow any postal packet to contain any enclosure addressed to a different person at a different address, the use of Commonwealth Duty Stamps issued from the High Commissioner's Office is limited to packets sent to single addresses, and such duty stamps must not be used in connection with the dispatch of circulars, etc., packed together but intended for different addresses.

China Covers for Switches.—**In view of the necessity for economising in the use of metals, Messrs. J. H. Tucker & Co., of King's Road, Hay Mills, Birmingham, have drawn our attention to a line of china-covered flat type switches which they are supplying in a variety of colours, to harmonise with surrounding woodwork. The "light oak" and "mahogany" coloured switches which they have sent us as samples, are admirable imitations of these woods; dark oak and walnut can also be matched, and covers of this kind possess decided advantages over the usual white and black china covers, of which also the firm supplies large quantities.**

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

13,344. "Connections of electrical conduits." F. W. Uren. September 20th.

13,357. "Electric switches." F. C. Stockel. September 20th.

13,388. "Electric switches." H. Lucas & W. C. Turner. September 20th.

13,389. "Laminated armatures for magneto-machines, cores for electric coils, and the like." H. Lucas & W. H. Edwards. September 20th.

13,415. "Manufacture of electrical conductor or wire retaining bands and apparatus therefor." E. Fewkes. September 21st.

13,436. "Electric ignition of internal-combustion engines." J. W. T. Cadett & C. Percy. September 21st.

13,438. "Production of X-rays." Sir J. M. Davidson. September 21st.

13,450. "Thermic telephones and like instruments." Pieter de Lange and Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. September 21st.

13,458. "Keys of electrical telegraph transmitters." H. E. Allcock. September 21st.

13,469. "Driving and controlling dynamo-electric generators." W. F. Wilkinson & J. Firth. September 22nd.

13,481. "Dynamo-electric machines." F. A. Heys (Neuland Patents, Ltd., U.S.A.). September 22nd. (Complete.)

13,482. "Dynamo-electric machines." F. A. Heys (Neuland Patents, Ltd., U.S.A.). September 22nd. (Complete.)

13,483. "Dynamo-electric machines." F. A. Heys (Neuland Patents, Ltd., U.S.A.). September 22nd. (Complete.)

13,484. "Dynamo-electric machines." F. A. Heys (Neuland Patents, Ltd., U.S.A.). September 22nd. (Complete.)

13,498. "Electric lamps." F. Mead. September 22nd.

13,504. "Electrical distribution systems." E. T. Williams. September 22nd.

13,555. "Incandescent electric lamps." W. J. Hermges. September 23rd. (Complete.)

13,561. "Dynamo-electric machines of the commutator type." G Schroeder. September 23rd

13,562. "Dynamo-electric machines of the commutator type." G. Schroeder. September 23rd.

13,568. "Means for minimising sparking at break of a circuit containing inductance and capacity in series." T. F. Wall. September 24th.

13,600. "Locking lamp socket." T. H. A. Brown. September 24th. (Complete.)

13,614. "Electric selective devices." A. H. Morse & Indo-European Telegraph Co., Ltd. September 24th.

13,615. "Supply of electric energy to wireless telegraphy installations." A. H. Morse & Indo-European Telegraph Co., Ltd. September 24th.

13,618. "Insulating airtight joints for terminals of vapour electric apparatus." British Westinghouse Electric & Manufacturing Co., Ltd. (Westinghouse Electric & Manufacturing Co., United States). September 24th (Complete.)

13,655. "Automatic circuit-interrupting devices." A. du Pasquier & J. M L. Slater. September 25th.

13,679. "Electro-magnetically-operated mechanisms." R. S. Lewis. September 25th.

PUBLISHED SPECIFICATIONS.

1914.

19,809. Process for Producing the Lining of an Electric Induction Furnace G. Brüstlein. September 15th.

20,908. Arrangements for Synchronising Apparatus having similar Periodic Movements. W. P. Thompson (Soc. Anon des Telegraphes Edouard Belin) October 13th.

22,226. Mercury Switches. G. Wilkinson. November 9th.

24,368. Fuses or Cut-outs for Electric Circuits. V. Hope. December 21st. (Addition to 22,575/13.)

1915.

498. Selecting Devices operated by Current Impulses. O. Imray (Siemens and Halske Akt. Ges.). January 12th.

553. Electric Locks and Switches for Lifts. Smith, Major & Stevens, Ltd., and C. G. Major. January 13th.

863. Sparking Plugs for Internal-combustion Engines and the like. W. F. Grafton and W. G. Cairney. January 19th.

982. Electrical Apparatus for Effecting the Chemical Combination of Gases. C. C. Meigs. January 21st. (January 23rd, 1914.)

1,113. Electric Switch for use with Weighing Scales. W. & T. Avery, Ltd., and R. R. Gibbs. January 23rd.

2,236. Electric Pedal Switches. Robert Bosch (firm of). February 11th. (July 29th, 1914.)

2,248. Electric Welding. E. I. Heinsohn. February 11th. (February 21st, 1914.)

3,283. Electric Controllers. Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). March 1st.

3,565. Arrangements for Operating Switching Devices by Electric Current Impulses. O. Imray (Siemens & Halske Akt. Ges.). March 5th.

3,997. Electrically-driven Radial-arm Drilling and the like Machines. H. Wilkinson. March 13th.

4,097. Production of Rontgen Rays. J. E. Lilienfeld. March 15th. (November 15th, 1913.)

6,196. Combination Electric Switch and Fuse. A. H. Short. April 26th. (Addition to 8,455/14.)

Strike at Schenectady.—**A Central News dispatch says that 10,000 men employed in the workshops of the General Electric Co. at Schenectady, New York, struck work on Monday.**

THE
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Vol. LXXVII.] CONTENTS: October 15, 1915. [No. 1,977.

Page
The Metric System and Decimal Coinage: Shall we Adopt Them? ... 481
Copper ... 482
The Appeal from the Trenches for More Munitions ... 482
The Electrical Industry in the United States, by "Contango" 483
Engineering and other Societies: The 1915-16 Session ... 484
Decimal Coinage and the Metric System ... 485
The Modern Electric Elevator (*illus.*) ... 486
A Thermostat for Moderate and High Temperatures, by J. L. Haughton and D. Hanson (*illus.*) ... 489
New Electrical Devices, Fittings and Plant (*illus.*) ... 490
Legal... ... 492
Business Notes ... 494
Notes ... 499
City Notes ... 501
Stocks and Shares ... 503
Share List of Electrical Companies ... 504
Market Quotations ... 504
The Isolation of Vibrational Disturbances, by F. H. Davies (*illus.*) ... 505
Energy Consumption in Condenser Auxiliaries (*illus.*) ... 508
Ignition Magnetos (*illus.*)... ... 509
Correspondence—
The Institution and Alien Enemy Members ... 511
The A.E.G. Meeting ... 511
War Items ... 512
New Patents Applied for, 1915 ... 512
Abstracts of Published Specifications ... 512
Contractors' Column ... Advertisement page xx

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THE METRIC SYSTEM AND DECIMAL COINAGE: SHALL WE ADOPT THEM?

IT is universally recognised that the vast upheaval which is shaking the foundations of civilisation and engrossing the attention of all humanity will not pass away and leave things as they were. We shall find ourselves in a changed world, faced with new conditions, and with a very different outlook upon our surroundings; neither business nor pleasure will be "as usual"—we shall have to adapt ourselves to conform with the new *régime*, and to bring ourselves into harmony with our environment as closely as possible. "Efficiency" in all respects must be our watchword—efficiency in organisation, in production, in distribution—and in order to attain efficiency every obstacle to our industrial and commercial progress must be removed, gently if possible, but firmly in any event. We are only gradually learning the lesson; our rulers have not yet dared to call upon us as a nation to make the supreme sacrifice and to attain the highest ideal of patriotism by subordinating ourselves and our private aims and feelings absolutely to the imperative needs of our country—but the time is fast approaching when they will do so. It is an epoch in the history of our race—we trust, a triumphant epoch; only those who merit victory can command it, and we confidently believe that the nation will prove itself worthy, as it has done before, and will shoulder the burden cheerfully and with unflinching determination to conquer.

But it is not only in the ranks of the Army and Navy, or of the makers of munitions of war, that self-sacrifice must be manifested; in every part of our social, domestic, and political life the welfare of the nation must be the predominant consideration, before which all private interests must give way. We are a conservative people—but we must learn to be progressive, bearing in mind that any hindrance to our progress must be ruthlessly flung aside. And surely there is no greater obstacle to our commercial welfare than the obsolete systems—if such they can be called—of coinage, weights, and measures that handicap our intercourse with foreign nations and impede the development of our trade, to an extent that is fully realised by few. We have for many years advocated reform in this connection, and we believe that the return of peace will afford an ideal and unique opportunity to bring it about—an opportunity such as may never recur.

In normal times, a great objection to the adoption of new weights and measures has been the "dislocation of trade" that many feared would ensue; now that our export trade has undergone a compound fracture, surely no one will hint at dislocation. The mind of the country is aroused; men and women in all ranks of society are alert, they are in a mood to receive new ideas, and to consider them without that tendency to prejudice with which we are afflicted in time of peace. Now, then, is the time; and we earnestly call upon all advocates of efficiency and reform to aid us in our efforts to convince the opponents of change that it is their duty to accept new systems of weights, measures, and coinage, for the sake of their country's welfare.

During the past month we have been preparing to open a campaign for this purpose, with the results which are set forth elsewhere in this issue; the prospects are far more favourable than we had dared to hope, and we are encouraged to believe that at least one great blessing may perhaps be gathered from this otherwise accursed conflict of the nations—the reform of our units.

While our inquiry made no pretence of being exhaustive, it was addressed to very diversified classes of firms, and the answers appear to be derived from all parts of the field embraced; they may therefore be taken to represent the opinions of a fair sample of the British manufacturers belonging to, or connected with, the electrical industries, and this view is strengthened by the fact that the proportion of ayes to noes has remained roughly constant from the time when they began to come in. Many of the replies were accompanied by interesting letters, a selection from which will be published in due course.

We may observe that, while we have here coupled the metric system and decimal coinage under one heading, we do not suggest that they are necessarily combined or interdependent; either could be adopted without the other, and it is interesting to note that although the numbers respectively for and against these two items are approximately equal, many of our correspondents favour one whilst objecting to the other. In view of the necessity of economising clerical labour after the war, we are disposed to regard the adoption of decimal coinage as of importance second only to that of the metric system. No one who has lived abroad for any length of time will dispute the assertion that facility in dealing with decimal coinage is acquired in a very few days, and that the simplicity of the system endows it with immense advantages over our awkward sub-divisions, rendering many calculations almost automatic. Similarly, it is to those who have had extended experience of the use of metric weights and measures that we should turn for guidance; and their verdict is unanimous. Most of the opposition to both systems is, we believe, founded upon lack of acquaintance with their true merits, and upon erroneous ideas regarding the difficulty of adopting them in office and workshop; we shall endeavour to convince the sceptics, asking them in the meantime to preserve an open mind, and to weigh judicially the pros and cons.

Copper.

The copper market has maintained a pretty uniform appearance of firmness, and it has become increasingly evident during the past few weeks that producers in America are in a position in which they can practically enforce their own terms. The fact that the financial centre of the world has, as one of the results of the war, practically left this country and settled itself in New York, is bound to play a more and more important part in the furtherance and extension of speculative operations across the Atlantic in all directions where the abundant supply of capital becomes a necessary accessory. So long as London regulated the world's money market, so long were American speculative interests, which were dependent upon the money market for carrying out their plans, continually thwarted, besides having their plans of campaign rendered the more difficult to arrange owing to the necessity of taking the London money market into their calculations. All this is now a thing of the past, and America, by drawing gold by the tens of millions from Europe, has assumed a financial superiority which her most enthusiastic financiers never foresaw. America can now finance copper by the hundred thousand tons if she chooses to do so, without any undue anxiety regarding the immediate consequences, and the outlook for the copper market has, therefore, undergone a fundamental alteration with the recognition of this fact by leading producers across the Atlantic. There is no longer any pretence made that consumption is absorbing output. Leading American smelters and refiners, indeed, state that they are accumulating stocks at their refineries, but they add that financial conditions are so altered that they can easily afford to pursue a policy which, but for the war, would have landed them inevitably, and in a short time, in an uncomfortable situation. Trade buying is pretty good, but naturally enough falls far below that of normal times, if only for the reason that Central Europe is cut off from the rest of the world. There is not much speculative interest taken in the London market; indeed, there is no money in this country available for speculation, and there will be less and less as the drain of capital proceeds without cessation. The Americans may continue to accumulate copper until the end of the war (whenever this may be), but if they are going to finance a tonnage increase at the present rate from now until then, there seems under the present somewhat disconsolate surroundings the chance of sufficient copper being piled up across the Atlantic to supply the entire world's requirements for many months *ex* stock. It is useless to attempt to forecast the future under the topsy-turvy conditions prevailing to-day; but for the time being entire control of the situation seems to be vested in producers.

The Appeal from the Trenches for More Munitions.

A REPORT prepared by another party of munition workers who have been to the Front, makes an urgent appeal on behalf of the Forces for more shells, more high-explosive shells, more galvanised iron to make roofs for the trenches, more expanded metal to hold up the sides, and more cable for communications. The men called for more of this, and more of that, but the deputation also saw the need as well as heard it expressed, and they appeal to everyone without exception, to give their best efforts and maintain such a record that the results will sustain all wants at the Front. The report, which is signed by representatives of the Steam Engine Makers' Society, United Brass Founders' Society, the Amalgamated Society of Engineers, the Electrical Trades' Union, and the Boiler-makers' Iron and Steel Shipbuilders' Society, says among other things:—"Industrial stoppages, for no matter what motive, cause great indignation. Our troops feel that, while they toil and fight under the full stress of modern military conditions, it is wicked and wrong for anyone to impede their supplies. Every course of action, whether by employers or men, that results in a limited output is regarded with the same detestation." Further: "Nothing more inspiring than the sight of our men at the Front can be imagined, and we return from our tour with a single desire—to do all in our power to maintain and increase the supplies on which the success of their heroic endeavours depends, and without which all they have been giving, and must still give, will have been given in vain."

We trust that such words as these, telling such terrible truths, will burn their way into the minds and hearts of all who have in hand any work whatsoever, the expediting of which may help to back up those who are fighting for, or with us, on so many Fronts. Such testimonies should not be merely printed once in the morning newspapers, to be overlooked among the other important matters of the day, or circulated in a "report to members," to be put out of sight after once perusing; they should be used as effective posters, printed in big type and placed on hoardings wherever vital manufacturing operations are proceeding, and in the thousand munitions factories too.

THE ELECTRICAL INDUSTRY IN THE UNITED STATES.

By "CONTANGO."

[This article contains a general view of present conditions, with some specific facts of interest to the manufacturer and central station manager alike. The author is a well-known financial writer of Chicago and New York, who also specialises on electrical matters, and who has just come safely through the War Zone.]

It is generally said in the United States that advertising bills are always the last to be paid, be it by manufacturing concerns or by big corporations. Whether this is the case in England, and why it is so in the United States, one does not know. But one does know that when times are bad and business is poor, in nine cases out of ten the advertising appropriation is the first to be cut, and also that the only man who does good business at such a time, and progresses in spite of depression, and the "cut expense at any cost" policy of his fellows, is the odd man who persists in sticking to it with his advertising. It is unusual, because, of course, he is the unusual man. This being the case, and it certainly is so in the States, in the opinion of one who derives his opinions from 25 years of observation, it may be stated that one and all of the great American corporations, industrial and public utility, started this year with a substantial cut in their annual appropriation for advertising. Let me give a succinct example of what this means. One of the great Chicago public utility companies has been accustomed for several years past to spend $260,000 a year on advertising put out by its advertising department, not to mention considerable in addition authorised by the executive department; but in January this year, when considering the Budget with a view to the future, it cut that figure by just about $50,000. Has the business of 1915 so far justified this, and was the economy a wise one? To the first question the answer must be "Yes"; to the second as a general proposition, the answer must be "No," and, in this particular instance, also "No," because there has been a betterment in the autumn outlook in the States for the first time since 1912. Therefore, continuous advertising would have been better.

Literally, as far as the electrical industry is concerned, there has been poor business, with a rather poor outlook since the middle of 1913 up to August of this year. Even the most determined boosters have allowed this "on the quiet," if not in public. The year 1913 closed with the tide decidedly at the ebb and business very dull. Then the beginning of 1915 showed a very slight turn with, however, a considerably larger volume of business than at any time in 1914. Though the American exports showed a big jump towards the closed of 1914, the electrical industry was not responsible as yet for much of this. Provisions and grain and the steel companies had the lion's share. However, there are very many manufacturing concerns identified with the electrical and kindred industries rushed at this time with war orders. To what extent this benefits the industry as a whole is a moot question; in ordinary times there would have been extreme difficulty in filling normal demands of central station systems and of electrical plants in all parts of the country, also the dealer in electrical supplies would have been hard put to it to get any orders through, but until just recently the central station systems and other electrical plants, as well as the dealer, had not been in the market to any extent; moreover, it must be noted here that while an increase in the use of electric power is steadily maintained by a change from steam, or by installations in new factories, yet, owing to the shutting-down of activity in many industrial lines, this development has not gone ahead as fast as usual. The point to consider in a broad way is, assuming the war to last for a considerable time longer, to what extent will the United States become the workshop of the world? England is more and more taken up with war needs in all branches of trade, so for that matter is France, and so will be any nation engaged in the conflict. Germany doesn't count, because her ability to do anything outside of herself has been completely crippled. This, then, bears on the immediate future to the extent that no man can tell at all what will happen in regard to the expansion of the electrical industry from the manufacturer's point of view by reason of the electrical needs of other nations. As to the central station, capital has for two years been withheld from the development of this branch. Extensions, as well as new projects, have been held back. Combination and consolidation of plants into systems have remained dormant. The usual capital released would, therefore, bring about tremendous expansion. But the question is, where is the capital to come from? As a rule it has flowed not only from England but from other European countries, or at any rate to the extent that international finance has played a sufficient part in American affairs to set free home capital in large quantities, both for the manufacturing end of the industry and the development of new centres of generation. But there is no such international finance these days.

There are in all parts of the country hydro-electric developments which it was intended to put into operation long ago. In the big centres of population the increase in building and new additions is beginning to crowd the existing generating stations. It must never be forgotten that the population is always increasing, and in the United States the growth of cities is extraordinarily rapid. All this increase in growth calls for an ever-increasing electrical supply, and the increase in the use of current means corresponding increase in the manufacture of transformers, cables, everything connected with the transmission of "juice" in fact, and then comes the increase in the use of appliances, devices, lamps and electrical conveniences of every kind. In the United States everything is electrical.

In point of fact, the electrical supply men, and even manufacturers, have said "nothing doing," when asked how business has been, at any time during the past two years. The outlook, however, is rather different now, for there is pressure from within and from without. If investors will get over their timidity and let their money go to help supply, even a portion of that daily five million dollars which it is estimated is needed at this period by the electrical central station industry as a whole, then there will be a tremendous forward movement in the United States, the signs of which are already slightly indicated.

One thing good has happened from the forced economies of the last two years, and that is the large organisations have learnt exactly where there has been waste and where hidden extravagance has gone on unchecked. Many corporations offered prizes to their employés for suggestions as to where a saving might be effected. This brought out all manner of unsuspected leaks. To be specific, one corporation used to allow each of its departments to handle its own stamps practically just as the head of the department would instead of having a central mailing department. This has now been established, and the result is a very remarkable saving in the stamp appropriation. Specific details such as these are given to show how very thoroughly in the past two years there has been a house-cleaning with the American corporations and industrial concerns. In conclusion, it may be stated most emphatically that the electrical industry in the United States has weathered the past two years of stress better than any other section of the industrial world. As to the central station systems, they, too, have for the most part kept up their interest and dividends. The number of failures has been comparatively small, though, of course, to achieve these results they have had to reduce their force of employés very considerably in all sections of the country.

The outlook, then, is good, better than it has been for a couple of years, and it is quite possible that the future may be one of very extraordinary growth, at any rate so far as the manufacturer is concerned. The English reader now has the facts before him as to existing conditions in the States and can be so guided.

New Diesel Engine.—A new type of Diesel engine has just been completed at the works of Messrs. Franco Tosi, at Legnano. It is of 1 000 H.P., and is intended for electrical work at the Government docks at Taranto. The engine, which is stated to embody several improvements, is of the four-cylinder, two-cycle single-acting type.

ENGINEERING AND OTHER SOCIETIES: THE 1915-16 SESSION.

We have made inquiries of the secretaries of various engineering and other scientific societies and organisations with reference to arrangements for the session which is now beginning. While many familiar faces will be missing owing to the war, in only a few cases has it been found necessary to make any material alterations so far as the holding of meetings is concerned. Meetings of graduates and students would hardly be expected at such a time when men of eligible age are either with the Forces or engaged upon engineering munitions work. We give below the result of our inquiries:—

Institution of Electrical Engineers.—The Institution will hold its first London meeting for the session on Thursday, November 11th, when Mr. P. C. Sparks, the new president, will deliver his inaugural address. The London and provincial Sections will meet practically as usual, but it may happen that one or two of the Local Sections will slightly reduce the number of meetings. The number of members of all classes with the Forces is at present 1,100.

The arrangements for the first half of Session are as follows:—

November 11th.—Mr. C. P. Sparks's Presidential Address.
November 25th.—Prof. A. B. Field, "Difficulties of Design of High-Speed Generators."
December 9th.—Mr. J. R. Beard, "The Design of High-Pressure Distribution Systems."
January 13th, 1916.—Prof. Miles Walker, "The Predetermination of the Performance of Dynamo-Electric Machines."
January 27th.—Mr. N. W. Storer, "The Possibilities in the Design of D.C. Traction Motors, &c."

The Institution of Civil Engineers.—The sessional meetings of the Institution will be held fortnightly as last year. The papers submitted for discussion in the early part of the session will include several communications on the question of wave-action in harbours, and papers on "Economy in Turbines and Condensers," "The Punjab Triple Canal Project," "The Main Drainage of Cairo, and the Rangoon River-Training Works." Naturally, the meetings will be considerably affected by the war, and following the course adopted last year, it is not proposed to hold Students' Meetings. The secretary (Dr. J. H. T. Tudsbery) already has a note of the names of some 1,500 of the members and students of the Institution who are in naval and military service, and it is probable that a larger number is so occupied in transport and munition work of all kinds that, for the time being, their attention must be altogether withdrawn from participation in the work of professional societies.

Institution of Mechanical Engineers.—A list of dates of meetings has just been issued. The first meeting takes place to-night, as already announced. Approximately 610 members of all classes of the Institution are serving in the Army or Navy.

Association of Mining Electrical Engineers.—It is not at present contemplated that the usual arrangements for branch meetings during the forthcoming Session will be altered consequent upon the war. The branches make their own arrangements regarding their meetings. So far as has been ascertained, 79 members of the Association are serving with the Imperial Forces.

Institution of Mining Engineers.—The general and annual general meetings of this Institution will be held next year, as usual, but the dates have not yet been fixed. About 250 members are at present serving with his Majesty's Forces, and we regret to learn that 20 members have been killed in action.

Faraday Society.—No particular alterations are being made in arrangements for the forthcoming session. A meeting is to be held on Tuesday next as announced to-day in your "Forthcoming Events." The society will hold a general discussion on "The Corrosion of Metals," the date of which will, in all probability, be early in December. Further details with regard to this meeting will be available later. A register is in course of preparation of members serving at the Front or serving H.M. Government in other ways.

Junior Institution of Engineers.—The meetings will be held as usual; the monthly one on the second Monday in the month, and the weekly ones every Friday. Approximately 185 members have joined the Forces. The following arrangements are announced:—

Friday, October 22nd.—"Safety Precautions for Transmission Machinery," by Mr W. V. H Capps.
Friday, October 29th.—"Electric Clocks," by Mr. W. B. Prince.

Association of Charge Engineers.—The Session opened on Wednesday last with the presidential address of Mr. Frank Bailey. It has been only with great difficulty that arrangements for the Session have been made. All the usual Socials have been dropped for the year, but a date has been provisionally fixed for the Annual Dinner "in the hope that we may have good cause for rejoicing." Many members have resigned previous positions and entered upon service in munitions factories; some are in the R.N.A.S., and others in other branches of the Forces. The following are some of the fixtures for the Session:—

December 8th.—Mr. A. E. Penn on "Ammunition Manufacture."
January 12th, 1916.—Mr. W. H. Booth on "Limit Gauges and their Applications."
February 9th.—Mr. Wilfrid Stokes on "Multiple Effect and Systems of Refrigeration."
March 8th.—Mr. W. H. Petty on "Lubricating Oils."
March 25th.—Annual Dinner.
April 12th.—Mr. Gerald Stoney on "Steam Turbines."

Society of Engineers (Inc.).—Meetings will be held as usual. No alteration was made last session, and the attendances at meetings were quite up to the average. The list of members with the Forces is very incomplete, containing the names of only 42 gentlemen.

North-East Coast Institution of Engineers and Shipbuilders.—No alterations are contemplated in the meeting arrangements for the Session, beyond that the meetings of the Graduate Section will be curtailed owing to the fact that a large number of Graduates are away on Active Service. The active Session of the Institution begins on Friday, the 29th inst., when Mr. Herbert Rowell, president elect, will deliver his presidential address. The following and other papers will be read on dates to be announced:—

"The Time Element in some Ship Calculations," by Prof. J. J. Welch.
"Notes on Ship Model Experiments," by Mr. G. S. Baker.
"The Education of Youths before and during their Apprenticeship," by Principal V. A. Mundella.
"The Organisation of Works," by Mr. P. B. Newell.
"The Standardisation of Stability Curves," by Mr. Wilfred Ayre.

So far as is known the number of members serving with the Forces is 150.

Manchester Association of Engineers.—The coming session will be on practically the same lines as those of previous years. The inaugural address of the President (Mr. Samuel Boswell) was delivered on Saturday last. Other items in the Syllabus are as follow:—

October 23rd.—Prof. J. E. Petavel (Manchester University), on "Notes on Some Recent Researches."
November 13th.—Mr. C. E. Stromeyer on "Science and Practice in Engineering."
November 27th.—Mr. H. J. Moysey on "Design and Application of Ball Bearings."
December 18th.—Topical Discussion Evening.
January 8th, 1916.—Mr. Alfred Etchells on "The Importance of Uniform Conditions for Engineering Operations and Industrial Work."
January 22nd.—Mr. E. L. Rhead on "Cast-Iron: The Strength and Properties of Castings."
February 12th.—Mr. G. E. Windeler on "Oil Engines."
February 26th.—Mr. Ernest F. Lange on "Cast Steel as a Material of Construction."
March 11th.—Mr. James Tinto on "India-Rubber and Balata Belting as Conveyor and Power Transmission Belts."
March 25th.—Report of the Tool Steel Research Committee.

Post Office, Telephone and Telegraph Society of London.—The membership of this Society is open to both sexes. About 50 male members have joined the Forces. The Society was reorganised on its present basis for the 1913-14 session, and the membership would have increased but for the war, which depleted the staff eligible for membership and caused additional demands upon those remaining behind. The following arrangements have been made:—

October 25th.—Presidential Address by the Postmaster-General, followed by an Address on "Telephones, Provincial Organisation and Development," by Mr. R. A. Dalzell (Secretary's Office).
November 22nd.—"Telegraph Experiences in India," by Mr. J. J. Tyrrell (Central Telegraph Office).
December 14th.—Fifteen Minute Papers:—
  "Supervision as Seen from Below," by Mr. S. A. Coase (C.T.O.).
  "Phonograms," by Mr. B. R. Mead (L.T.S.).
  "The Deficit on the Telegraphs," by Mr. W. H. F. Webb (C.T.O.).
January 24th, 1916.—"Public Administration and Finance. The Correlation of," by Mr. F. C. Cook (Accountant-General's Department).
February 28th.—"Loading of Telephone Circuits," by Mr. A. B. Hart (Engineer-in-Chief's Office).
March 27th.—"Telegraph and Telephone Work in a Provincial Depôt," by Mr. J. M. Rusk, of Stores Department, Edinburgh.
April 18th.—"Telegraph Tariffs and Economic Needs," by Mr. John Lee (Telegraph Traffic Manager, Secretary's Office).

Association of Electrical Station Engineers.—No particular arrangements made for the Session. Meetings will be held as and when required. Efforts are being made to hold regular meetings at the Newcastle and Manchester branches. Approximately 250 members are with the Forces.

Chemical Society.—The ordinary Scientific meetings will be held as usual, commencing with an informal meeting on Thursday, October 21st. Lectures have been arranged for as follows:—November 18th, by Dr. E. J. Russell; February 3rd, by Prof. W. H. Bragg; May 18th, by Prof. F. Gowland Hopkins.

Salford Technical and Engineering Association.—No alterations will be made. So far 35 members have notified the Secretary that they have joined the Forces.

Batti-Wallahs' Society.—The policy of the Society for the coming season has not yet been decided on. Out of a membership of about 250, between 40 and 50 are on active service.

Institute of Metals.—No alterations in arrangements consequent upon the war. The annual general meeting will take place as usual, in March, 1916, followed by the annual May Lecture in May, 1916. The number of members with the Forces is, approximately, 80.

Wolverhampton and District Engineering Society.—It is hoped to keep going as in previous years, but the syllabus is not yet prepared. Out of a membership of 150, 25 are with the Forces, and many, indeed most of the remainder, are engaged in different kinds of war work. There is, therefore, difficulty in securing suitable papers.

Nottingham Society of Engineers.—Consequent upon the war the meetings are being held monthly instead of fortnightly, and the number of works visits has been reduced. Approximately, 20 members are with the Forces. The society has proffered assistance to the local Munitions Committee. The President-designate, Brigadier Com. G. M. Jackson, is engaged on military service, and Mr. W. Ralph Bates (Alfreton Ironworks), a Life Vice-President, was elected President for the session 1914-15. The following arrangements are announced:—

October 20th.—"Steam Turbines, Blowers and Compressors," by Mr. J. Golder (Messrs. Fraser & Chalmers, Ltd.).
November 17th.—"Layout and Equipment of Engineering Works," by Mr. F. A. Garrett (Messrs. Ruston, Proctor & Co., Ltd.).
December 15th.—"Steel," by Mr. A. W. Shepherd (Messrs. J. H. Andrew and Co., Ltd.).

Diesel Engine Users' Association.—Regular meetings recommence on October 20th, when there will be a further discussion on the lubrication of Diesel engines. Most of the Association's 50 members have important responsibilities at home in connection with the supply of electric power for public purposes and for war factories. Many are working in connection with the various Munitions Committees or are on special constabulary service. Among those engaged on Active Service with the Forces are Capt. W. E. Brandreth, of High Wycombe, the hon. sec., whose place during his absence is being taken by Mr. Percy Still; Mr. A. C. Gilling, of Epsom; Mr. T. E. Eachus, of St. Albans; and Mr. A. N. Rye, of Guernsey.

Greenock Electrical Society.—The first meeting of the session takes place to-night as announced in our "Forthcoming Events." The syllabus for the session contains many interesting papers and visits. Mr. W. B. Smith, A.M.I.E.E., chief assistant electrical engineer, Greenock, is the president for the ensuing session, and the hon. secretary is Mr. H. G. Wright, Electricity Offices, Greenock.

DECIMAL COINAGE AND THE METRIC SYSTEM.

Realising some time ago the extreme importance of removing every impediment to our foreign export trade, in order that we may be able to withstand the onslaught that Germany is sure to make upon us in the industrial war when "peace" is restored, the Editors of this journal took steps to ascertain the views of manufacturing firms belonging to or associated with the electrical industries, with regard to the desirability of adopting the metric system of weights and measures, so as to facilitate our dealings with countries in which it was in force. We also took the opportunity of putting questions to them on certain other points, which were embodied in the following circular letter:—

DECIMAL COINAGE AND THE METRIC SYSTEM.

Dear Sirs,

In our issue of August 13th (p. 214) we published a letter written by a British commercial traveller to the British Chamber of Commerce in Italy, in which it was pointed out that price lists and quotations in English coinage, weights, and measures were unintelligible to Continental buyers, and that it was impossible to secure their orders unless our offers were made in terms of decimal coinage and the metric system.

We have for many years supported this view, and have advocated the national adoption of the metric system not only as a key to the trade of the Continent, but also as an invaluable aid to the development of engineering trade with the whole world; if this course is not yet possible, there is at any rate nothing to prevent to use of the metric system in preparing catalogues, price lists, and quotations for foreign countries. Some British firms have already adopted this policy, with advantage to themselves, and we are desirous of ascertaining the extent to which it has been pursued, with a view to promoting its further development. We should be much obliged, therefore, if you would kindly furnish us with replies to the questions subjoined, which will form the basis of a future article in the Electrical Review:—

1. Do you employ the metric system in your correspondence with foreign clients?

2. Are your products
   (a) described in your catalogues in terms of metric weights and measures?
   (b) priced in terms of foreign coinage?

3. Do you employ the metric system in your workshops?

4. Are you in favour of the adoption in this country
   (a) of decimal coinage?
   (b) of metric weights and measures?

5. May we quote your name in referring to your replies in the Electrical Review?

We enclose a copy of the questions and an addressed envelope to facilitate reply, and trusting that we may be favoured with your kind assistance in this matter,

We are, dear Sirs,
Yours faithfully,
The Editors.

September 15th, 1915.

Some 450 copies of this letter were sent out, to firms representing a very wide range of interests; over 120 replies have been received, which we consider a very satisfactory proportion, having regard to the experience of everyone who has conducted a similar plebiscite, and to the heavy pressure of work on the shoulders of the majority of British manufacturing firms. While we have not space to deal with the replies individually, we propose to publish a selection of them, representing both sides of the questions under discussion, and to tabulate the results of the voting with fairness to both parties. Afterwards we hope to show good reasons for our belief that the adoption of the metric system and of decimal coinage would be of advantage to this country, and would not entail the expense and inconvenience with which the change is generally charged; but first we wish to express our cordial thanks to all those gentlemen, without respect to party, who have favoured us with their views on these important questions, and to add the hope that many of those who have not yet replied will kindly do so without delay—that they will sit down *right away* and do it before they forget. We should also welcome answers to our questions from any or all of our readers, particularly from manufacturing firms and others connected with the electrical industries. In view of the limitations of our space, we reserve our discretion as to the publication of letters on the subjects here dealt with, but while we ourselves are emphatically in favour of root-and-branch reform, we will publish a fair proportion of the arguments that may be put forward to the contrary. We will not, however, bind ourselves to insert any suggestions for tinkering with our existing weights and measures—we regard such proposals as tending to aggravate the trouble, and we stand for uniformity with other nations, or no change at all.

The following table summarises in briefest form the answers to our inquiries. Some explanatory comments will not be out of place. Obviously, our questions could not be detailed and verbose, and therefore could not cover a variety of contingencies; and the answers must be read in the same light, though in many cases detailed statements of great interest are made. Some of these will be reproduced in extenso later; at the moment we can only indicate the general tenor of the replies, and our method of construing them. For instance, in reply to question 3, some say "partly," others "yes"; we read both these as affirmative—the question was not meant to imply "to the exclusion of English measures," but to ascertain whether the metric system was used to any notable extent. Again, question 2 obviously relates mainly to catalogues destined for the perusal of foreign clients, and not necessarily to catalogues that are circulated only in this country. A firm that employs the metric system in correspondence with foreign clients "when this appears desirable" evidently *does* employ it, and the answer is "yes"; but where "no printed lists are current" we place the answer in the "doubtful" column. A firm that issues no price lists, but always quotes "in the language and coinage and measurements of any foreign country," obviously answers questions 1 and 2 in the affirmative. Where a firm states that in all its future catalogues the metric system will be used, the answer is taken to be "yes."

In many cases where the metric system is used in catalogues for foreign circulation, the local coinage is not used. This is often due to the fact that the rate of exchange varies, and hence it is not possible to quote fixed prices except in terms of English money. Another reason often given for not employing foreign coinage is that the business is done through local agents, who undertake the translation and printing of catalogues in their own languages; hence the British firm is not responsible for the production of these catalogues. Again, some firms report that their foreign trade is not considerable, and the question has, therefore, not arisen; in such cases their replies are entered in the "doubtful" column, which also contains replies in which the writer expresses no definite opinion or leaves the question unanswered.

Question.	Reply. Yes.	No.	Doubtful.
1. Do you employ the metric system in your correspondence with foreign clients? ...	86	25	10
2 Are your products			
(a) described in your catalogues in terms of metric weights and measures? ...	56	51	14
(b) priced in terms of foreign coinage?	41	62	18
3. Do you employ the metric system in your workshops?	61	54	6
4. Are you in favour of the general adoption in this country			
(a) of decimal coinage?	79	20	22
(b) of metric weights and measures? ...	87	21	13

From the foregoing table, it will be seen that the great majority of those who give definite replies use the metric system in their correspondence with foreign clients, more or less. Rather more than half give metric equivalents in their catalogues, in addition to English measures, or use the metric values alone. Only two-fifths price their goods in terms of foreign coinage; some of the reasons for this small proportion are given on p. 485, and must be admitted to be weighty. The majority employ the metric system to some extent in their workshops, as well as English units; a very few use the former almost exclusively; but nearly half the firms use English measures alone. Several report that no difficulty is met with in the use of the metric system.

The fourth question is one to which we attach great importance; the others relate to the existing practice of the writers, whereas the answers to the fourth tell us what they would like to do, and would do if everyone else would do the same. It will be seen that, excluding the doubtfuls, there is a majority of 4 to 1 in favour of the general adoption of decimal coinage and the metric system in this country.

(To be continued.)

THE MODERN ELECTRIC ELEVATOR.

In a paper presented at a meeting of the American Society of Mechanical Engineers, last year, Mr. David Lindquist, Chief Engineer of the Otis Elevator Co., outlined some of the peculiar features of modern elevator or lift practice, which on account of the many storied buildings met with in American cities, has been developed to a much greater degree there than in this country. The following is an abstract of certain portions of his paper:—

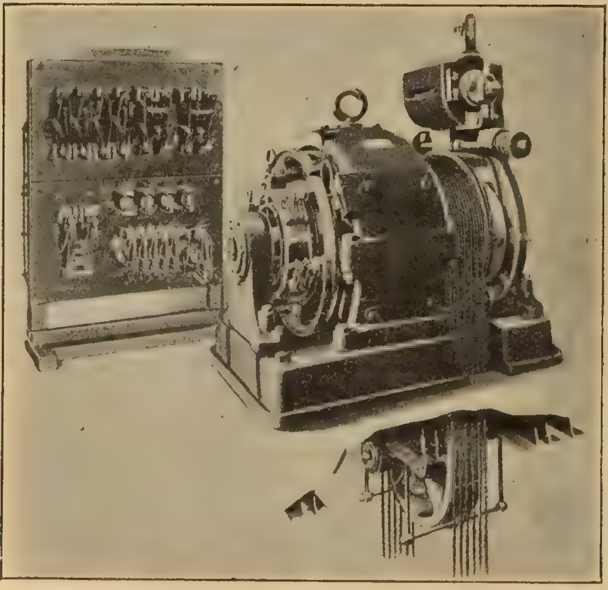
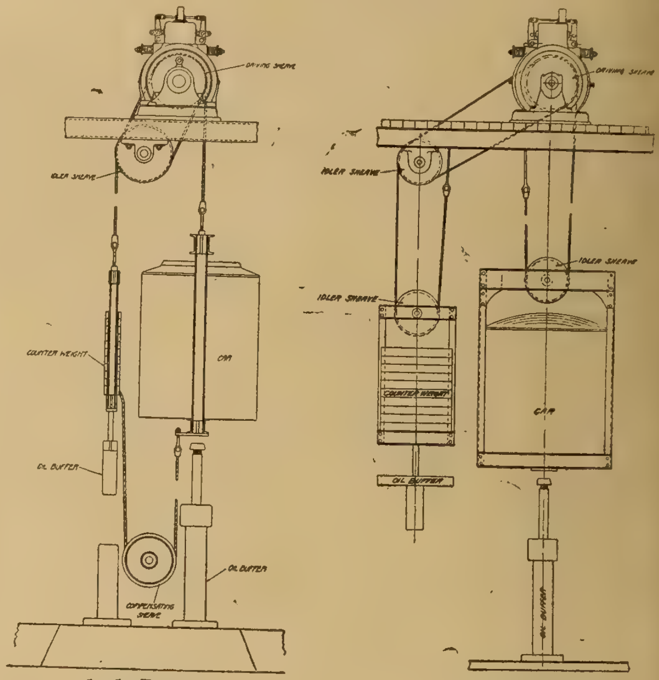


Fig. 1.—Overhead Installation of Gearless Traction Electric Elevator.

The most suitable arrangement when installing a traction electric elevator is to place the machine directly over the hatchway as shown in fig. 1. The advantages of so doing are better traction, less amount of rope, longer rope life, minimum space required, and higher efficiency. Placing the machine directly over the hatchway imposes a load on the building equal to the weight of the hoisting machine plus the loads on car and counterweight ropes, whereas placing the machine below imposes a load on the building equivalent to twice the loads on car and counterweight ropes. For a duty of 2,500 lb. at 700 ft. per min., the hoisting machine weighs about 16,000 lb., which is considerably less than the total load on car and counterweight ropes.

The roping of a so-called gearless 1:1 traction machine located overhead is very simple, as shown in fig. 2. The successful use in an elevator of a slow speed electric motor directly connected to the driving sheave was first accomplished about ten years ago.



1 : 1. Roping. 2 : 1. Roping.

Fig. 2.—Roping of Typical Gearless Traction Elevators.

At first glance it would appear as if the traction drive would be uncertain, the ropes on the driving sheave depending solely upon friction.

Before any of these traction machines were put on the market, a large number of tests were made under such variable conditions as would be encountered in actual installations. It was found that with one-half wraps around the driving sheave, the maximum traction relation—that is, the relation between the load on the heavy side of the ropes to that on the light side—was 1.56, and the minimum traction relation, with one-half wraps, was 1.4. With two half wraps the maximum relation is 2.43 and the minimum 1.96.

The maximum was obtained with a new turned sheave with practically new ropes and without any lubrication. The minimum was obtained with smoothly-worn sheave and ropes well lubricated, and with comparatively light tension and high speed. The principal reasons for this result are that with light tension and high speed there is an oil film between the rope and the sheave; moreover, the rope does not make contact over fully 180 deg. with the sheave, due to the stiffness of the rope and centrifugal action.

Under ordinary conditions a 1:1 traction machine is usually provided with six ropes, $\frac{5}{8}$ in. in diameter. The material is of soft steel, and in actual installations this will give a safety factor of not less than twelve.

Each rope is provided with a self-adjusting swivel rope hitch of the ball and socket type. This permits a gradual creeping and thus prevents any excessive twisting strain, and relieves the rope of the bending strains at the hitch, principally caused by vibration.

Traction elevators are arranged so that in case of overrun at terminals, either the car or counterweight bottoms on a buffer, thereby reducing the traction sufficiently to prevent further motion of the car and counterweight even if the motor keeps on running.

The buffer is usually an oil buffer of a spring-return type placed in the bottom of the pit.

In very high lifts the rope weight will cause considerable traction, which with the momentum of the car or counterweight may cause either of them to travel into the overhead work, and therefore a retarding and latching device is fitted at the top of the hatchway for both car and counterweight in addition to the buffers in the pit. The counterweight equals in total weight the weight of the car plus usually about 40 per cent. of the maximum load. In an elevator of 2,500 lb. lifting capacity this equals 1,000 lb. (the overbalance), which represents six or seven people. With these in the car giving balanced conditions, the only power required would be for acceleration, friction and electrical losses.

It is obvious that with a high rise elevator the variation in the net load on the elevator machine due to the shifting of the weight of the hoisting ropes from one side to the other of the driving sheave as the car moves up and down, would be excessive if this were not compensated for. This compensation is usually obtained by means of chains or ropes attached to the car and counterweight, and running down the hatch in a loop.

The weight per foot of these compensating ropes is such that they, together with the electric cables (that lead to the car), will compensate the weight of the hoisting ropes regardless of the position of the car.

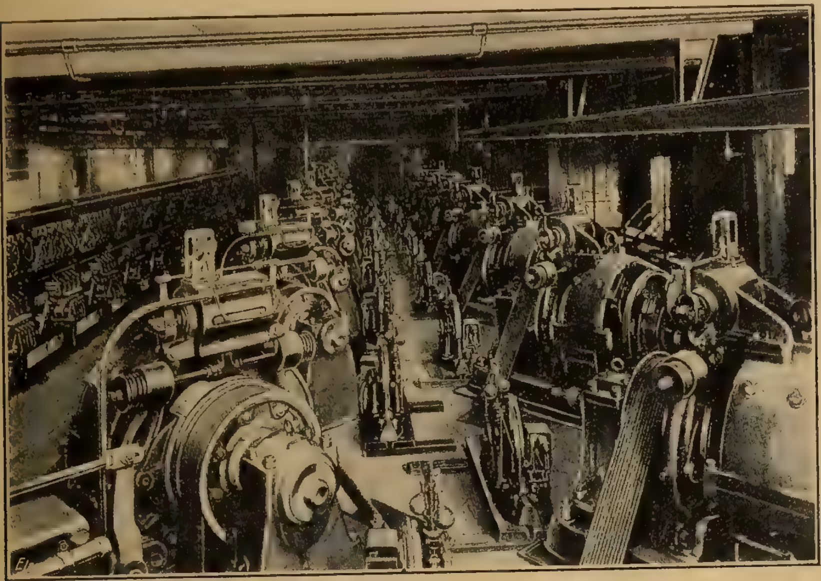


Fig. 3.—Installation of Traction Electric Elevator Machines with Plain Babbitted Bearings.

For all high speed high rise elevators, compensating ropes are used. In the pit a tension device is provided for the compensating ropes. For moderate rises and comparatively slow speeds, chains may be used instead of ropes.

The motor is of the slow-speed type, generally six-pole and usually provided with shunt field only; the armature is series wound with rectangular cross section conductors. With a 36-in. driving sheave, a car speed of 600 ft. per min. corresponds to 63.6 r.p.m. of the motor. This type of motor for the gearless elevator has a high efficiency at light loads, which is advantageous where the average motor load is usually less than one half its rating. A motor installed in the Metropolitan Life Tower, rated at 38 h.p., has a full load efficiency of 89 per cent.; 91.5 per cent. at half load, and over 90 per cent. at quarter load. The speed is 58 r.p.m. at 110 volts. The driving sheave and brake wheel are of the rim type cast integral and bolted to the armature sleeve or spider. Circular rope grooves are employed. The brake is of the shoe type, and the magnet is usually provided with series-winding for quick release, and with a shunt-winding for holding. The brake shoes are provided with a lining of fabricated asbestos. A gradual and soft application of the brake is obtained by a particular method of magnetic retardation of the magnet cores, eliminating thereby the necessity for dash pots. A characteristic of the brake lining is that the friction is practically constant; with leather the friction coefficient decreases with the speed, which leads to creeping of the machine.

Bearings of the self-aligning type, and ball and roller bearings are used; the latter save space and often eliminate the necessity for double decking the machines.

In the case of elevators with 2 : 1 roping, the saving in space in connection with the sheaves becomes a necessity; for particularly in the counterweight sheave a plain babbitted bearing of suitable size would be almost impossible.

The author considers ball bearings superior to roller bearings for elevators; they can run slightly out of alignment without causing destructive strains or excessive friction, and will resist a certain amount of end thrust, which is not the case with roller bearings.

The principal loss in ball bearings is that caused by the viscosity of the lubricant and increases greatly with speed. It is partly due to churning and partly to the force necessary to squeeze the lubricant out of the path of the balls; the main use of the lubricant is to protect against corrosion.

For slow-speed bearings a moderately heavy grease which will not flow is the best.

The speed variation necessary in connection with high-speed traction elevators is obtained, partly by field regulation and partly by series and by-pass resistance in the armature circuit. The field regulation is usually capable of reducing full speed down to a speed from 60 to 40 per cent. of full speed; further slow-down is obtained by resistance control.

The combination of the two methods mentioned is necessary for obtaining sufficiently slow car speed (about 90 ft. per min.). This slow speed is required for making accurate stops both at intermediate and terminal landings, and also in order to make a very short travel, or to "inch" up or down, to the landing. The exceedingly slow speed automatically obtained when approaching terminal landings is necessary not only to secure accuracy of stops with varying loads, but to provide a fundamental safety feature. It may be mentioned that anti-friction bearings not only materially aid in obtaining smoothness of operation but greatly facilitate the "inching" up to the floor landings. As a matter of fact, the 1 : 1 electric traction machine with ball bearings has practically the smoothness of motion so much appreciated in hydraulic elevators.

In connection with the regular operating features of the control apparatus, there are also a number of other features introduced for the purpose of safety. Some of these may be merely mentioned without going into too great detail:—

(*a*) Automatic return of car switch to "off" position.

(*b*) Automatic stopping switch on car for automatic stopping at terminal landings.

(*c*) Final cut-out limit switches in hatchway operating independently of the automatic stopping switch.

(*d*) Switches operated by centrifugal governor automatically stopping the elevator in case of overspeed; the first switch cuts the power off from the machine and applies the dynamic brake effect to the armature, and the mechanical brake to the brake pulley; the second switch applies the light retarding force to the car safety referred to later.

(*e*) The safety switch in the car under the control of the operator also performs the same function as the two switches operated by the governor.

(*f*) Regulation of the shunt field by centrifugal governor to maintain constant full speed with variable loads.

(*g*) Oil buffers, previously mentioned, capable of independently stopping the fully loaded car when descending at 50 per cent. excess speed without discomfort to the passengers.

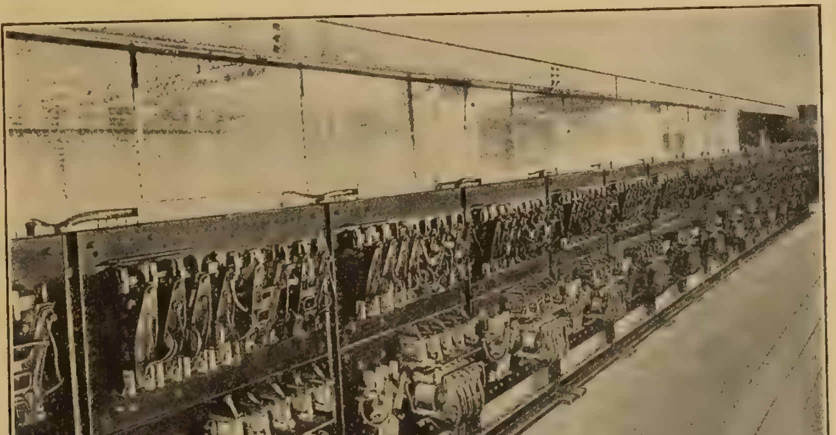


Fig. 4.—Group of Traction Elevator Machine Controllers in Overhead Installation.

(*h*) For high rise elevators the use of a mechanical retarding and latching device.

Gearless traction machines, utilising 1 : 1 or 2 : 1 roping, have been built for loads varying from 2,000 to 11,000 lb. at car speeds of 350 to 700 ft. per min. Of these duties the most generally used for the modern high office building, utilising 1 : 1 roping, is about 2,500 lb. at 600 to 700 ft. per min., although in many cases a speed of 500 to 550 ft. per min. is found suitable.

The high rise elevators in the Woolworth Building, N.Y., have a speed of 700 ft. per min.; in the new Equitable Building, N.Y., some of the express elevators travel part way at 650 ft. and the remainder, on local service, at 550 ft. per min., the speed change being automatic.

The curves in fig. 6, produced from elevator tests, show the relation between time and speed, for express runs and for stopping at every floor. The maximum speed in the latter case is only about 70 per cent. of express speed. This is, however, rather an extreme case, as the car was heavy and the ropes long.

For moderately high buildings a 2 : 1 roping is suitable for a car speed up to 450 ft. per min. Machines of the geared type are most suitable when lower speeds are involved or where service conditions are not so severe; they can never equal the gearless type in smoothness of operation. Two geared types have been developed, employing worm and herring-bone gear reductions.

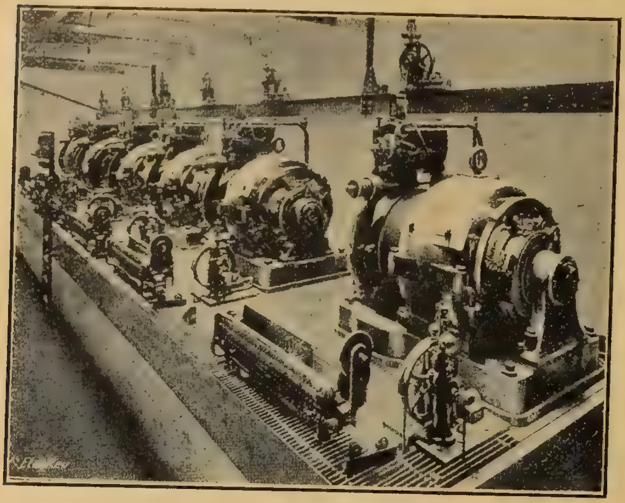
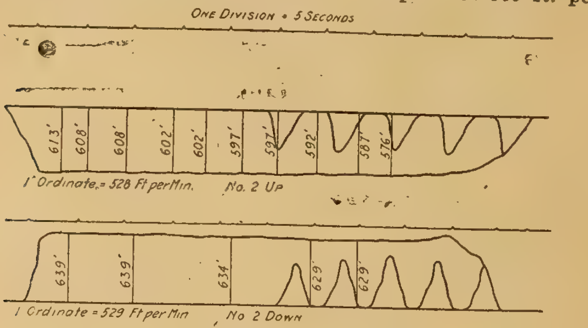


Fig. 5.—Installation of Ball-bearing Traction Machines.

The former is used extensively for slow and moderate speeds; the herring-bone gear is somewhat more efficient and has been used with some success on quite high speed elevators.

The worm gear has inherently less tendency to vibrate than the herring-bone gear.

Tests on one of the latter gears (9 : 1) showed a loss of 1.5 H.P. at a speed corresponding to a car speed of 500 ft. per min., due principally to the churning of the oil. If the oil is taken out of the gear case and the gear sprayed with sufficient oil to prevent cutting, the efficiency becomes practically the same at different speeds, being a little over 90 per cent.



Load in Car = 2550 Lbs. Stops at Terminals and at every Landing
Weight of Car = 5500 Lb. Overbalance 1050 Lb

Fig. 6.—Speed Curves: High-rise Elevator in Metropolitan Life Building Tower, N.Y.

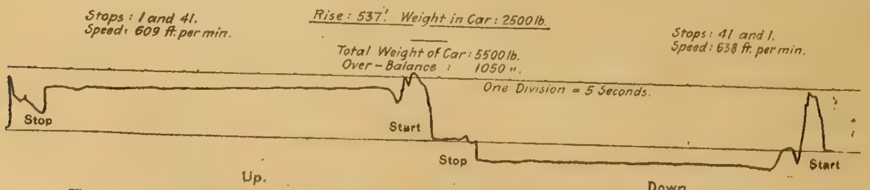
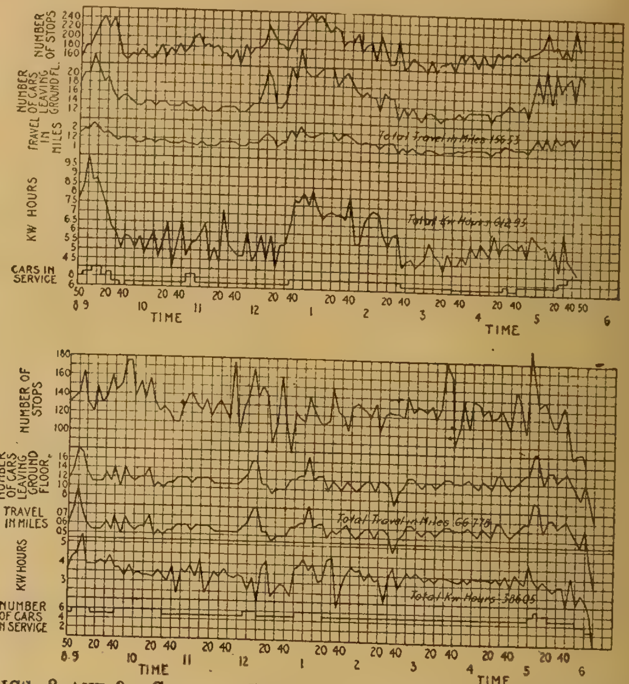


Fig. 7.—Power-Consumption Curve: Traction Elevator Machine, Metropolitan Life Building Tower, N.Y.

Tests of a 9 : 1 worm reduction showed an efficiency only 2 to 3 per cent. lower. Worm gears with high-pitched worms are not so inefficient as generally thought; the oil losses under similar conditions to these mentioned before, in this case also reach about 1.5 H.P.

Considerations of power consumption in the machine may be divided into three parts relating respectively to motor efficiency, gear efficiency, and inertia. The efficiency of the high-speed motor used with the geared machine is at normal loads less than that of the motors used with the gearless elevator, although its maximum efficiency may occasionally be as high.

An equal amount of field regulation may be applied to both high and slow-speed motors. The high-speed motor machine has under best conditions a gear loss of about 10 per cent., which is eliminated in the case of the gearless type.



Figs. 8 and 9.—Service Curves (Upper Chart Express, and Lower Chart, Local Service), for Elevators in Hudson Terminal Building, N.Y.

Kinetic energy, although the most important factor in power consumption, has been little considered, probably, owing to the difficulty in determining its amount in a complex elevator machine.

An idea of the relatively high cost of operation of electric elevators, utilising high-speed motors with gears, may be gained by means of the following example: Assume a weight of 1 lb. revolving at a radius of 9 in. at 800 R.P.M. (which is the speed usual with motors for worm gear machines). The kinetic energy to be imparted to this weight each time it is started from rest and brought to full speed will then be 61.3 ft.-lb.

If the elevator starts on an average of 4,500 times per day and runs 300 days per year, the cost of the energy absorbed for acceleration, at 4 cents per KW.-hr. would amount to $1.25 per lb. per year. If, instead of one lb., the weight were 219 lb. (which is the effective equivalent weight of a particular herring-bone gear machine), the cost would be $273.00 per year.

Of course, part of the kinetic energy required for starting is returned at the time of stopping, but, on the other hand, the starting efficiency is low, since a large amount of the power is lost in the starting resistance and some in the motor. The loss in the starting resistance and motor is certainly larger than the energy recovered at the stop, and hence the cost per year for accelerating and retarding 219 lb. of weight, under the above conditions, would amount to more than $273.00.

In ordinary passenger service the loads taken up and down are practically the same: the electric power is not primarily required for passenger transport but to overcome friction and supply the kinetic energy for each start less the amount recovered at the stop. The friction losses are by far the smaller of the two; therefore a comparison of the kinetic energies of two elevators in the same service, with the same method of control, gives a good idea of what their relative power consumption and rapidity of acceleration will be in actual service.

In the following tabulation are given the kinetic energies of two traction machines, one with herring-bone gear and the other gearless, both built for a car speed of 600 ft. per min., and for the same load. The herring-bone gear machine had a motor running at 505 R.P.M., a pinion with 23 teeth, gear with 213 teeth, and driving sheave 42 in. in diameter. The gearless machine had a motor running at 63.6 R.P.M. and a 36 in. driving sheave.

It will be noted that the kinetic energy per start of the herring-bone machine would be about 5.5 times that of the 1 : 1 gearless machine. Consequently, if the cost of power for accelerating and retarding the 13,400 ft.-lb. of the former amounts to $273 per year, the cost for the gearless machine would be $50.

Herring-bone Gear Machine.	Kinetic energy in ft.-lb.
Motor armature	7,420
Brake pulley	2,920
Driving sheave	1,000
Herring-bone gear	2,060
Total	13,400
Gearless Machine.	
Armature, brake pulley, driving sheave	2,450

The increased kinetic energy of the geared machine is not directly proportional to the speeds of the motors employed in the respective types, because the ratio between the kinetic energies of the driving sheave, brake and gear coupled to the motors is considerably less than proportionate to the motor speeds. If the armatures only are considered, the kinetic energy is more than proportional to the speed because the geared machine requires a larger motor on account of gear losses.

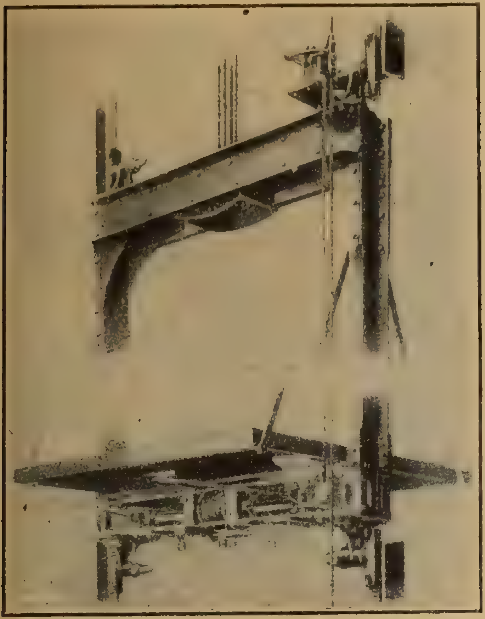


Fig. 10.—Arrangement of Wedge-clamp Safety.

The maximum efficiency of a gearless traction elevator in a New York telephone building, from line to load, allowing for all losses is over 71 per cent.; similarly, the maximum efficiency of a complete elevator with herring-bone gear machine in the New Yale Club building, N.Y., is about 62 per cent.

The two charts (figs. 8 and 9) show actual service conditions at the Hudson Terminal building, N.Y., which are severe and varied. In order to prevent congestion in a building, the elevators must be capable of taking care of at least half or, say, two-thirds of all the people in the building during practically ten minutes. High speeds must be maintained during rush hours; in this respect the electric elevator has the advantage over the hydraulic elevator, as the latter has its minimum speed when fully loaded.

Fig. 10 illustrates the safety device usually employed until recently on elevators; it is the standard so-called wedge clamp safety, which clamps the rails for retarding and holding the elevator car in case of overspeed or free fall. Present practice utilises the same principle of application whether the safety is actuated under conditions of excessive speed with ropes intact or during free falling. A very strong retarding force is required to stop a free falling car, but if this is applied with ropes intact and is excessive the passengers will get an unpleasant shock.

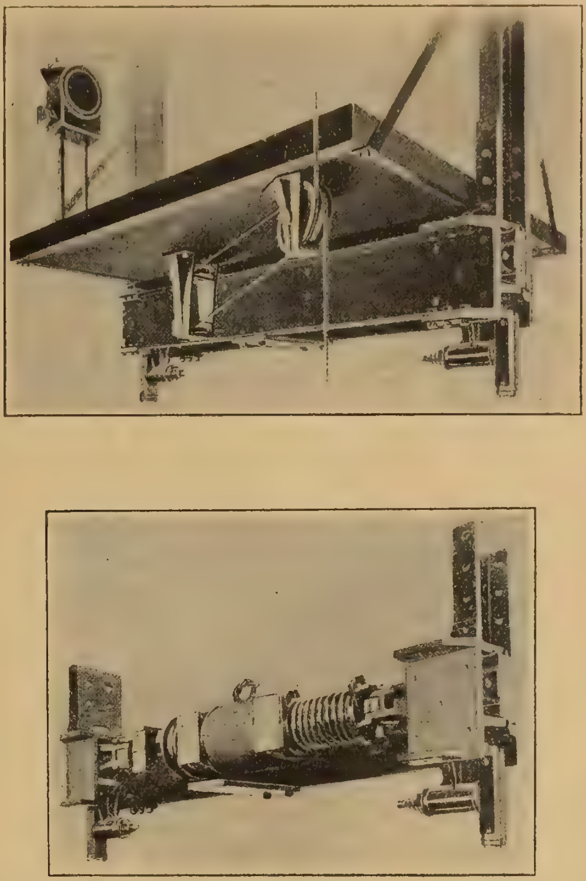
For the above mentioned reasons, it is essential, therefore, that the safety should apply a strong retarding force in case of a free falling car with ropes parted, and a light retarding force in case of overspeed with ropes intact.

Figs. 11 and 12 show the general features of an electro-mechanical elevator car safety, which embodies all of the above described requirements. The light retarding force is obtained by means of a helical steel spring forcing the wedges between the rollers of the safety jaws. When the car is in service this spring is held under compression by means of an electro-magnet. The instant the current in this magnet is interrupted, either by the centrifugal governor, safety switch in car or limit switches in the hatchway operated by the car or counterweight, the light retarding force is applied.

The strong retarding force is obtained by revolving the safety drum, thereby actuating the right and left-hand screw, which in turn moves the wedges and forces the jaws against the guide rails. The strong retarding force is definitely determined by the number of turns around the safety drum, which vary in number according to the maximum load and the amount of the safety rope tension weight.

The releasing carrier is placed on the counterweight and will therefore apply the strong retarding force of the car safety, even though the releasing carrier fails to release, due to faulty adjustment. The strong retarding force only is applied to the counterweight safety.

Whenever the current is cut off from the elevator, the electrical parts of the safety are operated, thereby applying the light retarding force. The mechanical actuating parts of the safety effecting the strong retarding force are continually kept in slight motion when the elevator is in operation, due to the different stretching of the hoist and governor ropes. A device of the kind described has been fitted by the Otis Co. to some 49 elevators in the new Equitable Building, N.Y., with very successful results.



Figs. 11 and 12.—Detail Views of Electro-Mechanical Safety applied to Car.

A THERMOSTAT FOR MODERATE AND HIGH TEMPERATURES.

By J. L. HAUGHTON, M.Sc. and D. HANSON, M.Sc., both of the National Physical Laboratory.

(*Abstract of paper read at the Autumn Meeting of the* Institute of Metals.)

In the investigation of alloys with a view to establishing their diagram of thermal equilibrium, it is often necessary to maintain the specimen at a more or less constant temperature for several hours, or even days or weeks.

For low-temperature work this is a very simple matter; the problem, however, becomes much more difficult when higher temperatures are required. Up to 300 deg. C., it is possible to make use of the differential expansion of metals; but above that temperature oxidation effects become serious unless the more expensive metals are used. D'Arsonval has used an air bulb working into a corrugated plate, such as that employed in an aneroid barometer, the motion of the plate being used to regulate the supply of gas to the furnace. A similar arrangement is described by Mellor for use with an electric furnace, the expansion of the air being employed to break a circuit through a relay, which switches off the main furnace current. Both these forms of apparatus suffer seriously from the fact that they are not independent of atmospheric pressure, and they have therefore to be adjusted with changes in the barometer.

Without being aware of the existence of either d'Arsonval's or Mellor's instruments, the authors attempted to solve the problem on similar lines. In the first apparatus that they constructed, a glass bulb was placed in the furnace, the bulb communicating with a U tube containing mercury. The use of glass necessarily limits the temperature attainable to about 500 deg. C., but it was considered better to experiment with glass before incurring the expense of making a silica apparatus.

The tube from the bulb leads, through a three-way cock A (fig. 1), to a U-tube containing mercury. By means of the cock the tube can be put into communication with the U-tube, or with the air, while the U-tube itself can also be put into communication with the air, the way to the bulb being, under these circumstances, closed. Another three-way cock B serves to connect the other limb of the U-tube with the air or with a second bulb C, which is kept at a constant temperature by being immersed in a "Thermos" flask filled with ice. A platinum wire D, sealed through the wall of the U-tube, and prolonged downwards inside it, makes permanent connection with the mercury, while a similar wire E, on the other side, and at a point where the tube is constricted, makes contact with the surface of the mercury of the other limb as it rises in the tube, the contact being again broken as it falls. The height of the wire E and the amount of mercury in the tube are so arranged that the pressure in the furnace-bulb is slightly less than atmospheric, so that should a break occur in that bulb the current would be switched off; a fall of temperature being, in the majority of cases, a lesser evil than a rise.

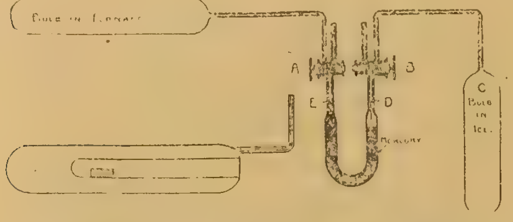


Fig. 1.—Complete Thermostat, and Modified Bulb.

The three-way cocks, though not necessary, render the adjustment of the temperature a matter of great ease. The use of a completely closed apparatus overcomes the difficulty of barometric influence, while immersing the outside bulb in ice neutralises the effect of changes of room temperature.

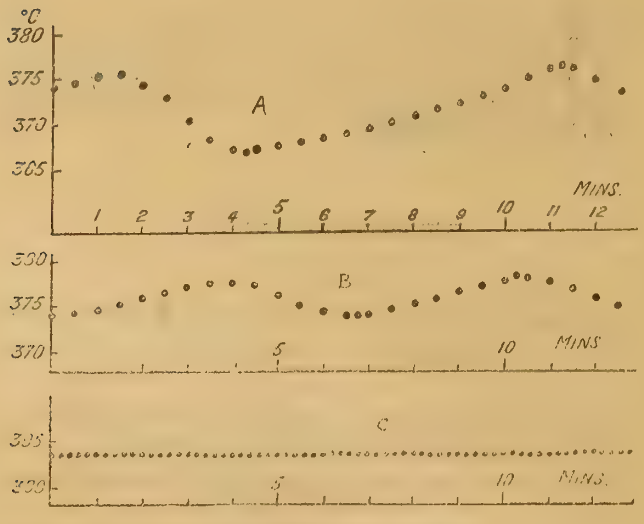


Fig. 2.—Temperature Curves.

The mercury-switch operates a relay in which a solenoid pulls a fork into or out of two mercury-cups. The whole apparatus (furnace, relay, etc.) is run off a 100-volt circuit. As first set up the relay controlled the whole current to the furnace—a current far in excess of that necessary to give the required temperature. With this arrangement the apparatus worked very badly, the temperature "hunting" over a range of about 50 deg. C. This was doubtless due to the large thermal lag between the furnace walls and the air-bulb, which enabled the excessive current to heat up the former to a very considerable extent before the latter operated the mercury control. On rearranging the apparatus so that only a definite amount of the current was cut in or out, leaving the maximum current not very much in excess of that necessary to heat the furnace to the required temperature, the uniformity was greatly improved, and fig. 3A shows the temperature curve obtained.

At this point it occurred to the authors that much better results could be obtained by placing the specimen in the middle of the bulb, so that the heat would have to pass through the air of the bulb before reaching the specimen. In this way the lag of the air-bulb would be utilised to reduce the fluctuations of temperature in the specimen, instead of accentuating them, as in the older form. For this purpose a glass vessel was made of the form shown in fig. 1. This was built into an electric resistance furnace, the heating wire being wound on to asbestos paper wrapped directly on the glass. This form of thermostat gave the curve of fig. 3B. It will be seen that the temperature fluctuations of the specimen have been reduced from about 10 deg. to about 4 deg. C. by this modification.

Alterations were then made in the amount of resistance cut into and out of the furnace by the relay. This was arranged so that the variations in current caused by the relay were just amply large enough to cover the range of accidental variations. This produced a further very considerable improvement in the working of the apparatus. Finally, the tube containing the specimen was plugged with asbestos in front of, and behind, the specimen, with the result that the curve shown in fig. 3C was obtained.

It was hoped to replace the glass vessel by a silica one, in order to enable work at a high temperature to be carried out; but pressure of other and more important work has made it necessary to postpone this indefinitely. Dr. Mellor found that his apparatus gave three times as great a variation at 700 deg. as at 400 deg. C., and he attributes this to the greater effects of lag at high than at low temperature. In the present form of apparatus this difficulty should be completely overcome.

It was always found that when a new bulb was put into the furnace the temperature was inclined to rise for a few weeks. For a day or two the rise was quite rapid—of the order of 5 or 10 deg. C. per day. This gradually fell off, and eventually the temperature steadied down. This conduct was all the more remarkable inasmuch as the apparatus was working under a slightly reduced pressure, and yet a rise of temperature could only be produced by a further reduction of the pressure. There is little doubt that this effect is caused by the ageing of the glass, which would be fairly rapid at the temperature at which the thermostat was working. The phenomenon is indeed identical with the ageing of mercury thermometers.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electrically-driven Dough Mixer.

The Swedish General Electric, Ltd., of Canada House, Kingsway, W.C., are the sole agents for the Century motors, which they stock.

The accompanying figure shows a "Century" 7½-h.p. single-phase repulsion induction motor, coupled through spur gearing to a heavy dough mixer. The application of single-phase, alternating-current motors to machines requiring a heavy starting torque in the case of small motors has usually involved the fitting of loose pulleys, friction clutches or similar unloading devices, all of which are open to the objection that they are expensive to install and maintain. Century motors can exert a starting torque equal to about 2½ times the running torque, and

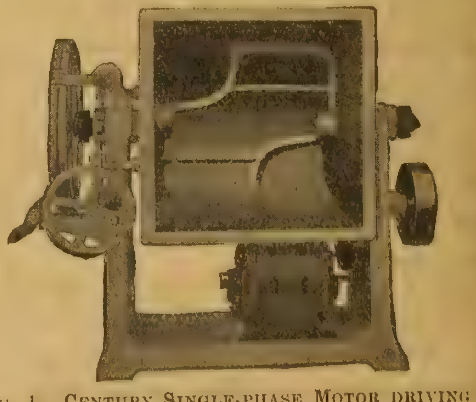


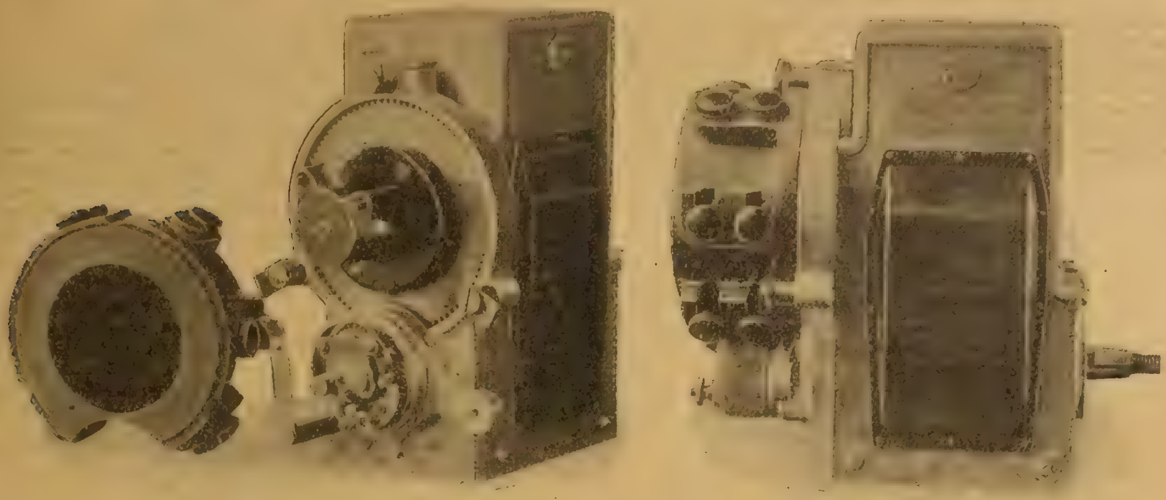
Fig. 1.—Century Single-phase Motor driving Dough Mixer.

consequently, a machine taking, say, 1 H.P. to start it, and ½ H.P. to run it, can be adequately driven by a ½-H.P. Century motor.

The Century Co. have recently introduced a completely new series of fractional H.P. motors, known as Type M, for all frequencies from 25 cycles to 60 cycles, and in sizes varying between 1/16 H.P. and ¼ H.P. They have the same characteristics as Type P motors, which have already been sold on this market for over 10 years.

A Magneto for 12-Cylinder Engines.

The introduction of the 12-cylinder engine has brought in its train the Dixie 12-cylinder magneto, which is said to be the first practical commercial 12-cylinder magneto to be offered having a single unit distributor. It is to be known as the "Dixie 120," and in construction it follows closely that of the "Dixie 40." There is no rotating wire-wound armature, and the usual high-pressure collector, with its attendant brushes, is eliminated.



Figs. 2 and 3.—Views of Dixie 12-Cylinder Magneto, Showing Distributor, and Complete Machine.

The distributor, as shown in the accompanying views, figs. 2 and 3, is no larger in diameter than the usual 4-cylinder distributor. It has, however, two rows of contacts, six contacts in a row, and the spark-plug cables are connected to these contacts by means of the usual outside terminals. Travelling round and wiping over each row of contacts is a separate brush, and connected to each of these brushes is an auxiliary brush, so arranged that the high-pressure circuit is connected first to one travelling brush and then to the other. At no time are both brushes alive, and, consequently, the separation of the various contacts in the distributor is maintained at such a value that jumping and misfiring are prevented.

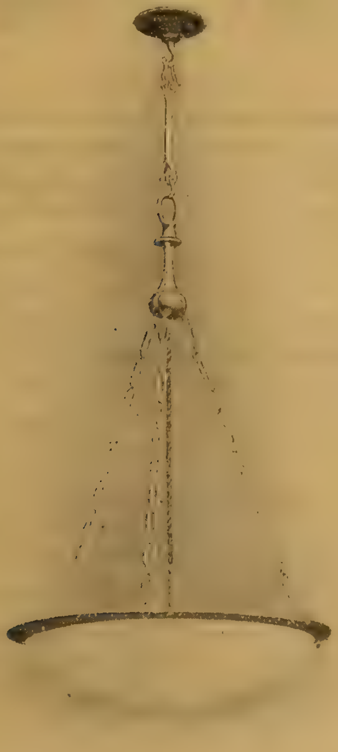


Fig. 4.—Ediswan Semi-Indirect Lighting Fitting.

The two rotating brushes in the distributor carry the same polarity, and therefore there is no tendency for a breakdown to occur between them.

From the foregoing it will be seen that in this 12-cylinder distributor there are four rotating brushes carried on a single movable distributing finger attached to the distributor gear, thereby eliminating all double distributor blocks, or the necessity for complicated brushes or other mechanism in the high-pressure circuit between the distributor and the generating windings.

The breaker contacts operate at 12-cylinder engine speeds in excess of 300 times per second, the vibrations of the breaker arm exceeding in speed the vibrations of the middle C string in a piano; in fact, the magneto, when running at maximum speed, gives a clear musical note. The magneto produces four sparks per revolution, and is geared to the engine 1½ times engine speed; by an ingenious device, practically any degree of advance or retard is accomplished, the intensity of the spark being the same at either advance or retard for any given engine speed.

Owing to the fact that the "Dixie 120" has no rotating wire-wound armature, or other parts that would not stand up under excessive speed, the Dixie may be driven at a speed of 5,000 R.P.M. indefinitely, at which speed 20,000 sparks per minute are produced, and these are in perfect synchronism, and of the same intensity at any given engine speed with the magneto to full advance or retard, over a spark range, usually of 40° to 60°. A 12-cylinder four-cycle motor fires six cylinders per revolution of the crank shaft, and sometimes reaches a speed of 3,000 R.P.M.; hence the interruptor must function at the rate of 300 times per second. The difficulty of overcoming the inertia of a breaker mechanism which must operate at such a tremendous number of current ruptures per second has caused the designers of the "Dixie 120" to double the number of working parts, this halving the number of movements of each part. A pair of breaker bars is used, one superposed on the other, and acting independently, the motion being transmitted by a double cam side by side with the rotor shaft, with the cam faces acting alternately first on one and then on the other bar, rupturing the primary current delivered to a common "anvil" containing two independently adjustable platinum-pointed screws.

The sale of the "Dixie 120" in Europe is controlled by the American Supplies Co., Ltd., of 162, Great Portland Street, London, W.

Ediswan Lighting Fittings.

The Edison & Swan United Electric Light Co., Ltd., Ponder's End, Msx., has issued a new finely-illustrated catalogue of Ediswan electric light fittings. Since the issue of its last list the company has had a largely increased turnover in fancy fittings, and has therefore decided to keep a larger assortment of stock designs. These are excellently shown in the catalogue now before us, which consists of more than 180 pages of art paper, and contains getting on for 500 illustrations. The contents are well arranged, the illustrations well executed and conveniently indexed

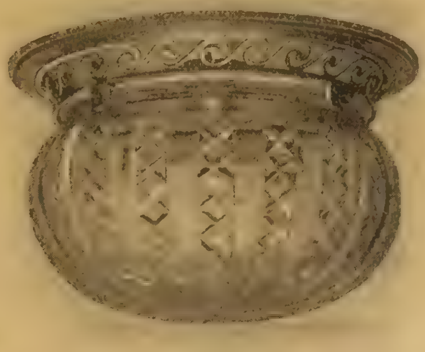


Fig. 5.—Three-Light Ediswan Ceiling Fitting.

both as to sections and numerically. The book is the best Ediswan catalogue that we have seen for many a day, and no doubt it will bring its reward.

The fittings, which cover a wide range, are classified under various headings, such as pendants, brackets, ceiling fittings, electroliers, standards, lanterns, semi-indirect fittings, &c. All of the designs shown can be seen at either of the company's London showrooms (123/125, Queen Victoria Street, E.C., and 71, Victoria Street, S.W.), and for the convenience of contractors and others there is a number of introduction slips for clients to present at those showrooms, included at the end of the book. Selections of the fittings may also be seen at the branch depôts.

We select for illustration a couple of typical examples of fittings shown in the catalogue, fig. 4 being representative of the semi-indirect lighting section, and fig. 5 a three-light ceiling fitting, in polished brass with crystal cut glass.

Motor Control Panel.

The British Thomson-Houston Co., Ltd., Rugby, has developed a series of D.C. motor control panels, as shown in fig 6 herewith, consisting of a sheet steel base carrying a starting rheostat and a switch fuse (shown open), the whole complying with the Home Office rules for the use of electricity in factories; there are no exposed live parts, and neither the starter nor the switch fuse can can be left in partial contact.

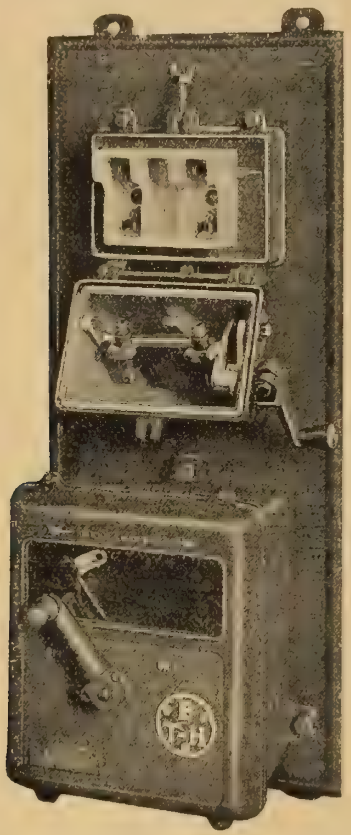


Fig. 6.—B.T.H. Motor Control Panel.

These panels are made for motors up to 7½ H.P. on circuits between 100 and 550 volts. The fuses are of the "bomb" type. The panels are described in Price List No. 3,260.

Lighting of West African House.—Messrs. E. P. Allam and Co. inform us that the whole of the wiring installation at West African House was carried out by them, and all the "Eye-Rest" fittings were fixed by them; while in small rooms the lights are, as stated by us last week, controlled by a single switch, in the larger room the lighting points are grouped under the control of two or more switches.

LEGAL.

Workmen's Compensation Claims.

An unsuccessful claim under the Workmen's Compensation Act was brought at the Warrington County Court on the 7th inst. by Sydney Bodle, 17, of Warrington, against the St. Helens Cable and Rubber Co., Ltd. He claimed for the loss of his left hand as the result of an accident which occurred at the respondents' works on April 26th last.

On April 6th Bodle was engaged by the firm at a wage of one guinea per week, with a war bonus of 10s. per month, to do whatever was required of him. On the 26th of the month he got his hand caught in a mixing machine, and the limb was so severely injured that it was necessary to amputate it. The point at issue was as to whether or no the accident arose out of, and in the course of, his employment. For the applicant it was contended that he went to the mixing machine for the purposes, and for the benefit, of his employers, and that he was not acting outside his duty. On the other hand, the respondents' legal representative argued that on the applicant's own admission he was engaged to do whatever work was required of him, and that, inasmuch as the work of feeding the mixing machine was skilled and was not found for him, it was evident that he was doing something he had no right to do.

This contention was upheld by Judge J. Scott Fox, K.C., who found that the applicant had not made out his case, and who accordingly gave judgment for respondents, with costs on Scale B.

In the Bow County Court, on Friday last, before his Hon. Judge Smyly, K.C., sitting with Dr. Bate, as Medical Referee, an application was made under the Workmen's Compensation Act, by David James Drury, of Oxford Street, Stratford, an electrician's labourer, for the continuation of an award against the Charing Cross, West End and City Electricity Supply Co. It appeared that on February 18th the applicant fell from a boiler, a distance of 22 ft., and broke his shoulder blade, besides sustaining other injuries. He was treated for a long time at the West Ham Hospital, and had attended there only the previous day. The applicant admitted that he had been offered work by the company, but was quite unable to do it. He was quite a nimble fellow before the accident, but to show how bad he had become he was refused for the Army as being quite unfit. Dr. Howitt, for the respondents, said the setting of the fractured collar bone had been very badly done, but it did not prevent free play for the shoulder. He considered the man quite fit to do his work. The respondents paid compensation up to July and then ceased, and he considered the man could have worked after that had he liked to do so. Judge Smyly decided that the man was now fit for work, and as the respondents had paid in a sum up to October 5th, he entered judgment for the respondents, with costs.

Unobscured Lighting.

At Wallasey Police Court on October 6th Henry Weissenberg, of North Drive, New Brighton, was summoned for having unobscured lights in his house visible from the sea, on September 21st. It was stated by Arthur Lodge, of New Brighton, that on the evening of the 21st ult. he saw an intermittent exhibition of electric lights from the kitchen of the defendant's house. He last saw the light about 8.30 p.m., and informed the police. Defendant said he had been in England 40 years, and had lived at New Brighton for 25 years. There were two lights in the kitchen of his residence each of 16 C.P. He was ignorant of the light being visible at the time, but had ascertained that the cook had opened the fanlight and the wind caused the blind to wobble, and every time the blind wobbled the light was brought to view. A fine of £10 was imposed.

What is Serious and Wilful Misconduct?

In the City of London Court, on Monday, a case under the Workmen's Compensation Act was heard, in which William James Vasse, an electrical fitter, made a claim against the British Thomson-Houston Co., Ltd., to recover compensation for injuries sustained while working for them.

Mr. J. Scott Duckers, for the plaintiff, said the only difficulty was the defence which had been raised by the defendants that the plaintiff had been guilty of wilful and serious misconduct, and whether the accident arose out of, and in the course of, the employment. The plaintiff was working on July 20th for the defendants at the Twickenham and Teddington electric supply station. While doing some work there he received a shock at 3,000 volts, and was very severely burned on the arm. He had recovered, and he had got back to work after 11 weeks' incapacity. All he was claiming was £11 compensation for 11 weeks at £1 a week, although he was earning over £4 a week. He was only entitled to £1 a week. There was no question of future liability.

Mr. Ralph Thomas, defendants' counsel, stated that so far as period of incapacity was concerned, there was only a question about one week, and, therefore, the defendants were agreeing the period at 11 weeks. He did not admit the plaintiff's estimate of £4 as being his average weekly earnings. The only questions for the Court were those indicated by Mr. Duckers.

The plaintiff was called, and he said he was sent to Twickenham to finish a job. He had to finish putting up an earth strip for earthing current. Defendants' foreman, McLean, gave him his instructions. He had to fix a nut on a bolt, and he had to fix the end of the earth strip in a cell. The bolt was fixed inside the cell. There were two switches, and he had to get in between them. The bolt was between the two switches. He thought his hand must have been drawn towards one of the switches because he did not know much else until the accident happened. He received a shock from one of the switches, and as a result of that he had to give up work for 11 weeks. Seeing that the current was at 3,000 volts he did not know how it was that he was not killed. He was all right now. In cross-examination, witness said he had been 12 to 14 years as an electrical fitter, and knew all about live switches with currents at 3,000 volts, and of their danger. In fact, he was warned about the danger before he began the job in question. The accident occurred on Tuesday, July 20th. On the previous Saturday he started the work. In re-examination, witness said that working with high voltages was very dangerous. He was accustomed to keep his hand off switches, but in the present instance he got it too near. There was no wilful misconduct on his part, and he had not gained anything by doing it. On the contrary, he had lost.

For the defence, **Campbell McLean**, defendants' foreman, said he had occupied that position for two years. He had been with the defendants for 12 years, doing electrical engineering work. The plaintiff had to attach a copper earth strip to a cubicle which contained switches at 3,000 volts, which was quite enough to kill a man. If he only just touched he might escape as the plaintiff had done. On the Saturday when he told the plaintiff to do the job in question the current was turned off and the cell made dead, because the plaintiff had to go into the cell to do the work. Everything was all right on the Saturday therefore, and it was made so that the plaintiff could not injure himself unless he tried. When the job was finished plaintiff invited him to have a look at it, which he did, and he said that it was all right, with the exception that he was to beat back a bulge into the wall with a hammer. He told the plaintiff to be very careful, as everything was alive on the Tuesday. Plaintiff said he would be. It was necessary for the plaintiff to get near the switches, but not to get inside the cell by any means.

Judge Rentoul asked for a little fuller explanation of what the plaintiff had to do, and later he said he knew that people like the plaintiff took risks which no other men would dream of taking at all.

In cross-examination, **Witness** said he could not say that it was very silly of the plaintiff to have done what he did, because it depended on whether he had been doing high-tension work. It might be that the plaintiff had only worked where the current was at 500 volts, whereas defendants had 11,000 volts. He specifically told the plaintiff of the danger. It was quite right for the plaintiff to put the bolt in where he did, and it was necessary for it to be screwed up with the nut. Screwing it alone would not take away the bulge, and the hammer was the only thing to use. He thought it was much too dangerous for a man to put his hand within 3 in. of the switch. Witness would not go within 6 in. He did not suggest that the plaintiff put his hand in on purpose. He did not think that was at all likely, or he would be preparing to commit suicide. The job would not have been in working order without the nut attached to the bolt. If he had known the plaintiff was going to do what he did on Tuesday witness would have had the cell isolated.

Thomas Collett, electrical engineer in the defendants' service, said he was in charge of the work in question, and that he warned the plaintiff of the danger of going into one of the cells while it was alive.

Cyril Wilstead, electrical wireman in the service of the defendants, said he heard plaintiff warned of the danger.

Mr. Thomas urged that the plaintiff had backed his opinion against the experience of the defendants' electricians, and so received his damage.

Mr. Duckers pointed out that the onus of proving wilful and serious misconduct was on the employers, and he urged that that had not been done. If there had been a regulation that under no circumstances was the plaintiff to put his hand inside the cell he would have been liable to prosecution for disobedience, and he would have had no case in that Court, but that was not done.

Judge Rentoul said the plaintiff knew on Saturday that the cell was rendered dead, and the motive of that was to make the work safe.

Mr. Duckers urged that men might have accidents of that sort in electrical works however careful they were. The present was an accident for which the employer was responsible under the Workmen's Compensation Act. There was no misconduct on the plaintiff's part, and an accident had arisen out of, and in the course of, the employment. It was necessary for the Court to hold that the plaintiff deliberately ran into the risk, and that he appreciated it, if he was not to recover.

Judge Rentoul: Plaintiff did a dangerous thing thinking it would not be dangerous.

Mr. Duckers: It is not suggested he was trying to commit suicide. Mr. Duckers urged that the accident was touching the wire, but wilful misconduct would be putting his hand in a place where he ought not to have put it. If the Workmen's Compensation Act was of any use to electricians and electrical fitters it would be necessary for the plaintiff to recover.

Judge Rentoul: He was doing what he was desired not to do, putting in this screw; if he had been injured in hammering, having been told to hammer, there would have been no defence.

The **Plaintiff** was recalled, and said that McLean had evidently got a bad memory.

Judge Rentoul thought there must be judgment for the defendants, and he thought there was serious and wilful misconduct. Consequently it was not necessary for him to go into the other question about scope of employment. He also gave the defendants their costs.

Mr. Duckers said the case was one of very great importance to the electrical world, and the plaintiff, who was supported by his Union, might perhaps wish to take the opinion of the Court of Appeal. If that were done, and if he were successful, he asked that certain medical costs should be allowed.

The **Judge** concurred.

Mr. Duckers said the plaintiff was a member of his Union, who might decide to support him in his appeal.

Munitions Cases.

At a sitting of the Oldham Munitions Tribunal, last week, Wm. Baron, of Middleton, a turner employed by the B.T.H. Co., Ltd., made a statement of complaint that his certificate had been unreasonably withheld by his employers. He had left the works, as he desired to get back to Oldham, but the firm had refused to give him a certificate. Baron said he would rather be on munitions work at Oldham than at Rugby. Mr. W. Sellars (Chairman) said that was not a reasonable excuse. Baron ought to have made application to the Rugby Munitions Tribunal, and not have left his work until he had got his certificate. Baron said he had been ill, and was not fit to continue. A communication from the B.T.H. Co. was put in, in which the firm stated that they were short of men, and could not see their way to grant the certificate. Mr. Sellars refused to grant a certificate.

In another case at the same Court, Messrs. Ferranti, Ltd., complained that George R. Unsworth, driller, of 82, Lord Lane, Failsworth, had infringed the rule that no person should be the worse for liquor in the establishment, or bring in intoxicating liquor, and another rule that no person should refuse to obey the lawful orders of any person having authority over him. It was stated that the man had attended at the works under the influence of drink. As to the second rule, it was stated that the man was not in a proper state to do his work, and could not obey orders, but the Chairman observed that that would not do, the man not having refused to work. This part of the complaint was then dropped, and, the representative of the firm stating that they did not want a heavy penalty, but would be satisfied with a warning, Unsworth was fined only 5s.

Before the London Munitions Court at Caxton Hall, on October 4th, a workman named Jonathan Peel was, on the complaint of Messrs. Vickers, Ltd., fined £2 for cutting an electric lead connecting a grinding machine, with intent to hinder the progress of certain work.

Phœnix Telephone Co. Fined.

At Bow Street Police Court, on October 8th, the Phœnix Telephone and Electrical Works, Cricklewood Lane, was summoned before Mr. Graham Campbell for unlawfully failing to send in writing to the Public Trustee particulars of shares and stock of the company held by, and for, the benefit of enemies. According to the report of the matter in the *Financial Times*, Mr. Travers Humphreys appeared on behalf of the Director of Public Prosecutions, and said that the proceedings were taken under the Trading with the Enemy Amendment Act. The requirements of the Act were published, and proceedings which had been taken under it at Bow Street Police Court had been published in the newspapers. It would be difficult, therefore, to accept as a defence, or even a plea for the mitigation of a penalty, that companies did not know the law on the subject. The Phœnix Telephone and Electrical Works had a capital of 8,284 preference shares of £1 each and 2,757 ordinary shares of 1s. each. Four shareholders in the company residing in Germany held 1.284 preference shares and 426 ordinary shares. No notice of this was sent to the Public Trustee, but he became aware of the fact through the returns of the company made at Somerset House. When Mr. Oppenheimer, the managing director, was spoken to on the subject, he stated that no dividends had been paid to enemy shareholders, and eventually a full return was made to the Public Trustee. Mr. Travers Humphreys proceeded to state that the case was not put forward as one in which the company or the officials had deliberately desired to conceal from the authorities that they had enemy shareholders. He also wished to point out that although the returns made to Somerset House disclosed the names of enemy shareholders, they did not comply with the Act, the object of which was to enable the Public Trustee to see that no moneys were paid to those persons.

Mr. Walter Frampton, who appeared for the defendants, said that they were now solely occupied in executing Government contracts. Before the war they had purchased certain machinery and materials from Germany, and their customers there had accepted part payment in shares.

The **Magistrate** said he must impose a substantial penalty as a warning to others, and imposed fines and costs amounting to £185 10s.

Baldock's Telegraph Instruments Co., Ltd., v. British Telegraph Instruments Co., Ltd.

In the Chancery Division, on Tuesday, a motion in this matter came before Mr. Justice Sargant.

Mr. Whitmore Richards, on behalf of the plaintiff company, moved for an injunction to restrain the defendant company from presenting a petition to wind up the plaintiff company. In reply to his Lordship, counsel said the defendant company were not represented that day, but a letter had been received from the solicitors for the company suggesting that the motion should be treated as the trial of the action. The solicitors had not, however, instructed counsel.

His Lordship said, on the production of a consent brief on behalf of the defendant company, he would make the *ex parte* injunction which he made on Friday perpetual.

Mr. Richards said the terms of the injunction would be to restrain the defendant company from presenting a petition to wind up the plaintiff company, or from taking any proceedings to wind up the company in respect of an alleged debt of £155.

BUSINESS NOTES.

Bankruptcy Proceedings. — Arthur Faraday Hawdon, of "Yetholm," Elmfield Gardens, Gosforth, Northumberland, electrical engineer.—At Newcastle-on-Tyne Bankruptcy Court on the 7th inst., this bankrupt came up for his first public examination. The statement of affairs showed liabilities expected to rank of £545, and assets estimated at £52. The debtor attributed his failure to Motor Ignitionisms, Ltd., of which he was managing director, going into liquidation. The debtor commenced business in 1905, in Newcastle-on-Tyne, in partnership with another person, under the title of Hawdon, Oliver & Co. The capital amounted to £40 borrowed by the debtor, which had not been paid. The partnership was dissolved in 1907, when debtor paid his partner £20 for his share of the capital, and continued the business under the style Motor Ignitionisms Co. In December, 1909, the company was registered under the style of the Motor Ignitionisms, Ltd., with a nominal capital of £1,000, in £1 shares, which was afterwards increased to £2,000, and the debtor received 500 shares for his business, the company undertaking to pay the trade liabilities but not his private liabilities. In 1913, the debtor and his wife began trading under the style of "A. Faraday Hawdon and Co.," at Newcastle-on-Tyne, without capital, for the purpose of making portable inspection lamps, and in May, 1915, a company was formed named Mico, Ltd., with a nominal capital of £500 in £1 shares, for the purpose of acquiring the business. On February 10th, 1915, £307 was due to debtor from Motor Ignitionisms, and he received £196 on account, and debtor and his wife, who were trading as A. Faraday Hawdon & Co., paid the company £196, which included £165 from machinery and fittings. The hearing was adjourned.

Godfrey, Herbert J., electrical engineer, Tooting.—Trustee released September 23rd.

Catalogues and Lists.—Messrs. Drake & Gorham, Ltd., 1, Felix Street, Westminster Bridge Road, London, S.E.—Two new illustrated and clearly priced pamphlets. No. 237 (14 pp.) brings together most conveniently particulars and prices of Bastian, Belling, Quead, Ferranti, Falco, and Jackson electric fires, also lamp radiators, and the "D.G." electric radiator. No. 236 (16 pp.) is devoted to tungsten and tantalum lamps and lanterns. Prices are tabulated of 11 different makes of one-watt lamps and various designs of lanterns for these lamps, including a new range for smaller-sized lamps, also fittings and lanterns for half-watt lamps; three pages are devoted to Holophane reflectors.

Messrs. F. Husband, Ltd., Craven House, Kingsway, London, W.C.—16-page catalogue of "Quead" electric fires.

Messrs. Johnson & Phillips, Ltd., Charlton, S.E.—16-page illustrated catalogue and price list (section "B") of ironclad switchgear, including "Juno" and "Charlton" fuseboards, "Charlton" and "Victoria" ironclad switches, fuses, fuse elements, accumulator switchboards, tubular hand-grip fuses, "Charlton" bridge fuses, motor-starting panels, fool-proof starting panels, ironclad distribution boards, &c.

Messrs. Belling & Co., Derby Road, Edmonton, N.—The firm have issued a considerable collection of new literature regarding their electric heating specialities. One of the publications is a 40-page illustrated catalogue containing much descriptive information respecting the Belling patent electric fires, many patterns for use in all kinds of places and amid all sorts of surroundings being shown, their prices being stated for various finishes. Several smaller pamphlets, prepared so that contractors and traders can have them over-printed with their own names, deal respectively with the Belling fires for business offices, and for household service as coal and work savers; a desk blotter leaf shows how the "domestic" may be neat and smart, "even at 8 a.m." by using —. The best of the batch, from a pictorial point of view, is a very large advertising poster, executed in appropriate colouring, depicting an Army officer availing himself of the heating properties of a "Belling" in the lighting of a cigar—the purpose of the poster being to catch the eye with the most effective subject of current interest, and to get home with the idea that the electric fire shown is "hot as fire." The sheet forms an effective advertisement, and might be very useful as a cheerful screen for shop windows in these days of restricted lighting. Firms interested can have copies of any or all of these publications on application.

The Edison & Swan United Electric Light Co., Ltd., Ponder's End.—A new catalogue covering a wide range of electric light fittings has been issued, and is referred to in our "New Devices" section to-day.

Argentine Republic: Electrical Imports.—The imports of electrical goods into the Argentine Republic during the six months ending with June last only reached a value of £353,000, as contrasted with £959,000 in the corresponding half of 1914.

Argyll Cars.—A new company has been formed to carry on the manufacture of the Argyll motor-car. The large modern premises of the old company, now in liquidation, have been taken over, and the electric plant will be devoted to specialising in cars for passenger and ordinary work.

Advance in Prices.—The Electric and General Works, Ltd., of 15, Victoria Street, S.W., announce that, in consequence of the increasing cost of manufacture, they have increased the advance on their catalogue prices for switchgear to 20 per cent.

Social.—The engineers of the St. Helens Cable and Rubber Co. held a social at the Royal Oak Hotel, Warrington, a few days ago. Mr. Seymour, the works manager, presided.

Catalogues Wanted.—The Commanding Royal Engineers, York District, as will be seen from our advertising pages to-day, is in want of catalogues of electrical appliances—particularly those relating to lighting.

For Sale.—Messrs. Fuller, Horsey, Sons & Cassell will sell by auction on November 10th, at South Wharf, St. Leonard's Street, Bromley-by-Bow, engineering plant, including a horizontal compound tandem condensing engine, one 30-kw. electric lighting set, a steam pump, a number of three-throw power pumps, conveyors and elevators, winding engines, &c. Particulars are given in our advertisement pages to-day.

Our Trade with China.—Mr. T. M. Ainscough, the Special Commissioner appointed by the Board of Trade to inquire into the conditions and prospects of British Trade in China, has now returned to this country and is prepared to interview (by appointment) representatives of British firms who may be able to see him at the offices of the Commercial Intelligence Branch of the Board of Trade. In order that appointments may be satisfactorily arranged, British firms who may desire to have an interview with Mr. Ainscough are requested to make their application as soon as possible. Such applications should be addressed to the Director, Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Liquidation.—British Drawn Wire Lamp Co., Ltd.—A meeting is called for November 13th, at 59, Chancery Lane, W.C., to hear an account of the winding up.

Trade Announcement. — Mr. M. F. Farrar, electrical engineer, has opened new premises at 14, Crossley Street, Halifax.

"Screwol."—From the Stern Sonneborn Oil Co., Ltd., of Royal London House, Finsbury Square, London, E.C., we have received a leaflet giving particulars regarding their "Screwol" soluble oil. They will be pleased to forward free testing samples of this oil to any of our readers engaged in munition work.

Book Notices.—"Labour Unrest—War-Time Thoughts on a National Danger." By G. E. Toogood. London: A. Brown and Sons, Ltd. 6d. net.

"*Bulletin* de la Société Internationale des Electriciens." No. 45. Vol. V. August, September and October, 1915. Paris: Gauthier-Villars. Price 3 fr.

"Experimental Physics." By H. A. Wilson. Cambridge: University Press. Price 10s. net.

Circular of the Bureau of Standards, No. 55, "Measurements for the Household." Scientific Papers of the Bureau, No. 253, "A Direct-reading Device for use in Computing Characteristics of Vacuum Tungsten Lamps;" No. 254, "A Study of the Quality of Platinum Ware." Washington, U.S.A.: Government Printing Office.

"Elementary Lessons in Electricity and Magnetism." By Prof. Silvanus P. Thompson. London: Macmillan & Co., Ltd. Price 4s. 6d.

"Continuous and Alternating Current Machinery Problems." By W. T. Ryan. London: Chapman & Hall. Price 2s. 6d. net.

LIGHTING AND POWER NOTES.

Argentina.—The public light and power installations belonging to a joint stock company at San Martin (Province of Mendoza) have been sold to Messrs. O. Bromberg & Co., of Buenos Ayres, who will undertake the public service after extending the installation.

The movement recently started in Concordia (Entre Rios) for the formation of a local electric supply company, is materialising rapidly. The proposed capital is $300,000 m/n. Energy for light would be sold at $0.25 and for power at $0.15 per kw.-hour, with a rebate to large consumers. The present price is $0.40 cents.—*Review of the River Plate.*

Banbridge.—Messrs. R. J. Hale & Co., having installed an electric lighting plant, are asking permission of the Urban Council to erect poles and overhead wires or underground cables for supplying premises.

Barrow.—Price Increase.—The Electricity Committee recommends that an addition of 10 per cent. be made to the accounts for the December quarter, and until further notice upon the gross amount charged to private consumers for energy supplied for lighting, heating and power, but as regards consumers whose agreements include a coal clause, credit will be given for any increase resulting from such clause; the increase is not to apply to the Tramway Co., but it will apply to the net amount charged for energy supplied for street lighting.

Blackburn.—Price Increase.—The price of electrical energy is to be increased by 15 per cent. for all purposes.

Bradford.—Bulk Supply.—The Electricity Committee has been informed that the agreement with the Bradford Dyers' Association, Ltd., for bulk supply to Bowling Dye Works will expire in a year's time; that the company did not propose to renew it, but desired to continue a supply on similar terms, but subject to determination by nine calendar months' notice from either party. The Committee agreed to this suggestion.

The Electricity Committee has concluded an agreement with Messrs. Hindle & Firth in regard to a supply of electricity in bulk to their premises at Mill Lane, Bradford.

At the Saltaire Mills a new 1,500-h.p. Westinghouse turbo-generator has been installed, to supersede the several large reciprocating engines previously employed in these works.

Brighton.—Price Increase.—The T.C. has decided to make the following increase in charges for electricity:—Special tariff for arc lamps and advertising signs, 3½d. to 4d.; maximum demand, from 6d. and 3d. to 7d. and 3d.; flat rate from 4½d. to 4¾d.; flat rate to consumers of a minimum of 15,000 units per annum, from 3½d. to 4d. The charge for hotels, public-houses and piers taking more than 20,000 units per annum, is to be increased by ½d. on the 1½d. rate, and theatres and other premises taking 20,000 units per annum, by ½d. on the 3d. rate. The flat rate of 5d. per unit for electricity supplied outside the borough is to be increased to 5½d., and for electricity supplied through prepayment meters, by ½d. per unit; the flat rate of 1·1d. for current supplied for power will be increased to 1·25d., and the charge for electricity supplied to the tramways undertaking will be increased from 1·3d. to 1·35d. per unit.

Callan (Co. Kilkenny).—Workhouse Lighting.—The proposal to install electric light in the workhouse has been adjourned for 12 months. The Guardians indicated that they would like to have a statement and estimate from the Electric Lighting Co.

Canada.—The fourth annual report of the Toronto hydro-electric system for the year ended December 31st, 1914, just issued, shows that the operations for the year yielded a gross income of $1,501,291; the cost of electric current, operation and management expenses, including repairs and maintenance, absorbed $874,358, leaving a gross profit on operation account of $626,932; after providing for interest, depreciation and sinking fund amounting to $556,513, there remained a balance of $70,419. Of this sum $69,536 was absorbed by charges and allowances not strictly attributable to the operating account for the year, and by other charges and allowances arising out of transactions of the previous year, the net surplus being $883. The increase in the gross income over that of 1913 was 29½ per cent.; the net increase in consumers connected to the system during the year amounted to over 9,000; the total number of consumers connected at the end of 1914 was over 31,500, and their connected load over 88,000 h.p. A new schedule of rates has been adopted, and came into operation at the commencement of the present year, viz.:—

	Reduced rates. Average per kw.-hour part of 1915.	Old rates. Average per kw.-hr. same period, 1914.	Reduction.
Residence lighting ...	4.00 cents	4.60 cents	13.1 %
Commercial lighting...	2.85 „	3.99 „	28.5 %
Commercial power ...	1.31 „	1.56 „	16.0 %
Street lighting ...	2.12 „	2.49 „	14.9 %

The general manager in his report states that the year has been mainly devoted to consolidating the system and improving the service, together with such extensions as were necessary to deal with the requirements of the immediate future. During the year 5,600 electric irons, among other things, were disposed of, which on the basis of three hours' use a week would mean the sale of 480,000 units per annum, which at the old rates would bring in $13,000. Some 2,400 street lamps were added, making at the end of 1914, an equivalent of 40,800 100-watt lamps. Winter and summer load curves are included, the former showing a maximum momentary peak of 30,430 h.p. and a max. 20 min. peak of 29,020 h.p., and the latter a maximum momentary peak of 19,970 h.p., and a max. 20 min. peak of 18,900 h.p., the winter and summer load factors on the particular days being 68 and 77 per cent. respectively.

Cheltenham.—Annual Report.—The year's working of the Corporation electricity department shows a gross profit of £13,690, as against £14,585 in the previous year; after deducting £10,890 for financial charges there was a net profit of £2,800, as against £3,737. The net profit, added to £294 brought forward from 1913-14, totalled £3,094, from which £2,061 was deducted, being the last full instalment payable on the deficit loan. The balance, £1,043, was carried forward to next year's account.

Cheriton.—Prov. Order.—The B. of T. has granted the Folkestone Electricity Supply Co. an order to supply current to premises at Cheriton.

Continental. — Italy. — The Italian Department of Provincial and Communal Loans for the municipalisation of public services, instituted at the Minister dell'Interno, has sanctioned the redemption by the Communal authorities of the electric light installation at Tirano for a sum of 135,000 lire, and has authorised the commune to contract a loan of 350,000 lire with the Cassa Depositi e Prestiti for the purchase and other expenditure.

Spain.—A company has been formed called the Compania de Energia Electrica de Popayan to supply electricity in the city of Popayan. Water power is available on the Cauca River, from which an open canal brings the water to a point within three miles of the centre of the city; the head is 70 ft. to 80 ft.

Dover.—Annual Estimates.—The working of the electric light undertaking for the year ending March, 1916, owing to the increased cost of fuel (£1,421), and the loss on street lighting (£2,283) is expected to result in a loss of £555, after the payment of interest and sinking fund amounting to £11,788, instead of a surplus balance £2,525, which was obtained last year; the loss is to be taken from the surplus in hand.—*Dover Express.*

Dublin.—Theatre Rates.—The Electricity Supply Committee has recommended the fixing "of a rate of 3½d. per unit net for supply to the regular theatres and music-halls and the offices of the daily newspapers." The capital charges on plant and feeder mains are held to be not properly chargeable in these cases. The picture theatres are excluded from the reduced rate on the ground that a proportion of the plant and feeder mains must be provided for them, since they work during the heavy early evening load.

Dundalk.—Valuation Appeal.—The Court of Quarter Sessions has confirmed the assessor's valuation of the Council's electric light undertaking at £440; the Council submitted that it should be returned at £255.

Ellesmere Port.—Prov. Order.—Messrs. A. J. Leigh and Partners have informed the U D.C. that they propose to apply for a prov. order for the supply of electricity in the adjoining districts.

Ellon.—New Generating Station.—The site of the generating station (the formal opening of which we reported last week) is that occupied by the gas works, the feu of which was transferred from the T.C. to Duncan's Electricity Supply Co., Ltd. The plant consists of two 68-b.h.p. suction-gas engines, by Messrs. Fielding & Platt; two 42-kw. dynamos, by the British Electric Plant Co.; and a storage battery of 666 ampere-hours capacity, by the Chloride Co. The switchboard was supplied by the Switchgear Construction Co., Ltd. There is at present a total of 1,660 lights in the burgh, and the number is steadily increasing. The whole of the work was carried on under the supervision of Mr. M. K. Cooper, of Messrs. T. C. Smith & Co., Aberdeen. It was expected that the work would have been finished last year, but when the war broke out practically the whole staff of electrical engineers were called up or left on military duty. The new illuminant has given great satisfaction throughout the town.

Farnworth. — The Electricity Committee has been informed that damage had been done to the destructor, presumably from the presence of some kind of explosive in the refuse. It was stated that war badges had been applied for in respect of the chief engineer, assistant engineer, shift engineer, switchboard attendants and mains assistant.

Gillingham (Kent).—Oil Fuel.—The T.C. has asked the advice of the B. of T. as to the purchase of oil fuel for the electricity works. The Anglo-American Oil Co. offers a contract for six or 12 months, at £5 2s. 6d. per ton, ex Purfleet, or £5 11s. 3d. delivered at the works.

Gloucester.—New Industry.—The electrical engineer reported that inquiries had been received from the Gloucester Paper Mills Co. (a new company about to be established in the district), in regard to a large supply of energy for power and lighting purposes (approximately, £5,000 worth a year). The proposed supply would involve very extensive alterations and additions to the existing plant at the electricity works. A Sub-Committee has been appointed to take any preliminary action that may be necessary.

Harrogate.—Year's Working.—For the year ended March 25th, 1915, the revenue of the Corporation electricity undertaking amounted to £18,790, and the gross profit to £8,289. Including other amounts brought in, the balance of net revenue amounted to £8,564, from which, after meeting interest and loan charges, and placing £250 to reserve, the balance of £573 was applied to rate relief. The reserve fund now stands at £2,504. During the year 2,056,731 units were generated, and 1,452,009 sold; the public lamps numbered 825 (incandescent), and the maximum load was 940 kw.

Kettering.—Plant Inspection.—On October 5th the past and present members of the U.D.C. met at the electricity works to inspect the installation generally, and the recent extensions in particular. The new plant has been supplied by the Brush Co. and Messrs. Siemens, and the whole work has cost £8,600. Congratulatory speeches were delivered, the chairman, Mr. Lewis, mentioning that the plant was now in a position to generate over three million units per annum.

Leeds.—Improved Lighting.—As a result of arrangements between the Street Lighting Committee of the Corporation and the chief constable, the streets are to be better lighted than has been the case for some time past, the improvement being gradual until about two-thirds of the street lamps are again brought into use.

Leek.—The Electricity Committee recommends that the charge for lighting churches and chapels be reduced from 5½d. to 5d. per unit, as from July 1st last, subject to an allowance of 10 per cent. on conditions.

London.—Woolwich.—Bulk Supply.—The Finance Committee has been in correspondence with the L.C.C. as to the B.C.'s application for sanction to borrow £4,700 for linking up the undertaking with that of the South Metropolitan Electric Light and Power Co. The sanction is being granted on the understanding that the balance of the loan for plant will be repaid by the B.C. when the plant is no longer in use for the purposes of the undertaking generally, subject to the approval of the B. of T.

Newcastle-under-Lyme.—Exhibition.—An electrical exhibition in premises in the Iron Market, is being held during October by the Corporation.

Oldham.—War Bonus.—The employés at the Corporation electricity and destructor works have agreed to wait B. of T. intervention with regard to a claim of 2s. per week war bonus for all the members of the Municipal Employés' Association.

Pembroke (Co. Dublin).—Plant Extension.—The Council has decided to purchase a new engine in connection with the electric lighting plant of the township, at a cost of £2,000.

Portrush.—B. of T. Sanction.—Intimation has been received by the Urban Council that the B. of T. is now in a position to give its consent to the proposed works for a generating station for electricity supply.

Reading.—Street Lighting.—The Electric Supply Co. has allowed the T.C. a rebate of £84 per annum in respect of the reduced public lighting at Caversham.

Sheerness.—Loan Application.—The L.G.B. has informed the U.D.C. that it cannot at present sanction a loan for the provision of a refuse destructor.

Stockport.—Improved Street Lighting.—The lighting of the streets, which has been subdued for some considerable time, is now to be improved.

Stretford.—Improved Street Lighting.—The D.C. has received an intimation from the County Police that the lighting of the district may now be improved.

Swansea.—Market Lighting.—The Markets Committee has decided to substitute half-watt lamps at the Swansea Market for the present arc lights, which have been causing considerable trouble. The engineer reports that a saving of 25 per cent. would be effected in the consumption of current, and the cost of carboning—£30 per annum—would be done away with. Against this, however, the cost of replacing about once every three years of the burnt-out half-watt lamps would have to be met. The expenditure on the arc lighting (current and carbons) averages £123 per annum at the present time.

In order to economise, the Highways Committee has decided to limit the public lighting of the borough, much of which is by electricity, by lighting only every alternate lamp except where the electric lights are in series, and situate at the junctions of streets.

The Electric Lighting and Tramways Committee was informed that the G.W. and Rhondda-Swansea Railway Companies and the Harbour Trust had granted free wayleaves to enable the Committee to run a cable to the works of the English Crown Spelter Co., but Lord Jersey, through his agent, pressed for the payment of £10 per annum, as it was purely for trade profit purposes. The Committee decided to inform the War Office that the work was being held up owing to the conditions imposed by Lord Jersey.

Trowbridge.—Overhead Wires.—The U.D.C. has decided upon an area in the town in which, as a general principle, no overhead wires are to be used by the Electric Supply Co.

Tunbridge Wells.—Street Lighting.—Owing to restricted lighting the electricity department has allowed a reduction of £1,410 per annum, whilst the regulations are in force, off the public lighting account.

Wilmslow.—The U.D.C. has decided to ask the Alderley Edge and Wilmslow Electric Supply Co. to resume the full lighting of the district at once.

Wolverhampton.—Loan Application.—The Electricity Committee has decided to lay additional mains, &c., at an estimated cost of £1,365, for which L.G.B. sanction is to be asked, as also to the borrowing of £5,000 for defraying expenditure in connection with other mains in the borough. The Committee proposes to renew, for a further period of five years, the agreement for the supply of current to the British Oxygen Co.

TRAMWAY and RAILWAY NOTES.

Australia.—Through the courtesy of Mr. W. G. T. Goodman, chief engineer and manager, we are able to give the following particulars of the working of the Adelaide (S. Aust.) Municipal Tramways Trust for the half-year ended July 31st, 1915. The net revenue during this period was £57,794, and the full statutory charges amounted to £62,390, leaving a deficit of £4,595, but some £2,500 extraordinary revenue expenditure was incurred. The gross revenue for the period was £153,283, or £11,420 less than the corresponding period of last year, and £18,000 less than it should have been had ordinary economic conditions prevailed. The capital cost of the revenue earning portion of the electric traction system, excluding purchase-money and stores, was £1,399,996; the surplus revenue over operating expenses (excluding Port Adelaide horse-car account) was £58,206, and the percentage of working expenses to revenue was 61·9. The surplus revenue over operating expenses equalled 8·3 per cent. on the capital cost. The reserve for renewals now amounts to £87,364, and the insurance reserve to £8,307.

A recent issue of the *Sun* contains some particulars of the new Sydney (N.S.W.) suburban electric railway scheme, for part of which contracts have been made with Messrs. Norton, Griffiths, Ltd. The whole scheme includes a two-track loop-line round, and through, the city, with stations within easy access of all the important business and shipping centres, also an Eastern suburbs railway and a Western suburbs railway. The latter line will pass over the proposed bridge over Darling Harbour to Balmain. The present contract includes the whole of the city railway and parts of the Eastern and Western suburbs railways. It is proposed to provide 160 trains an hour in each direction on the new city railway from the new central station; an ultimate capacity of 192,000 passengers an hour in each direction will be given. A speed of 18 miles an hour, including stops, is proposed, and the round city journey will occupy 10 or 12 minutes. A recent report showed that with the present rate of expansion the suburban railway traffic would double itself in 5·8 years; the city and suburban tramway traffic would double itself in 6·8 years; the Northern suburbs tramway traffic would double itself in 4·9 years; and the ferry traffic in 7 years. Tramway traffic has reached saturation point, and more cars cannot be accommodated at rush hours. It is calculated that the new services would account for 164,000, or 37 per cent., of the through tramway passengers daily, and that 40 per cent. of the tramway cars can be removed from the streets in consequence.

Bradford.—As a result of a conference between the Bingley Council and the Tramways Committee, the latter has agreed to pay an increased price for the current supplied in accordance with Clause 11 of the lease of the Bingley Tramways.

On Thursday, last week, when a Corporation tramcar had mounted nearly to the top of Church Bank—a steep incline where a fatal accident took place some years ago—the vehicle commenced to slip down the hill. Some passengers jumped off the car and received injuries. The car travelled a short distance down the bank before the driver was able to make the brakes work, when it was brought to a standstill, and later it proceeded on its journey.

Bury.—The Tramways Committee has decided that no employé enlisting without the sanction of the head of his department shall receive the benefit of wages during his service with the Forces; it was explained at the T.C. meeting on the 7th inst. that there was no intention to discourage tramway employés from enlisting, but the resolution had become necessary because of the inconvenience caused through motormen staying away and enlisting without giving notice of their intention to do so.

Continental.—Spain.—The concession for an electric tramway from Mongat to Tiana (Barcelona) offered to public competition has been secured by Juan Gari. The line is to be built according to the official plans, and the scale of fares is prescribed.

Cuba.—The Havana Electric Railway, Light and Power Co. has been authorised to construct a new double-track electric tramway in that city. Work must be commenced within a year, and completed within two years, from the date of the promulgation of the decree.

Doncaster.—The Tramways Committee has decided that no unaccompanied parcels be accepted for carriage on the cars, and no fish in boxes, meat in bulk, or fixed perambulators or mail carts; that passengers boarding cars after the first collection of fares has been made on leaving any terminus, and desirous of riding on the top, be asked to pay their fares on the platform before proceeding upstairs.

India.—Electric Vehicle.—According to *Indian Engineering*, there is no reason why small electric vehicles should not displace the rickshaw in hill stations, where these are in general use. Electric vehicles are now on the market that will take most of the gradients found in and about Simla. The overall dimensions of the car need not exceed about 11 ft. × 5 ft., which would be inappreciably larger than the single-seated rickshaw. The conditions on a hill station are ideal for regenerative control, and advantage would naturally be taken of this fact; also the electric braking properties of the motor greatly facilitate matters for hill station use.

Leeds.—War Bonuses.—Application has been made by the tramway employés for extra rates of pay, including time and a half for the seventh day of duty, and for all special or extra duty. It is stated that the previous war bonuses of 2s. and 1s. per week conceded by the Corporation are inadequate to meet the increased cost of living. The General Purposes Committee has declined to accept the contention of the men that the seventh-day work is overtime within the meaning of the agreement as to employment, and considers it would be absurd to submit the point to Sir George Askwith, as desired by the workmen.

London.—On Thursday morning last week, a tramway accident occurred near Finsbury Park, in which from 20 to 30 passengers received injuries. The accident was due to a following car colliding with a stationary car in front, which was discharging passengers, and it considerably interrupted the tramway service.

Liverpool.—Traffic Report.—During the first nine months of the year the economies effected on tramway capital expenditure and in other ways reached £17,000. Over £25,000 worth of free rides were given to members of H.M. Forces and nurses, and war allowances and bonuses were paid at the rate of £40,000 a year. The receipts were £521,546 against £517,240 in the corresponding period last year. The passengers carried had risen from 109 million to 112 million, while the earnings per car-mile had increased by 1·23d.

Manchester.—Track Renewals.—The work of reconstructing the outward track in Portland Street—one of the principal central thoroughfares—has just been commenced.

The Bucklow R D.C. has decided not to renew the licences granted to the Manchester Corporation tramway department for the running of motor-omnibuses to Northenden, owing to the inadequate service. It appears that the military authorities impressed all the Corporation's motor-'buses. The Corporation received three motor-'buses—it had eight formerly—and ordered more, but the Treasury ban on expenditure made it impossible for it to get the vehicles. It was stated that arrangements had already been made for a "suitable service."

New Zealand.—The Dunedin Council has decided to borrow £26,000 for new tramcars, remodelling the existing cars and for alterations to the approaches to the car-sheds.—*Tenders.*

Oldham.—The tramways manager has been authorised by the Tramways Committee to order parts for renewal of a crossing at Mumps Bridge, at an estimated cost of £400.

Female Labour. — At a meeting of the T.C. last week criticism was offered as to the employment of women as car conductors, and it was suggested that the Tramways Committee could get men suitable for the work. The Mayor said that his wife intended to become a lady car conductor when her year of office was completed, a remark received with laughter.

Rochdale.—War Wages.—The Tramways Committee having considered the application of the tramway workers for a permanent increase of wages in lieu of a war bonus, has decided that it cannot see its way to depart from the decision of the T.C. in the matter.

Southampton.—Electric Tower Wagon.—The Tramways Committee has recommended the purchase of an Edison electric chassis, at £627, for the purpose of a motor tower wagon; also a motor-generator, at an estimated cost of £250, for charging the vehicle, upon the understanding that the Electricity Committee will supply the necessary current at 1d. per unit, the vehicle to be charged off the peak load.

Southport.—Year's Working.—For the year ended March 31st last, the Corporation tramways carried 4,772,478 passengers, an increase of 108,899 on the previous year; the car-mileages for the two years were 475,680 and 463,242 respectively. Despite these increases, the energy used per car-mile decreased from 1·011 to ·977 unit. Working expenses, less war allowances, show a saving of £139, the ratio working expenses to receipts falling from 68·8 to 63 per cent.; the gross profit was £7,312, as against £5,864, and, after meeting war allowances, there was a net profit of £12, the first shown for the past six years. In the previous year there was a deficit of £1,403. The improved returns are attributed to the opening of the "Grand Tour" section, on which the receipts averaged 29·4d. per car-mile, despite the interference of the war. The reserve and renewals fund is stated to be £442 for the Corporation worked lines. Certain lines in the borough are leased to a company, and the balance of receipts from those lines is shown as £15,804; up to the same date there was a total deficit on the Corporation worked lines of £9,472, and, taking both concerns, there is a balance shown of £6,332.

Walsall.—The Birmingham and Midland Tramways Joint Committee is to be asked for the reason of the failure of current on the Wednesbury and Willenhall lines on four occasions recently, when the tramway traffic was suspended for some hours. The tramway manager reports that the introduction of female labour on the cars has been successful, and that, at present, 18 women are engaged as conductors. Messrs. W. A. Stevens, Ltd., state that, in consequence of Government orders connected with the war, they could not give any date for the delivery of the three motor-omnibuses remaining to be delivered under their contract, and that they could not give an unconditional guarantee of delivery of the three additional 'buses for which the Committee contemplated giving them an order. Under the circumstances, the Tramways Committee has decided not to place a further order with the company at present, and, in view of the urgent necessity for additional travelling facilities to be provided, recommends that it be authorised to purchase three 'buses, at a total cost not exceeding £3,000. In this connection the town clerk has been instructed to write to the War Office, the Admiralty, and the Ministry of Munitions, requesting that, in view of the necessity for further travelling facilities being provided for the adjoining colliery districts, they will allow the contractors to deliver the motor-'buses ordered, or to be ordered, on behalf of the Corporation, so that an adequate service can be given to such districts. The Committee is prepared to make a contribution of £2,000 in aid of rates, out of the profits of the undertaking, for the year ending December 31st next.

TELEGRAPH and TELEPHONE NOTES.

Australia.—A revised scale of charges for telephone services has been laid before the House of Representatives by the Postmaster-General; it practically doubles the present rates for effective calls, both on subscribers' instruments and public telephones, while the ground rents are to be imposed on a basis which, in some individual cases, will involve a slight reduction, and in others a slight increase. The line covered by ground rent is in each case miles. The revised scale for ground rent is as follows:—

Subscribers' lines connected.	Radius of network.	For an exclusive service.			For each subscriber or instrument on a two-party service.			For each subscriber or instrument on a three or more party service.		
Exchanges or networks having—	Mls.	£	s.	d.	£	s.	d	£	s.	d.
From 1 to 300...	5	3	0	0	2	10	0	2	0	0
" 301 to 600	5	3	5	0	2	10	0	2	0	0
" 601 to 1,500	5	3	10	0	2	15	0	2	5	0
" 1,501 to 4,000	10	3	15	0	3	0	0	2	10	0
" 4,001 and upwards ...	10	4	0	0	3	0	0	2	10	0

Charge for Calls.

For each effective call originating from a subscriber's instrument, 1d.

For calls originating from a public telephone, 2d. per conversation of three minutes.

In future the ground-rents will vary according to the number of subscribers' lines, instead of being based on a population basis as at present. In the aggregate the department will lose about £1,000 by the change. The population basis has proved to be unfair. Existing contracts will be allowed to run their course, but the rentals on the new basis will apply immediately to all new subscribers. The increased rates will come into operation about the New Year.

In submitting the new scale, Mr. Spence also tabled the report of the Departmental Committee of Investigation which met last year to inquire into the best means of meeting the deficiency on telephone working, which amounted to £296,424 for the year ended June, 1914. The Committee found that a saving of £78,000 per annum could be effected by economies in operating and repairs and maintenance. To make up the remaining deficiency of £218,000, the Committee recommended the adoption of an amended scale.

Chorley.—The B. of G. has decided to install the Dictograph-Turner intercommunication telephone system in the workhouse, at an estimated cost of £140. Tenders are to be invited for the work.

Japan.—According to a report just to hand, although there is a very active demand for connections to the telephone system in Tokio, only one-tenth of the recent applications have been attended to, the Central Telephone Bureau not having sufficient available funds. It is also stated that the telephone apparatus in use is quite out of date, and not to be compared with that employed in Europe and America. The authorities are fully aware of this, but cannot do anything to improve matters; owing to the shortage of allotted appropriations and the rigorous curtailment in expenditure enforced in all the Japanese Government Departments.

New Lines.—The Compagnie Française des Câbles Télégraphiques has opened for traffic a submarine cable between San Domingo and Mayagnez in Puerto Rico, connected by an overland line 186 km. in length with San Juan.—*Journal Télégraphique.*

New Telephone.—It is reported from Christiania that a new micro-telephone (? microphone) has been devised by a Norwegian inventor, which renders it possible to telephone to a distance three times greater than at present, and that the invention is also of considerable importance for wireless telephony. The sum of £25,000 has been set apart for carrying out official experiments, which are to begin shortly.

Norway.—The construction of the trans-Atlantic radio-telegraph station at Stavanger, Norway, which has been delayed by the war, has been resumed by the Marconi Co. When completed Stavanger will exchange traffic with the Marconi station at Chatham, Mass.—*T. and T. Age.*

Spain.—The installation of a telephone system connecting the various towns of the four united Provinces of Catalonia, including the establishment of central telephone exchanges, has been authorised.—*Board of Trade Journal.*

Telephoning in French.—The French language is said to have been found much better adapted to long-distance telephoning than the English, and operators in Paris have succeeded in transmitting messages to London at the rate of 190 words a minute.—*T. and T. Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—December 7th. P.M.G.'s Department (various States). Non-encrusting zincs, carbon and manganese powder, manganese chloride, chloride of ammonia, porous pots (2 in.), outer jars for cells, carbon blocks, resistance boxes of 5,000 ohms, &c. See "Official Notices" to-day.

SYDNEY.—December 6th. Municipal Council. 33,000-volt outdoor transformers and switchgear. Specifications (10s. 6d.) from Electric Light Department, Town Hall.

December 20th. Metropolitan Board of Water Supply and Sewerage. Centrifugal pumps and electric motors at the Marrickville low-level pumping station.

November 4th.—P.M.G. 58 miles lead-covered cable (11 items).

January 12th, 1916. N.S.W. Railway and Tramway Department. Two water-tube boilers, &c., for the Zara Street power house, Newcastle. See our last issue for further particulars.

January 31st, 1916. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

MELBOURNE.—December 14th. Deputy P.M.G. Eleven sections of a lamp-signalling trunk-line switchboard, and other material necessary for increasing the equipment of Melbourne trunk exchange from 108 to 240 lines. Schedule 1,207.*

VICTORIA.—December 14th. P.M.G. For delivery in all States, 18 670 common-battery wall pattern telephones, manufactured in Australia. Sched. No. 1,264.

VICTORIAN RAILWAYS.—January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

PERTH.—December 8th. 294 accumulators, and power board complete, for P.M G.'s Dept. See "Official Notices" October 8th.

GOULBURN.—October 30th. One 200-KW. direct-coupled D.C. generating set, gas or steam driven. Specification (10s.) from the Town Clerk, or at the office of the Local Government Association, 103-4, Queen Victoria Markets, Goulburn.

Darlington.—October 22nd. Corporation. 3,000-KW. turbo-alternator; surface condensing plant. See "Official Notices" October 8th.

Dublin.—October 25th. Corporation. Alterations and additions to electric lighting of public baths and wash-houses, Tara Street. Specifications from the City Electrical Engineer, Fleet St.

November 4th. Great Northern Railway Co. (Ireland). Twelve months' supply of stores, including a number of electrical items. See "Official Notices" to-day.

Dundee.—October 21st. The Harbour Trust. Electric lighting of Shed "Y" at the new wharf. Specifications, &c., from Mr. J. H. Thompson, General Manager and Engineer.

Greystones (Co. Wicklow).—One 60-B.H.P. gas engine, alternator, and switchboard panel for Greystones Electric Light and Power Co. See "Official Notices" October 1st.

Leeds.—October 18th. Overground transformer chamber at Houghton Street and Rawson Place, Dewsbury Road. C. N. Hefford, Manager, Electric Lighting Department, 1, Whitehall Rd.

Littleborough.—October 22nd. U.D.C. H.T. cables, road-work, &c., transformers and switchgear for sub-station. See "Official Notices" October 1st.

New Zealand.—DUNEDIN.—November 3rd. City Council. Insulated and bare copper wire for a period of two years.*

November 3rd. City Council. One 3,000-volt regulator.*

Salford.—October 18th. Coal required for the electricity department. Particulars from the Borough Electrical Engineer, Frederick Road, Pendleton.

Spain.—October 30th. The municipal authorities of Avila are inviting tenders for the concession for the electric lighting of the town during a period of ten years.

Watford.—October 18th. Wiring new waterworks pumping station for light and power, for the U.D.C. Mr. D. Waterhouse, Engineer, High Street. (Returnable deposit of £1.)

York.—October 28th. N.E. Railway. Six or twelve months' supply of telegraphic apparatus, wire, and line stores. See "Official Notices" to-day.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Argentina.—The tender of the Anglo-Argentine General Electric Co., Ltd., for the supply of 40,000 carbons for the lighting of the port of La Plata has been accepted by the Direccion General del Puerto de Buenos Aires; price $4,475 m/n.

Australia.—TASMANIA.—The tender of the B.I. and Helsby Cables, Ltd, has been accepted by the Launceston City Council for the supply of 2,640 yards of underground armoured feeder cables, at £1,082, subject to the market price of copper and lead.

SYDNEY.—The following contracts have been received by the Municipal Council:—

D.C. TWO-WIRE METERS.

Noyes Bros.	(recommended)	£2,920
Standard Waygood-Hercules, Ltd.		2,938
Haes & Eggers		3,743
Edison & Swan		4,049
Aust. General Electric Co.		5,747

A.C. TWO-WIRE METERS.

Standard Waygood-Hercules, Ltd.		£6,830
Haes & Eggers		7,025
Noyes Bros.	(recommended)	7,145
Laurence & Hanson		7,176
Edison & Swan		7,699
Aust. General Electric Co.		8,063

TURBINE PLATFORM, NO. 12 TURBINE.

Poole & Steel	(recommended)	£298
Sydney Steel Co.		319
Luke Muras		340
R. L. Scrutton & Co.		365

MOTOR OR ROTARY CONVERTER.

		2,000-KW. set.	Price per KW. of output.
Brit. Westinghouse Co.	(recommended)	£7,847	£3·469
Guthridge, Ltd.		8,437	4·89
Dick, Kerr & Co.		9,364	4·432
Siemens Bros.		9,780	4·890
Aust. General Electric Co.		10,199	5 099

OIL DRYER AND FILTER.

Aust. General Electric Co.	(recommended)	£368

The following tenders have been accepted:—

VICTORIAN RAILWAYS.

Electric lighting material for the Jolimont car shop, £287.—W. T. Henley's Telegraph Works Co., Ltd.

Electrical equipment for new bogie cars, Brighton street railway.—Aust. General Electric Co.

N.S.W. PUBLIC WORKS DEPARTMENT.

Installation of six electric goods-lifts at the State abattoirs, Homebush £2,935.—Standard Waygood-Hercules, Ltd.

EMU BAY MUNICIPAL COUNCIL (TAS.).

Electric lighting plant, £2,284.—Dalgety & Co. —*Tenders.*

Bradford.—The city engineer having reported that the North-Eastern Steel Co., Ltd., had rolled about 45 tons of steel tram rails in excess of the quantity required by the Corporation under their contract, and that the surplus rails were now offered at the price of £6 per ton, it has been decided to recommend the City Council to accept this offer.

At a recent meeting of the Works Sub-Committee, the general manager submitted correspondence which had passed between himself, the War Trade Department, and the Board of Trade, with respect to the contract placed by the Corporation with Messrs. Brown, Boveri & Co., Ltd., for the supply of tramcar motors. He further reported that, as a result of small modifications in detail of the motors, the original contract price of £22,000 would be increased to £22,318, and the Sub-Committee decided to recommend that the increased price be approved.

The Tramway Works Sub-Committee has accepted the offer of the British Oxygen Co., Ltd, for the supply of oxygen required by the Tramways Department during the ensuing three months at the price of 35s. per 1,000 cb. ft. It has also accepted the tender of Messrs. Scholey & Co., Ltd., for gear wheels and pinions for car motors as follows: 200 tool-steel gears, at £7 9s. each, and 200 tool-steel pinions, at £1 5s. each.

Dartford.—The electrical engineer has been instructed to order 100 tons of South Leicester nuts from Messrs. J. Waddell and Sons, at 24s. per ton delivered, and, if it proves satisfactory, a further 400 tons. The offer of Messrs. John Hudson & Co., Ltd, of about 180 tons of South Hetton coal, at 26s. 9d. per ton delivered, has been accepted.

Edinburgh.—The Council has accepted tenders by Messrs. Fraser & Chalmers for turbo-alternators and condensing plant for the Portobello new power station. Messrs. Vickers and Messrs. Richardsons, Westgarth & Co., are sub-contractors. A discussion that took place respecting the matter is reported in our "War Items" to-day.

Hereford.—The T.C. has accepted the tender of Messrs. Bowater, of Birmingham, for 1,000 tons of Haunchwood fine slack coal for the electricity works.

London.—L.C.C.—The Highways Committee recommends that the operation of standing order No. 295 be suspended, in order that payment may be made to the following firms for work done at the Greenwich generating station:—Messrs. J. Cochrane & Sons, Ltd., retention money under their contract for the laying of condensing water pipes; payment on account of £3,127 to Messrs. Davidson & Co., Ltd., in respect of their contract for the provision of four induced draught fans; a further payment on account of £4,885 to the British Westinghouse Electric and Manufacturing Co., Ltd., in respect of their contract for the supply of high-tension switchgear, &c.

Rotherham.—The Tramways Committee of the T.C. has arranged to purchase three motor-omnibuses from the Daimler Co., Ltd., at £953 10s. each.

Southampton.—In reference to the Electricity Committee's contract with the British Thomson-Houston Co., for the supply of a rotary converter, the British Electric Transformer Co., who are sub-contractors to the British Thomson-Houston Co., have notified them that their original price of £496 for the necessary high-tension transformers would not hold good owing to the increased cost of materials, &c. Under the circumstances the Committee has agreed to the amount of the contract being advanced to £542. The Committee has had its attention drawn to the necessity of providing slot meters, but has deferred consideration of the matter in view of the difficulty of obtaining meters at the present time.

The T.C. received the following tenders for installing electric light at the Ascupart Street Police Station :—

A. Kingman & Co.	(accepted)	£18 12 0
J. Davis & Co., Ltd.		19 10 0
F. W. Cook & Co.		21 11 6

The tender of Messrs. Edgar Allan & Co. has also been accepted, at £225, for tramway points and crossings. Messrs. Hadfield's Steel Foundry, Ltd., quoted £240.

The offer of Mr. H. P. Pemberton to purchase a quantity of old rails, at 87s. per ton, has been accepted.

Torquay.—The Electricity Committee has accepted the offer of Messrs. Cory Bros. to supply 1,500 tons of coal in equal quantities extending over a period of 12 months, subject to their giving the Council the benefit of any rebate allowed them from the collieries in consequence of Government legislation for limitation of prices.

Watford.—The Electricity Committee has accepted the offer of Messrs. W. Cory & Son, Ltd., to supply 900 tons of Arley peas coal, at 19s. 7d. per ton.

Wolverhampton.—The Electricity Committte recommends the acceptance of the tender of Messrs. Amies & Sharratt, at £1,045, for constructing the foundation and other work in connection with the new cooling tower.

Woolwich.—The following tenders have been accepted by the Electricity Committee in connection with the extension of the Globe Lane Station :—

S. B. Goslin & Sons.—C.I. chute plates, £23.
Bell's Asbestos Co.—Covering 3 in. and 8 in. steam pipe for 8,000-KW. turbo-alternator, £39.
Ferranti Ltd.—Switchgear for 1,000-KW. converter, £120.

The borough electrical engineer has been instructed to purchase either a new or secondhand centrifugal pump to be installed at Globe Lane Works, so that the various turbines may be run in parallel without risk of losing the circulating water. By the adoption of this pump a larger output can be handled with greater safety. The Royal Arsenal authorities have accepted the Committee's quotation for a permanent supply to the Dockyard, and in this connection a contract is to be sealed with Messrs. Ferranti Ltd., for the supply of the necessary switchgear at a cost of £101.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, October 15th. At 8 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "The Theory of Grinding, with Reference to the Selection of Speeds in Plain and Internal Work," by Mr. J. J. Guest.

Greenock Electrical Society.—Friday, October 15th. Lecture by Mr. F. H. Whysall (Hon. President), chief electrical engineer, Greenock, on "The Construction of Storage Batteries." Mr. A. Norwell, B.Sc., Principal of Greenock Technical School, will preside.

The Faraday Society.—Tuesday, October 19th. At 8 p.m. At the Institution of Electrical Engineers. General Discussion on "The Transformations of Pure Iron." Sir Robert Hadfield will preside. Dr. A. E. Oxley, of the University of Sheffield, will open the Discussion. Tickets may be obtained from the Secretary, at 82, Victoria Street, S.W.

Diesel Engine Users' Association.—Wednesday, October 20th. Further Discussion on "Lubrication of Diesel Engines."

Nottingham Society of Engineers.—Wednesday, October 20th. At 7.30 p.m. At Welbeck Hotel, Milton Street. Paper on "Steam Turbines, Blowers and Compressors," by Mr. J. Goldes.

Chemical Society.—Thursday, October 21st. At 8 p.m. At Burlington House, W. Informal Meeting.

Junior Institution of Engineers.—Friday, October 22nd. At 8 p.m. At 39, Victoria Street. Paper on "Safety Precautions for Transmission Machinery," by Mr. W. V. H. Capps.

Manchester Association of Engineers.—Saturday, October 23rd. At Grand Hotel, Aytoun Street. Paper on "Notes on Some Recent Researches," by Prof. J. E. Petavel.

NOTES.

Lamp-Trimmer's Ladder.—The street lamps in Chicago are trimmed from a ladder which is set firmly against the base of the post on which the trimmer is working, while the ladder leans outwards and is supported from the post at its upper end by an iron stirrup, which maintains it at a convenient distance from the lamp globes. The trimmer, while ascending the ladder and while working on the lamps, remains at all times between the ladder and the post. Such a ladder possesses several advantages over the ordinary ladder. It is, for example, impossible for it to slip ; it presents practically no obstruction to pedestrian traffic ; it places the trimmer in a convenient position for working, and it minimises the hazard to both the public and the trimmer.—*Electrical World.*

Foreign Trade.—FIGURES FOR SEPTEMBER.—The following are the electrical and machinery figures given in the official returns for September :—

	Month of September. £	*Inc. or dec.* £	*Nine months, 1915.* £	*Inc. or dec.* £
IMPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	107,369	+ 59,599	766,128	− 263,084
Machinery ...	805,587	+ 583,889	6,873,390	+ 1,566,117
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	262,088	+ 82,015	2,270,267	− 114,123
Machinery ...	1,611,450	− 12,600	14,611,354	− 11,495,212

Radium and Plant Growth.—As the result of very careful experiments, the conclusion has been reached that radioactive materials exert no appreciable influence on the growth of plants, in spite of the favourable results that were announced some time ago.

Spanish Prize Competition.—The Spanish Society for promoting the national industries, styled El Fomento del Trabajo Nacional, announces that the Deu annual premium of 5,000 pesetas will be awarded this year for any new invention, process, or improvement in the department of electrical or mechanical engineering, chemistry, physics, the arts, or commerce, tending to the progress of Spanish industries. The competition is open to foreigners, and further particulars may be obtained from the Secretaria, 4, Plaza Santa Ana, Madrid.

Removing Russian Electrical Plant.—It was reported at a recent meeting of the Electrotechnical Section of the Russian Military Industries Committee, that much of the electrical machinery and apparatus removed from places ordered by the military authorities to be evacuated had been removed by wholly incompetent people. Many comparatively useless parts had been taken, and essential parts left behind. It is stated that to obviate such errors in future, the Military Industries Committee will be charged with the execution of the work.

The A.S.E.—It is announced that the Amalgamated Society of Engineers has, by 16,075 votes to 14,259, resolved to secede from the General Federation of Trade Unions. The *Times* reports Mr. Young, the general secretary, as saying that the members no longer wish to belong to a financial federation, but to build up a fund of their own.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—

Company Orders.—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week commencing October 18th, 1915 :—

Drills, 6.15 to 7.15 ; 7.15 to 8.15 p.m.

Monday, October 18th.—Section 1, Technical ; Section 4, Squad.
Tuesday, October 19th.—Section 2, Technical ; Section 3, Shooting.
Thursday, October 21st.—Section 3, Technical ; Section 2, Shooting.
Friday, October 22nd.—Section 4, Technical ; Section 1, Squad.

Signalling Class Mondays and Fridays, but members will attend Technical Classes Mondays and Fridays with their Sections. Recruits attend on Mondays and Fridays.

Members will fall in for all Drills at the new Headquarters, Chester House, Eccleston Place, S.W., on and after Monday, October 18th.

E. G. FLEMING,
Company Commander and Acting Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, October 14th, 1915 :—

Week-end Parades.—Saturday.—Field Day. The Battalion will parade at Baker Street Station at 2.15 sharp, and proceed by train, right half Battalion, under the command of Mr. H. O. King, to Neasden Station ; left half Battalion, under the command of Mr. W. Ridd, to Preston Road Station. The general idea has been issued to the Commanders concerned.

Sunday.—The Battalion will parade at Liverpool Street Station at 9.30 a.m. and proceed by train, for entrenching duties, returning about 4.55 p.m. The Quartermaster will make the necessary arrangements for lunch and refreshments.

Entrenching.—Members are reminded that this work is still being carried on daily (except Fridays), and are directed to attend as frequently as possible.

Musketry.—Saturday next, the 16th inst. There will be shooting at both Acton and Bisley Ranges, as usual. Members proceeding to Bisley must report themselves to Sergeant Cotter, at the barrier of No. 9 Platform, Waterloo Station, at 12.45 p.m.

Tuesday next, the 19th inst. Shooting at Acton, as usual.

A. G. JOINER, *Major and Adjutant*, O.B.C.

A 500-mile Electric-Vehicle Run.—Recently Mr. Chas. Chamberlain, of Buffalo, N.Y., made a journey across State from Buffalo to New York, in a Waverley electric car. The trip would have been completed in three days but for poor charging facilities in two places which delayed matters. To cover the 500 miles, 94 KW.-hours were required, or ·18 KW.-hour per mile.

The Electro-Harmonic Society.—The first smoking concert of the season was held on Friday evening last at the Holborn Restaurant. Notwithstanding the prevailing war conditions there was a large company present. The well-filled concert hall bore evidence that the value of a few hours' fraternisation and relaxation among kindred spirits is clearly recognised in these days when electrical men, like other engineers, are feeling the strain of munition-making and other war activities and anxieties. The artistes were all good—several specially so. Encores were frequent, and the applause was both enthusiastic and unstinted. Altogether the opening night augured well for a successful season. Mr. W. J. Tennant made a capital chairman, and as his remarks are, in our estimation, worthy of a wider circulation than they obtained last Friday, we quote them below:—

"Gentlemen, the next turn is my turn. Your secretary—you know what a martinet he is—has asked me to say a few words. First, I have to express regret that our hon. treasurer, Sir John Snell, who was to have taken the chair this evening, at the last moment found himself unable to do so. As you all know, his official responsibilities have recently been much increased, and he writes that he is driven from pillar to post, and is being shamefully overworked. Then our old friend and musical director, Mr. Gatehouse, writes that he is recovering from a slight attack of bronchitis. He says the programme has purposely been made a little shorter than usual on account of the difficulty of getting home these times. You have to grope your way owing to the increased darkness of the streets, and there are also the difficulties of reduced train facilities and other means of locomotion to contend with. Members may, therefore, be glad of the opportunity of leaving somewhat earlier than has been the case in previous years. Now I have a few statistics which I should like to bring to your notice. The number of members on the roll at the end of last season was 632 as compared with 664 at the end of the previous season. Since the end of last season two have died, 21 have resigned outright, and 36 memberships are in abeyance till the end of the war, either on account of absence on active service or because of bad times. This is somewhat serious, as the result is that our active membership is reduced to 573, and, furthermore, only 13 new members have been put up for election so far this season, as compared with 55 last year. Last, but not least, current subscriptions are not coming in as well as they might, and certainly not as well as usual, or as they ought to do. In these unprecedented times, I think we should make a special effort to keep things going and to carry on as usual. Is it to be said, when the war is over, that we had not the nerve or the cash to keep the Electro-Harmonic Society going in spite of the 'Bosches?' That these are days for economy, I agree; but there are wise and unwise economies, and I think this is essentially a time when a sane and reasonable amount of recreation should be taken, especially when it does not run us into much expense. The concerts we get at the Electro-Harmonic Society are half the price of, and far superior to, those usually provided for this class of entertainment; and there is a camaraderie existing amongst us that is not to be found amongst ordinary audiences. I suggest that we should all put our shoulders to the wheel, and determine to keep the flag of the Electro-Harmonic flying bravely until the better times arrive that we must all hope are in store for us in the future. Remember the 'Ladies' Nights,' and bring the ladies on those occasions just the same as usual. The ladies are doing a great deal for us in these days, and we should show our gratitude to them in every possible way."

Workman Fined.—Frank Taylor, iron turner, of Ann Street, Stockport, was summoned at the Stockport Police Court, on Tuesday, by his employers, Messrs. G. H. Heywood & Co., Ltd., electric power engineers, of Reddish, for breach of contract in unlawfully absenting himself from work. It was stated by Sir William Cobbett (for the firm) that between September 4th and September 28th defendant absented himself from work, more or less, on 12 days, and was away for just short of 50 hours. Defendant worked on a lathe, and his action in absenting himself rendered other workmen, and machines also, idle, with consequent loss to the firm, who were engaged in important Government work. The firm claimed £5 from defendant. Taylor told the Bench that he did the heaviest work in the shop, and he complained that there were two motors behind him, and he felt a draught. He was ordered to pay the £5 claimed, together with the costs of the proceedings.

Institution and Lecture Notes. — Institution of Heating and Ventilating Engineers.—At the autumnal general meeting held on Tuesday last at the Holborn Restaurant, Mr. W. Jones read a paper on "Heat Transmission and Heat Emission," and Mr. S. Naylor read one on "A Comparison between Forced Firing and Slow Combustion."

University of London.—Prof. J. A. Fleming is to deliver a course of six lectures on "Electric Heating and Electric Furnaces," at the University College, on Friday evenings, at 5 p.m., beginning on October 29th. The fee will be £1 11s. 6d. for the course.

Electrical Association of Australia.—The first meeting of the Federal Council was held in Melbourne on August 16th, 17th and 19th. Those present included New South Wales councillors Mr. O. W. Brain (Federal president), Mr. H. W. Myers (president New South Wales section), and Mr. A. C. F. Webb. The latter also acted as substitute for Mr. H. R. Forbes Mackay, who was unable to be present. The Victorian councillors were Mr. W. H. Alabaster (president of the Victorian section), Prof. Payne, and Mr. W. J. Newbigin. Mr. Newbigin was appointed hon. Federal secretary. A number of matters pertaining to the Association were discussed. A draft of the proposed rules governing the work of the Federal Council was submitted and approved, and a number of applications for membership were dealt with and approved prior to their election by the respective sections.

At the August meeting of the N.S.W. Section a paper on "Direct-Current and Alternating-Current Sub-Stations" was read by Mr. J. S. Just.

Association of Mining Electrical Engineers.—It was reported at the opening meeting of the session of the West of Scotland Branch that the membership now stood at 201. The Chairman (Mr. A. B. Muirhead) in explaining the work for the ensuing session, specially referred to a series of coal-cutting demonstrations which had been arranged through the kindness of Mr. Arnott, of the United Collieries, and Mr. J. P. C. Kivlen, of the Brodisholm Colliery. Mr. Muirhead delivered an address on "The Development of Electricity in the Scottish Mining Industry," in which he pointed out that they had now got sufficiently far from 1911—when the present code of electrical rules applicable to mining came into operation—and sufficiently near 1920 (when plant installed under the code of 1904 must be removed from active service to comply with statutory regulations) to justify a *résumé* of the whole position. Scotland's mining output had doubled in 30 years, and the mining conditions were hard and uncompromising. These difficulties had not always been understood by the legislators south of the border, who seemed to think it fitting to make laws as if Britain had one colliery of one coal seam and one set of conditions. Those difficulties in mining had led to a most marked development in the use of electricity for power purposes below and above ground, and he submitted tables to show that in all approximately 137,200 E.H.P. in motors had been installed, and taking this at 340 out of a total of 547 collieries, they had an average of 403·5 E.H.P. per colliery. The number of electrically-operated coal-cutting machines in use, which reached a total of 747, showed to what extent electricity had been called upon for "in-bye" purposes in the Scottish mine field. The number of compressed-air coal-cutters in use and their output per year did not appear to indicate that that type of machine need be seriously considered as a rival to the electrical machine as they now knew it.

Inquiries.—A correspondent asks for information as to the electrical uses of "Manjak."

Kharkoff Electric Supply System.—The *Electritchestvo* gives a full illustrated account of the Kharkoff electrical plant and equipment, which have undergone a series of extensions; further additions are again called for. The old town electric station was inaugurated in 1897, with four steam generators of a total capacity of 150 × 4 = 600 I.H.P., and an accumulator battery. Extensions of the plant took place in 1900, 1904 and 1906. In the year 1909 the total output was 2,927,212 KW.-hours. The street lighting was entirely effected by means of arc lamps, of which there were 530 in 1910. The demand has always been ahead of the capacity of the station. The town tramways began operation in 1906. In 1910 it was recognised that the station was inefficient in respect of pressure, accommodation and plant, and the construction of a new station, with alternating high-pressure (6,000 volts) current, was proceeded with, this station being inaugurated in 1912. It was built on very bad ground, and special measures had to be taken to complete the construction within the agreed time. The buildings and lines are planned to reach their maximum in the winter of 1915-16. Down to 1/14 January, 1914, the money spent on all the work was about 1,200,000 roubles, besides bonds to the value of 500,000 roubles. There are about 35 versts of tramway, of metre gauge, employing about 800 workpeople.

New 7-cwt. Edison Electric Vehicle.—A new electric delivery vehicle built to Mr. Edison's designs and intended for loads up to 7 cwt. has just been publicly displayed at the Edison works at West Orange, New Jersey, U.S.A. According to a statement by Mr. Edison, the object of the car is to replace the horse-drawn delivery van of the small tradesman, and he claims that the cost of upkeep and running, including energy and storage, will equal only half the cost of feeding and stabling a horse, while the cost of tires will be less than that of shoeing a horse. The new vehicle is fitted with an Edison battery of a capacity sufficient for a range of travel of 45 miles on one charge, at a speed of 10 miles per hour.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. A. F. BOND, shift engineer at the Hornsey Corporation electricity works, has been granted a commission in the Royal Field Artillery. Mr. Bond has already seen service at the front in the 6th London Regiment, having been sent home wounded last May.

The Woolwich B.C. has increased the salaries of the following officers in the electricity department:—Mr. C. G. ELEY, leading charge engineer, from £150 to a maximum of £180; Messrs. T. W. BUNCE, L. G. BUTLER, and C. HOBSON, charge engineers, from £140 to a maximum of £170 by two annual increments of £15 per annum. Mr. W. SCOTT, at present acting charge engineer, is to be designated "charge engineer," and his salary increased from £130 to £140 per annum, rising to a maximum of £170 by two annual increments of £15.

Mr. W. Leighton Chubb has been appointed station superintendent at the Maidenhead Corporation electricity works.

Mr. F. Hayward and Mr. Poole, of the staff at the Hereford Corporation electricity works, have resigned. The former has taken up munitions work at the Coventry Ordnance Works.

Mr. H. A. Neville, the Wakefield City Electrical Engineer, has received permission from the Electricity Committee to accept the post of Secretary to the Wakefield Munitions Committee.

Mr. Archd. J. S. Waddell has resigned his position of shift engineer under the West Bromwich Corporation, having been appointed to a similar position at the Nechells power house under the Birmingham Corporation.

Mr. Herbert Broadbent, engineer and manager of the electricity department of Perth, Western Australia, resigned his post at the end of July, and has returned home in order to assist in the manufacture of munitions, or otherwise to take part in war work. Before leaving Perth he was presented with many souvenirs by societies with which he had been connected for many years, and at a farewell meeting of councillors and municipal officials held in his honour, the Mayor pointed out that Mr. Broadbent went to Perth in 1896, to erect the first electrical plant of any size in the State, for the Gas Co.; under his guidance the electricity department had been exceedingly successful, and was acquired by the city in 1912 on very generous terms, Mr. Broadbent continuing in office as engineer and manager. The Mayor expressed regret at his departure to place his services at the disposal of the home authorities, and wished him the best of fortune; the ex-mayor and the chairman of the lighting committee supported the Mayor, and Mr. Broadbent expressed his appreciation of the goodwill shown towards him.

Captain G. C. Milnes, borough electrical engineer for Lancaster, has been appointed Adjutant of the 5th King's Own Royal Lancaster Regiment, which has been rendering fine service in France since February.

General.—The marriage took place at the Independent Church, Llanfair Caereinion, on October 6th, of Mr. Evan Evans, electrical engineer, of Perthyfflin, Dinas Mawddwy, and Miss L. Jones, of Llanfair Caereinion.

Mr. D. B. Baddeley, manager for Scotland and the North of Ireland for Messrs. Crompton & Co., Ltd., having received a temporary commission in the Army Service Corps, will be absent from the Glasgow district for the period of the war. Messrs. Crompton are keeping his post open, but during his absence the management of the branch will be in the hands of one of his assistants.

Sapper H. A. P. Bale, from the London Electrical Engineers, has been appointed second-lieutenant, Hampshire Fortress Engineers.

The Council of the Institution of Electrical Engineers have elected Mr. J. E. Kingsbury to be honorary treasurer of the Institution in place of the late Mr. Robert Hammond.

Mr. Harry Mapes, of the staff of Messrs. Crompton & Co., Ltd., of the Arc Works, Chelmsford, who was married on October 2nd to Miss H. A. Willingham, has been presented by his colleagues with a set of cutlery.

At Rugby Parish Church, on October 5th, the marriage took place of Mr. Thos. C. Hurley, of the engineering staff of the British Thomson-Houston Co., Ltd., and Miss Winifred Neeves. Mr. Hurley is conductor of the B.T.H. Choral Society.

Mr. A. E. H. Dussek, of the Dussek Bitumen Co., who on account of ill-health has been away from business for the past three months, wishes his friends to know that he hopes shortly to have the pleasure of again meeting or calling upon them.

The Admiralty has made the following appointment:—Commander W. E. Prowse (Acting) to the *Ganges*, additional, for charge of Signal and Wireless Telegraphy Schools, Shotley (November 5th).

Mr. Joseph V. Gil has resigned his position with the British Westinghouse Co., designing electric railway control apparatus, and has this week taken up the appointment of assistant electrical engineer with Messrs. Matthews & Yates, of Swinton, Lancs.

Mr. Egerton J. Ward, A.M.I.E.E., was granted a commission in September last and posted to the 3rd Battalion, The Royal Irish Regiment.

Roll of Honour.—Corporal Tombs, of Chester, who has gained the Victoria Cross, is an electrical engineer who received his training in Yorkshire. He was engaged at Warrington when he joined the King's Liverpool Regiment. His brave action was the rescue of four wounded comrades under heavy fire, a task that took eight hours to accomplish.

Private George Wm. Smith, of the 1/5th Battalion West Riding Regiment (Huddersfield Territorials), was killed in action a few days ago by the bursting of a shell. He was 31 years of age, and was formerly employed in the electricity department of the Huddersfield Corporation.

Rifleman Tom West, 10th Battalion King's Royal Rifle Corps, who was on the electricity staff of Rochdale Corporation, has been killed in action.

Private Colin Chadwick, of the 7th Manchester Regiment, who was engaged at the works of Mirrlees, Bickerton & Day, Ltd., of Stockport, is reported to be missing, and believed to be killed, at the Dardanelles.

Second-Class Petty Officer G. B. Burgess, a member of the Beckenham U.D.C. electricity staff, has been awarded the Distinguished Conduct Medal for gallant service. Sergeant F. J. Fuller, shift engineer at the Council's works, has been mentioned in dispatches by Sir John French, and both have had sent to them the congratulations of the Council. Sergeant Fuller in 1905 joined the Electrical Engineer Volunteers, and he is in France with the Royal Engineers' Signal Company.

Private Benjamin Bond, of the 1/7th King's Own Royal Lancaster Regiment, formerly employed at the cable works of Messrs. Glover, Trafford Park, has been killed in action in France. He was 36 years of age.

Information has reached Kilmarnock of the death in action in France, on September 30th, of Second-Lieutenant Andrew Yates Young, 13th Scottish Rifles, attached to the 2nd Royal Scots Fusiliers. The deceased served his apprenticeship to engineering in the Glenfield Works, Kilmarnock, and after taking the Technical College course was engaged with the British Electric Plant Co., of Alloa.

The many friends of Mr. Arthur Jacob, of the British Aluminium Co., Ltd., will regret to learn that his only surviving son, Lieut. A. Leslie Hamilton Jacob, 18th Battalion London Irish Rifles, was killed in action, on September 25th, in France. Lieut. Jacob, who was 19 years of age, was born in Dublin in 1896, and educated at Bowden House, Seaford and Felstead, Essex. He was gazetted in September last, and obtained promotion in May.

Obituary.—Mr. Charles Swain Agnew, of Southport, a member of the firm of Messrs. J. H. Agnew & Bro., grey cloth agents, Manchester, who died last Friday at the age of 79 years, was a director of the National Telephone Co. before the telephones were taken over by the Government.

NEW COMPANIES REGISTERED.

W. A. and R. J. Jacobs, Ltd. (141,783).—This company was registered on October 6th, with a capital of £3,000 in £1 shares, to carry on the business of manufacturers of electrical apparatus and fittings, electric lamps, and cycle and motor accessories of all kinds, metal workers, japanners, enamellers, electro-platers, galvanisers, general engineers, manufacturers of goods in glass and iron, steel and other metals, etc., and to enter into an agreement with W. A. Jacobs and R. J. Jacobs. The subscribers (with five shares each) are: W. A. Jacobs, 94, Leonard Street, E.C., manufacturer; R. J. Jacobs, 94, Leonard Street, E.C., manufacturer. Private company. The number of directors is not to be less than two or more than three; the first are W. A. Jacobs and R. J. Jacobs (both permanent). Qualification, £5 Remuneration as fixed by the company. Registered office: 94, Leonard Street, Finsbury, E.C.

Feltham and District Electric Lighting Co., Ltd. (141,806).—This company was registered on October 8th, with a capital of £100 in £1 shares, to carry on the business of generators, producers and distributors of electrical energy for lighting, power or traction purposes, within the area of supply mentioned in the first schedule to the Feltham and District Electric Lighting Order, and to adopt an agreement with F. H. Edwards. The subscribers (with 10 shares each) are: C. E. Baker, 35, Parliament Street, Westminster, solicitor; W. Garner, 164, High Street, Hounslow, solicitor; J. E. Drower, 28, Victoria Street, S.W., quantity surveyor; F. H. Edwards, 76, Cheapside, E.C., solicitor. Private company. The number of directors is not to be less than three or more than six; the subscribers are to appoint the first. Qualification, £10. Remuneration as fixed by the company. Solicitors: Baker & Sons, 35, Parliament Street, Westminster.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bland Light Syndicate, Ltd. (97,494).—A memorandum of satisfaction to the extent of £1,500 (leaving balance outstanding of £3,500) on August 30th, 1915, of debentures dated October 14th, 1913, nominally securing £6,000 (of which £5,000 has been issued), has been filed.

Pintsch's Electric Manufacturing Co., Ltd. (in voluntary liquidation).—Charge on hereditaments and premises, etc., dated September 16th, 1915, to secure not more than £350. Holders: Pintsch's Patent Lighting Co., Ltd. (in voluntary liquidation), Friars House, New Broad Street, E.C.

Carville Site and Power Co., Ltd.—Issue, on September 28th, 1915, of £10,000 debentures, part of a series of which particulars have already been filed.

John Davis and Son (Derby), Ltd.—Capital, £35,000 in £1 shares (15,000 pref.). Return dated July 9th, 1915. 15,000 ord. and 11,000 pref. shares taken up. £1 per share called up; £26,000 paid. Mortgages and charges: Nil.

CITY NOTES.

Quebec Railway, Light, Heat and Power Co., Ltd.

At the annual meeting, held in Montreal on September 14th, the directors presented their report for the fiscal year ended June 30th, 1915. The gross earnings from operation were $1,548,096, an increase of $16,875. After adding miscellaneous income of $235,978, the total revenue from all sources was $1,784,074, an increase of $17,076. The operating and maintenance expenses were $924,817, an increase of $11,716. The fixed charges and taxes of all kinds amounted to $739,482, leaving a net surplus of $119,775, which, added to that of last year, leaves a total surplus to date of $347,499. The properties and plants of the company and its various subsidiary companies have been maintained in the same high state of efficiency as heretofore, as evidence of which there was expended during the year on maintenance account $193,897

Dick, Kerr & Co., Ltd.

The directors' report for the year ended June 30th, 1915, states that the profits earned amount to £46,960, which added to £25,525 forward from last year makes a total of £72,485. Out of this sum the debenture interest and trustees' fees have been paid, and there has been reserved the sum required to provide for the premium payable on the redemption of the present debenture stock. These items absorb £10,839, leaving £61,647 available for appropriation as under:—A dividend of 6 per cent. per annum on the preference share capital [Note.—The half-yearly dividends to December 31st, 1914, and June 30th, 1915, have already been paid.] £18,300, setting aside as a reserve against contingencies £25,000, and carrying forward £18,347. In view of the abnormal conditions prevailing, the directors are unable to recommend the payment of a dividend on the ordinary shares.

The meeting is called for October 21st.

Swiss Escher Wyss & Co.

The report of Escher Wyss & Co., of Zurich and Ravensburg, for the year ended with March 31st, 1915, refers first to the influence on the undertaking of the outbreak of the war and the mobilisation, and to the efforts made to maintain working. In the autumn it was believed that the lowest level of the depression had been overcome, and as orders gradually came to hand in increasing numbers it was eventually possible to resume full-time working, although with a reduced number of workmen, owing to the call to the Colours. The greatest difficulties were still encountered in the securing of orders and the provision of raw materials and semi-finished products, and also in the forwarding of deliveries. The multiplicity of the branches of manufactures was of advantage in connection with the rapid accommodation of the company to the changing requirements and conditions of the economic life. Although all departments were affected by the unfavourable times, the branch for steam and hydraulic turbines probably suffered the least. The steam turbine department had to deal with a large stock of orders brought forward from the previous year, and new orders were received to a large extent, mainly for smaller machines. The work of the hydraulic turbine shops had to be limited more to the construction of small plant, for which abundant occupation was available, chiefly on the part of works having their own motive power, such as spinning and weaving mills, etc., to which the war had brought orders in an increased measure, and which were, therefore, encouraged to proceed with extensions of their works. The work on the enormous machines for the Barcelona Traction, Light & Power Co. had to be suspended for several months, but the recent reorganisation of this group assured the delivery of the machinery. After devoting £21,000 to depreciation, as compared with £29,000 in 1913-14, the accounts exhibit net profits of £13,000, as against £22,000, and a dividend of 4 per cent. has been declared on share capital of £260,000, this comparing with 6 per cent. in the preceding year.

German Electrical Companies.

The Stickstoff Werke, A.G., of Herringen, near Hamm, which company was formed by the firm of de Wendel, and, together with the latter, is under Government supervision on account of the war, reports a loss of £1,800 for 1914-15, as against a loss of £360 in the preceding year, the deficit thereby being increased to £2,800 on a share capital of £50,000.

The gross profits earned by the *Deutsche Elektrizitats Werke Garbe, Lahmeyer & Co., of Aix-la-Chapelle* in the year ended March 31st, 1915, amounted to £60,000, as compared with £104,000 in the previous year. After defraying general expenses and setting aside £14,000 for depreciation, as against £16,000 in 1913-14, the accounts indicate net profits and balance forward of £20,000, as contrasted with £28,000, and a dividend of 5 per cent. has been declared, as in 1913-14.

The Suddeutsche Telephon Apparatus, Kabel und Drahtwerke, of Nuremberg, which belong to the group of the Felten and Guilleaume Co., earned gross profits of £46,000 in 1914-15, as contrasted with £15,000 in the previous year. After meeting general expenses and allocating £17,000 for depreciation, as against £4,400 in 1913-14, the accounts show net profits of £14,000, as compared with £1,700 in the preceding twelve months. The latter amount was carried forward; the method of disposing of the present balance is not disclosed in the official accounts.

The report of the *Kabelwerk Rheydt, A.G., of Rheydt*, for the twelve months ended with June, 1915, states that the demand for the company's manufactures decreased. In the course of time the deliveries, except for war purposes, entirely ceased, as all essential materials were only permitted to be used for these objects, and the company continued to be occupied with contracts of this character. The gross profits realised in 1914-15 amounted to £175,000, as compared with £131,000 in the preceding year, and the net profits, after apportioning £25,000 to depreciation (chiefly of the cable factory and rolling mill), as contrasted with £20,000 in 1913-14, were £140,000, as against £83,000. It has been decided to pay a dividend of 18 per cent., the rate for 1913-14 having been 12 per cent.

The directors of the *Isaria Zahlerwerke, A.G., of Munich*, which is associated with the Brown-Boveri group, states that the outbreak of the war at first caused almost a complete stoppage of business, although a resumption took place gradually to the extent that business became almost normal with the exception of the relations with hostile countries. A partial compensation for the decline in export trade was afforded by the orders received from the Army authorities, but the decrease in the profits was attributed solely to the effects of the war. After placing £6,300 to depreciation in 1914-15, as compared with £7,100 in the previous year, the accounts show net profits of £10,500, as against £17,400, and a balance of £26,000 and £22,000 in the two years respectively, inclusive of the balance brought forward. It is proposed to pay a dividend of 10 per cent. on share capital of £110,000, as against 5 per cent. in 1913-14. It is, further, mentioned that the orders on hand for peace purposes are satisfactory, and further orders have been received from the Army authorities.

The report of *Brown, Boveri & Co., of Mannheim*, for the year ended March 31st, 1915, states that the production and deliveries were considerably less than the normal figures in consequence of the war, and the receipt of raw materials was in part greatly hindered. The stoppages in working caused through the calling-up of men on the outbreak of the war were overcome in a comparatively short time in so far as it was possible having regard to the conditions created by the war. Nevertheless, the value of the turnover was materially less than in 1913-14. According to the assets side of the accounts, the value of the investments and other financial interests in undertakings rose from £63,000 in 1913-14 to £147,000 last year, chiefly through the payment of further instalments on ordinary shares in the Turbinia Co., the Electric Power Supply Co., and the Rhenish Wire & Cable Works, and through subscriptions to the war loans, the last mentioned being the only reference in the report to any participation in the war. The gross profits, including receipts from investments, amounted to £193,000, as contrasted with £207,000 in 1913-14. After providing for general expenses, interest on loans which total £354,000, and allocating £29,000 to depreciation, as against £33,000, the accounts represent net profits and balance forward of £34,000, as compared with £35,000. It is intended to pay a dividend of 5 per cent. on the paid-up capital of £450,000, being the same rate as in the previous year.

Adelaide Electric Supply Co., Ltd.

An extraordinary general meeting of shareholders was held on Monday at the offices, Finsbury Pavement House, E.C., under the presidency of Mr. Percy R. Sellon.

The Chairman, after explaining that he occupied that position owing to the absence of Mr. Braithwaite, the Chairman of the company, who had been suddenly called to the United States on business, proposed the following resolution:—

> That the capital of the company be increased from £500,000 to £750,000 by the creation of a further 50,000 shares of £5 each; and that the directors be and they are hereby authorised to issue such further shares as ordinary or preference shares (subject when necessary to the consent of the holders of the company's existing 6 per cent. cumulative preference shares), in such amounts, at such price or prices, to such persons, and at such times, as the directors may from time to time determine.

He said the directors asked for sanction to increase the capital in order to meet the demands of the business. The capital powers of the company were now practically exhausted, the whole of the preference and ordinary shares having been issued. It might be said: was this a proper moment at which to involve ourselves in further capital expenditure? The explanation was simply this—that whereas in the case of a private industrial undertaking it was quite possible to exercise discretion as to whether capital increases should be incurred or not at any given moment, in the case of a company operating under statutory powers there was no choice in the matter. They were compelled under certain conditions to incur such capital expenditure as might be necessary at any given time in order to carry out their obligations to supply light and power to those who applied for it. The war had naturally exercised a somewhat adverse effect upon electricity supply undertakings everywhere, but the directors were very happy to be able to say that so far as their undertaking at Adelaide was concerned, it had by no means had the effect of stopping the flow of demand for light and power upon their mains, or the necessity for extensions of mains under the terms of their statutory obligations in those districts where fresh demands arose. For that purpose they were compelled to raise additional capital. Just how and when it would be necessary to make a further issue, and under what conditions, was a matter which at the moment was engaging the attention of the board in consultation with the local board at Adelaide and their officials on the spot. They proposed to deal with that question when they had the whole of the data at their disposal.

Mr. Benjamin Brookman seconded the resolution, which was carried unanimously.

Companies Struck off the Register.—The following companies have been struck off the Register and are accordingly dissolved:—

British Automatic Telephone Syndicate.
British Magneto Co.
Consolidated Electric Works & Appliances.
Eclipse Boiler Furnace (London & South).
"Electricity."
Gambles' Patent Telephone Recorder Co. (Continental).
Haywards Heath Electric Supply Co.
Magnetic Separator.
Pacific Radiotelegraph Co.
Premier Electric Control.
Radio and Electric Power Co.
Rail and Road Traction.
Silent Day Engine Syndicate.
Spiral Turbine Syndicate.
Sunturbo Engineering Co.
Tramways Construction Syndicate.
Tungsten Metal Co.
United Electrical Construction Syndicate.

Official Notices re Companies.—The following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Brabbins Fuelless Engine Syndicate.
Budleigh Salterton Electric Light & Power Co.
Economic Coaling Appliance Co.
Emanda Engineering Co.
Liverpool Traction, Light & Power Investment Trust.
Maximum Magneto Co.
Oil and Gas Turbine Syndicate.
Russian Wireless Telegraph Trust.
Telenews.
Vacuum Electric and Gas Heating Appliances.
Walker Reversible Turbine Co.

Oriental Telephone and Electric Co., Ltd.—The directors have declared the following interim dividends:—3 per cent. on the 6 per cent. cumulative preference shares for the current year, less income tax; and 4 per cent. on the ordinary shares, free of income tax. The warrants will be posted on 30th inst.

STOCKS AND SHARES.

Tuesday Evening.

The attitude of the Stock Exchange at present is distinctly a waiting one. Some men regard the news as bad; others, as satisfactory. Between the two schools of opinion there is sufficiently wide divergence to check business, since times of doubt and perplexity hold a restraining rein upon investment and speculative investment. There is a certain amount being done in both classes, but not sufficient to affect prices in any material manner. Fresh impetus has been given to the boom in American rails by a fall in the early part of the week in the rate of exchange, this following upon an outburst of bullishness in New York which caught up prices of railroads and industrials alike. In the electricity sections, the strongest continues to be that for telegraph issues. Mexicans have dipped, but Brazil Tractions keep comparatively steady. The Stock Exchange has decided to pay no interim dividend on its own shares, which are £13 paid, received £4 a share dividend this time last year, and now stand about £70.

The Excess Profits Tax continues to engage lively attention in City and in manufacturing circles. Publication of the full details of the Bill is eagerly awaited. Discrimination will have to be applied in so many cases, if the law is to be administered with equity and logic, that whatever tribunal may be set up will undoubtedly have an enormous task in front of it when it comes to sift the liable from the exemptable. The rubber-growing industry alone can furnish hundreds of companies that vary considerably in degree of fitness for exemption. These columns contain no wardrobe for the prophet's mantle; but if they did, we should pick out the one marked General Dissatisfaction as likeliest to fit the majority of cases concerned, although it would be easily enveloped by the wider cloak of Patriotism.

The Electricity Supply list is steady in most of its prices. A fall of ⅛ to 4⅝ has occurred in London Electric 6 per cent. preference shares; save for this, the catalogue is unchanged. Candour compels the admission, all the same, that there are prospective sellers about of various shares for which buyers are lacking; but quotations remain without alteration, because war experience has shown there is little use in putting prices down when buyers are holding aloof. Levels may be artificial now; but it is contended that they would be misleading if dropped, or raised, 10 or 20 points, should there still be no buyers in the first place, or sellers in the second.

The announcement that some sort of relief is to be afforded to the obscuring of London lights is welcome to holders of electricity supply shares in the London companies. If this modification were to be accompanied by a few simple safeguards against accidents—such, for instance, as requiring curbstones to be whitened—the risk of winter accidents would be greatly lessened.

The difficulties in the way of raising money through the medium of new issues are well enough known; and invitations to the public to subscribe are put forward sparingly. Several corporations have recently invited tenders for loans upon specified security. For instance, Wednesbury, the well-known Staffordshire town, early this week advertised that its Town Council would receive tenders for certain loans, amongst which occurred, under the heading of Electric Light, three amounts, namely: £3,086 for 18 years, £460 for 30 years, and £600 for 25 years. A couple of lines suffices to give the information that the rateable value of the town is £102,000, the rates 9s. 8d. in the £, the debt £100,086, and sinking funds £12,079. Obviously, therefore, the security is excellent; and it would be interesting to know on what terms Wednesbury obtains the money.

Mexican prices have given way, as noticed above. There are falls in Mexico Tramways bonds, Mexican Light & Power preferred and first mortgage bonds. This is somewhat remarkable, in light of the recognition which the United States is said to have accorded to General Carranza and his Government—a concession which, by the way, naturally arouses wonder in the mind of the British V.T.C. member as to whether the Carranzist will now be permitted to wear a red brassard on the left arm, inscribed with the letters G.R. Most of the railway issues connected with Mexico have improved, and no doubt those of the commercial undertakings will follow suit when the present trifling amount of stock which is on offer has been absorbed. Anglo-Argentine Tramways stocks are rather better, but Brazil Tractions moved down a small fraction in consequence of a slight decline in the Rio exchange.

There has been a further outbreak of activity in Canadian industrials. Apart from munitions, the harvest in the Dominion bids fair to tax all the efforts of the Canadians to deal with it, and it is declared that the current year's crops will show an increase of at least 90 per cent. over those of the previous twelvemonth—which, however, it must be recalled, was a somewhat lean period. So Shawinigan Water and Power common has risen several points to 137, ex the dividend of 1½ per cent. deducted last week. Consolidated Gas, Electric Light & Power of Baltimore have held their improvement at 110¾, though Kaministiquia is still dormant, the shares not having changed hands for nearly six months. There is a fair amount of business in Victoria Falls preference shares on the basis of 17s., the ordinary being 4s. 9d., and the second mortgage debentures in the neighbourhood of 90.

The Home Railway market is a dull one. There seems to be no interest taken in any of the stocks. A little languid business goes on day by day in Underground Electric income bonds, but even here, notwithstanding the high yield, there is no recovery in the price: in fact, at 71, last week's small gain has been lost. Metropolitans have eased off to 23; and Districts failed to recover from 13. There is more doing in the preferred stocks, which can be bought to pay 5½-6 per cent. on the money. In the ordinary group, public interest is very slender.

New York Telephone 4½ per cent. bonds are 1½ up at 101, thanks once more to a fall in the American rate of exchange. The Anglo-French loan up to the present has hardly justified the expectations that were formed of its being able to rectify the weakness of the exchange position; and everything connected with the United States, in the way of securities, is booming on both sides of the Atlantic. Oddly enough, American Marconis have not moved; the price, in fact, is a little dull at 18s. 3d., and the parent shares went back to their previous figure of 1⅞. Canadian Marconis remain at 5s. 6d.

The demand for American securities directs attention to Anglo-American issues; and those of the cable companies are mostly better on the week. Both preferred and deferred stocks of the Anglo-American Telegraph Co. have advanced. Direct United States Cable shares are higher at 6. Another brisk advance took Indo-Europeans to 47, so that their slump of a fortnight ago has been nearly recovered; and the fortunate people who picked up the shares at 36½ may well congratulate themselves upon their perspicuity. United River Plate Telephones again rose ⅛, and Western Telegraphs are similarly better at 12⅛. On the other hand, West India and Panama shares eased off to a sovereign.

Amongst manufacturing shares, Henleys have been done at 12 13-16 and also at ⅜ lower, while the company's 4½ per cent. preference shares (of £5 each) are 4¾, and the 4½ per cent. 1st mortgage debenture stock is nominally about 92, with a full half-year's interest due in the middle of next month, allowing for which the yield on the money comes to all but 5 per cent. Babcock & Wilcox are unaffected by the dividend, published here last week. Edison & Swan 4 per cent. debenture stock is a little lower. Castner-Kellners are firm at £3. The rubber market is sustained by the price of the raw material having risen to 2s. 6d. per lb. There is, moreover, a little business doing in this section; and people are spending money on the best-class rubber shares, which can be bought to pay 10 per cent., putting these away with their gilt-edged securities with a view to the establishment of a 6 per cent. all-round yield upon investments made at the present time. This rate seems to be a perfectly reasonable one to expect, in present conditions—more particularly when it is remembered that within the next few months there is certain to be another War Loan, which can hardly fail to have a directly competitive effect upon all existing stocks and shares.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend, 1914.	Price Oct. 12, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	7½	—	£6 18 4
do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	8¾	—	6 18 4
do. do. do. 4½ Pref. ..	4½	8¾	—	6 0 0
do. do. City Pref.	4½	8½	—	6 8 7
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4¼	—	6 17 8
do. 4½ Deb.	4½	87	—	5 8 6
City of London	9	12¼	—	7 7 0
do. do. 6 per cent. Pref. ..	6	10¾	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10¼	—	6 16 7
do. do. 6 per cent. Pref. ..	6	10¼	— ¼	5 17 3
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6¼	—	7 4 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref. ..	6	4⅝	— ⅛	6 9 9
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	8½	2¼	—	7 15 7
do. 4½ per cent. Pref. ..	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6¾	—	7 8 2
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6¾	—	6 18 4
do. 4½ Pref.	4½	4¼	—	5 9 0

TELEGRAPHS AND TELEPHONES.

	Dividend, 1914.	Price Oct. 12, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	100½	+1	5 19 6
do. Def.	1½	22⅛	— ⅛	6 16 4
Chile Telephone	8	6½	—	6 8 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11⅞	— ⅛	*6 14 9
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord...	7	119	+1	*6 14 7
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	80	—	5 0 0
Globe Tel. and T. Ord.	6	9¾	—	*7 0 8
do. Pref.	6	9¾	—	6 8 0
Gt. Northern Tel.	22	33	—	6 13 4
Indo-European	13	47	+2	6 18 4
Marconi	10	1⅞	— 1/16	6 8 0
New York Tel. 4½..	4½	101	+1½	4 9 0
Oriental Telephone Ord.	10	1 15/16	—	5 8 1
do. Pref.	6	1	—	6 0 0
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5¾	+ ⅛	*8 2 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1	— ⅛	10 0 0
Western Telegraph	7	12⅛	+ ⅛	*6 13 4
do. 4 Deb.	4	80	—	5 0 0

HOME RAILS.

	Dividend, 1914.	Price Oct. 12, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented ..	4	69	—1	5 16 0
Metropolitan	1¼	23	— ½	5 8 8
do. District	Nil	13	—	Nil
Underground Electric Ordinary ..	Nil	1⅜	—	Nil
do. do. "A"	Nil	5/6	—	Nil
do. do. Income ..	6	71	— ½	*9 11 8

FOREIGN TRAMS, &c.

	Dividend, 1914.	Price Oct. 12, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Arg. Trams, First Pref. ..	5½	8½	—	7 17 2
do. 2nd Pref.	5½	8	—	9 8 4
do. 4 Deb.	4	74	+1	5 8 1
do. 4½ Deb.	4½	72	—	6 5 0
do. 5 Deb.	5	75	+1	6 13 4
Brazil Tractions	8½	49½	— ½	7 1 5
Bombay Electric Pref.	6	10½	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds ..	—	37	—8	Nil
do. 6 per cent. Bonds ..	—	35	—	Nil
Mexican Light Common	Nil	23	—2	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	37	—3	—
Adelaide Sup. 6 per cent. Pref. ..	6	5	—	6 0 0
do. 5 Deb.	5	97	—1	5 3 0

MANUFACTURING COMPANIES.

	Dividend, 1914.	Price Oct. 12, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	2 3/16	—	6 8 5
British Aluminium Ord.	5	1 1/16	—	4 14 1
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	10⅝	—	7 1 2
do. Pref.	6	5⅞	—	5 2 2
British Westinghouse Pref.	7½	84/-	—	8 10 8
do. 4 Deb...	4	72	—	5 11 1
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref...	5	4½	—	5 11 8
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	61/-	—	4 18 6
Edison & Swan, £3 pd.	Nil	10/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	57	—1	7 0 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/9	—	7 1 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	12½	—	*9 2 0
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	8	—	6 5 0
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

Indo-European Telegraph Co., Ltd.—The directors have declared an interim dividend for the half-year to June 30th at the rate of 5 per cent. per annum, free of income tax.

Indian Electric Supply and Traction Co., Ltd.—The directors have declared an interim dividend of 2½ per cent.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, October 13th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a „ Nitric	„	..	..
a „ Oxalic	per lb.	1/-	..
a „ Sulphuric	per cwt.	..	..
a Ammoniac Sal	„	..	..
a Ammonia, Muriate (large crystal)	per ton	£50	£6 inc.
a Bleaching powder	„	£9	..
a Bisulphide of Carbon	„	£23	..
a Borax	„	£23	..
a Copper Sulphate	„	£28	..
a Lead, Nitrate	„	..	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	..	..
a Potash, Caustic (88/90 %) ..	per ton	..	..
a „ Chlorate	per lb.	1/4½	..
a „ Perchlorate	„	1/6	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers ..	„	£11 10	..
a „ Recovered	„	..	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %) ..	„	..	..
a „ Chlorate	per lb.	1/3½	..
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks ..	per lb.	5½d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	..	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	..	..
b „ Sheet, in ton lots ..	„	..	..
p Babbitt's metal ingots	„	..	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/0¾ to 1/1	..
c „ Tubes (solid drawn) ..	„	1/1¼ to 1/1½	½d. inc.
c „ Wire, basis	„	1/1¼ to 1/1½	..
c Copper Tubes (solid drawn) ..	„	1/1¼ to 1/1½	¼d. inc.
g „ Bars (best selected) ..	per ton	£100	£4 inc.
g „ Sheet	„	£100	£4 inc.
g „ Rod	„	£100	£4 inc.
d „ (Electrolytic) Bars ..	„	£88 10	10/- inc.
d „ „ Sheets ..	„	£106 10	10/- inc.
d „ „ Rods ..	„	£95 10	10/- inc.
d „ „ H.C. Wire	per lb.	11½d.	..
f Ebonite Rod	„	3/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/5½	1d. inc.
j Iron Pig (Cleveland warrants) ..	per ton	64/6½	3½d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£26	..
g Lead, English Pig	„	£25	..
g Mercury	per bot.	£15 15	..
e Mica (in original cases) small ..	per lb.	6d. to 3/-	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 14/- & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	..	..
p „ „ rolled bars & rods	„	..	..
p „ „ rolled strip & sheet	„	..	..
o Platinum	per oz.	190/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	„	£149 to £150	..
n „ Wire, Nos. 1 to 16	per lb.	2/7	..
p White Anti-friction Metals ..	per ton	..	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a G. Boor & Co.	*h* Edward Till & Co.
b The British Aluminium Co., Ltd.	*j* Bolling & Lowe.
c Thos. Bolton & Sons, Ltd.	*k* Morris Ashby, Ltd.
d Frederick Smith & Co.	*l* Richard Johnson & Nephew, Ltd.
e F. Wiggins & Sons.	*n* P. Ormiston & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	*o* Johnson, Matthey & Co., Ltd.
g James & Shakspeare.	*p*
	r W. F. Dennis & Co.

Hurst Nelson and Co., Ltd.—For the year ended July 17th, after providing for depreciation, etc., and including £16,811 brought forward, £68,390 was available. After placing £13,694 to reserve to secure the preference dividend, and £15,000 to general reserve, a dividend of 10 per cent. on the ordinary shares is being paid, leaving £15,696 to be carried forward.

Cuba Submarine Telegraph Co., Ltd.—Interim dividends for the six months ended June 30th, at the rate of 10 per cent. per annum, subject to income tax, on the preference shares, and at the rate of 5 per cent. per annum, free of tax, on the ordinary shares.

New Issue.—The Aluminium Corporation, Ltd., has been offering the balance of its first debenture stock to the preference and ordinary stockholders at par.

United River Plate Telephone Co., Ltd.—The directors have declared an interim dividend of 3 per cent. on the ordinary share capital for the half-year to June 30th.

THE ISOLATION OF VIBRATIONAL DISTURBANCES.

By FRANCIS H. DAVIES.

The suppression of vibration from running machinery is a problem that has always been with the engineer, but never more so than at present. Modern conditions involving heavier and more complex machinery and higher rates of production have all tended to this end, and the increasing employment of the steel frame factory building which, unless specially designed, affords every facility for the transmission of vibrational disturbances, has given further prominence to the importance of the question. Numerous instances might be cited to show that the attitude of the law in cases of nuisance arising from the operation of machinery is becoming more merciless to the transgressor, a fact which claimants seem to be fully aware of, and it is no uncommon thing in such cases for substantial damages to be awarded, or even for the plant to be shut down under an injunction. The position has naturally created a demand for effective methods of isolation, and the demand has been met by several means which are interesting, and, for the most part, decided advances over the somewhat crude and unsatisfactory earlier methods. To a certain extent these older and more primitive systems of isolation still have their uses, chiefly in connection with very small plant or in situations abroad where rough and ready devices often have to be adopted. There is a good variety of them, but one and all they fail in greater or less degree to fulfil the conditions which experience has proved to be essential. To be thoroughly effective, an isolating medium, whether employed in connection with prime movers or driven machinery, must be of such a nature that continued pressure and vibration will not cause it to take a permanent set and thus lose its elasticity. This is the most important point and the one by which all isolating materials should chiefly be judged. Further, it is essential that the substance should be as impervious as possible to the attacks of insects, rats, oil, damp and climatic changes, as in these respects its position, either under the foundation or on top of it directly under the bedplate, is naturally an unfavourable one. Comparative inexpensiveness in this matter is not a virtue, and it should not be allowed to enter into the question. The amount at stake is generally too great, and it must be remembered that it is always a costly matter to renew or replace such isolators if this entails the lifting of a heavy machine or the destruction and rebuilding of a concrete foundation.

What is wanted is a material which will last and retain its resiliency indefinitely, and in the very nature of things such a substance cannot be bought cheaply. The earlier and cruder systems, most of which do not provide any real solution of the difficulty, may be listed and criticised as follows :—Timber baulks, generally of pine, elm or beech, creosoted or otherwise prepared to resist decay, are insufficiently resilient and for most purposes useless. Ordinary builders' felt and sheet lead used, either singly or in combination, will temporarily meet the case of small plant, but will ultimately lose practically all resiliency. Hair felt placed in a tray in order to keep it from being squeezed out under pressure, is fairly satisfactory for the lightest of machinery, but quite out of the question for heavy plant. Asphalt, also placed in a tray for the same reason, and about ½ in. thick has been recommended, but again, its sphere would be restricted to small plant, and it is very doubtful whether the low resiliency it possesses would be of much service. As an alternative, an asphaltic concrete has been employed with somewhat better results. Mastic asphalt is heated to about 350° Fahr., and is mixed with 50 per cent. of its weight of boiler scale in pieces about the size of macadam stone. It is then reheated to about the same temperature, and when cooled becomes a slightly resilient mass, suitable for installing under a foundation. It will possess more resiliency than pure asphalt, but is not comparable in this respect to the various special materials now made for the purpose of absorbing vibration, and is, therefore, not so efficient. Raw hides soaked in oil and placed under the bedplate have been used, but while probably of some service for temporary purposes, such a choice cannot be recommended for permanent work.

A 6 in. layer of fine dry sand or medium sized gravel is always helpful under a foundation if kept dry and properly restrained from lateral spreading. It is serviceable, and often used where a foundation bears down on a vein of rock, which it is well known will transmit vibration over great distances. Interposed between the rock and the foundation, such a layer will damp out a good deal of the disturbance, but it cannot always be regarded as a thorough solution to what is often a very difficult problem, and should therefore not be solely depended upon in a bad case. Other materials which have been advocated are sawdust and granulated cork, but like all such substances, their sphere of utility is very limited, and in view of modern improvements they are only worthy of consideration where nothing better is at hand.

A good method of constructing a sand cushion foundation is shown in fig. 1. The hole destined to contain the concrete block is lined on all sides with 6 in. or so of concrete, forming a well. The requisite depth of dry sand is then shovelled in and levelled, and on top is placed a sheet of oiled paper or similar waterproofed substance. The wooden mould or form for the foundation is then placed in position and the concrete poured. When set, the form is removed and the spaces at the sides of the block are filled in with sand up to a few inches from the top. The floor is then completed up to about 1 in. from the sides of the foundation, and, if possible, more sand is fed in through this gap until the space is quite full, the gap itself being closed by a ring of asphalt which to a sufficient extent isolates the foundation from the floor.

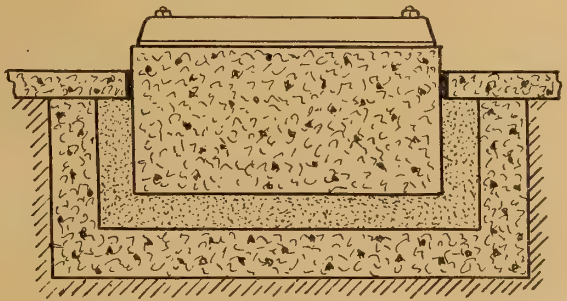


Fig. 1.—Isolation by means of Sand Cushion.

The object of this construction is to prevent sand being forced out at the top, as this would, of course, lead to settlement. An alternative method is to use metal plates, which being embedded in the part of the floor immediately surrounding the foundation and projecting across the gap until they touch the block, serve the purpose of closing all exit for the sand. The objection to such plates is that to some extent they will conduct vibration from the foundation to the floor.

Before examining the latest practice in the matter of isolating materials, it may be advantageous to touch upon the question of vibration generally, to the extent of indicating the manner in which it is propagated by different types of engines and transmitted through the soil. It is essential that these points should be clear, as otherwise a well devised system may prove useless through misapplication. Leaving out of the question the causes of vibration in an engine or machine, which alone constitute a vast and very complicated subject, we come directly to the effects, and these are found to differ materially according to the type of engine. Vibration is never of a simple nature, that is to say, of a fixed amplitude and direction. In all machines the disturbance felt is the net result of numerous disturbances set up individually by every part which is capable of generating vibration. Thus, if we assume the case of a badly-balanced engine with a slightly sprung shaft, there are at once two main sources of vibration, not to mention minor sources, such as comparatively small reciprocating and unbalanced parts. The effects of the latter are, of course, largely overwhelmed by those of the former, which, being far heavier, preponderate. However, it is found that every class of engine has characteristics in this direction which may be taken as typical, and which always predominate. Thus, the disturbances set up by a horizontal engine are mostly in the horizontal plane, and for equally obvious reasons a vertical engine generates vibrations in a more or less vertical direction, the effect of which is to cause the engine and its foundation to move bodily up and down. Both types also tend to set up a tilting oscillation, particularly two-line vertical engines. So long as the problem is confined to a single engine or machine mounted on its own foundation, it is comparatively simple; but when, as is often the case, we have to consider the joint effect of several engines, possibly of different types and speeds, erected on one large foundation block, it becomes complicated. Occasionally the vibrations set up by the various engines will synchronise, producing a maximum effect, and this will be followed more or less regularly by periods of comparative quiet. This phenomenon has often been observed, especially where the installation consists of high-speed engines, the vibrations of which come more frequently into phase than those of low-speed sets. So far as disturbance is concerned the latter are, however, the greater offenders, the larger amplitude of their vibrations being more marked and more annoying than those of high-speed engines, the vibrations of which are for equal power of smaller amplitude, though of greater frequency.

The problem is further complicated where alternating-current generating sets running in parallel are concerned. If, as is very seldom the case, all the sets are of the same type, capacity, and speed, the intensity of the net vibrational disturbance they will set up is a matter of chance, depending entirely upon the relative angular positions of the cranks at the instant of paralleling, and whatever the result may be, it will be constant (except for load variations), because the relative speeds of the engines cannot alter. If, however, the sets are of different speed, the effect will be entirely changed, and periods of maximum and minimum disturbance will occur, even though the generators are running synchronously. Of course, if the sets are each mounted on an independent foundation, the net result may again be different, but it is quite impossible to say to what extent, as all the peculiar conditions surrounding the case would have to be taken into full account. Since the disturbances set up by horizontal engines are mostly in the horizontal plane, it follows that the chief consideration is to keep the foundation clear of the soil on all sides. Vibration can then only be transmitted by the base, and if this is isolated by some suitable material, and also by a layer of dry sand or gravel, the spreading of disturbances is unlikely to be serious, unless there is a very marked vertical disturbance as well. It is, of course, more difficult to isolate vertical vibration, and such cases demand more care and more thorough methods. It is helpful, but by no means sufficient to leave a clearance all round the foundation block, and while this is perhaps the most important point with horizontal engines, it is the base of the foundation which calls for the greatest care where the plant is of the vertical type. In the great majority of cases the mass of a foundation in conjunction with the soil immediately around it is sufficient to absorb any disturbance which the machine it carries may set up, and this is, of course, one of its principal functions. Should it be unable to do this, either because its mass is insufficient, the engine particularly badly balanced, or because the subsoil under the foundation is of a nature that very readily transmits such disturbances as are communicated to it, some special method of isolation becomes necessary. It is well understood that soils vary greatly in their power of transmitting vibration. The two extremes of hard rock and wet unstable soil are the worst sinners in this respect, and the effects which they give rise to are at times very curious and difficult to follow. Vibration is often plainly discernible at one particular spot at a considerable distance from its source, the intermediate ground being entirely free from it. This may possibly be accounted for by a vein of rock which carries the disturbance at some depth to a point where it rises to the surface, and where the trouble becomes apparent. It has also been traced to an underground stream or vein of wet soil, and in such cases the vibration is always more marked after wet weather. If the subsoil is uniform in nature, the disturbances communicated to it by the foundation will spread more or less equally in all directions, and will gradually diminish as they are absorbed by the soil. This represents the conditions in the average case, and should they differ in this respect it is fairly certain that the soil is irregular in nature. The interest of the case is enhanced thereby, but unfortunately the difficulty and cost of overcoming the trouble will also probably be enhanced.

One mistake in design which is not common, but which has at times been made, is to install plant upon a concrete raft or floor which is securely tied to the wall foundations of the building. This is practically equivalent to erecting plant on a drum or sounding board. In time the soil shrinks slightly and leaves the raft at any rate partially supported by the walls, with the consequence that it vibrates severely and impairs the stability of the building. The trouble gets worse as time goes on, because the vibration of the raft pounds down the underlying soil and allows the amplitude to become greater. Such a case is a very difficult one to remedy, and is an infraction of the elementary rule that engine or machine foundations should always be clear of all walls.

The materials used almost exclusively in methods of isolation of the modern class are rubber, a special hair felt, cork in different forms, or combinations of these, and they are applied in different ways in various systems. In the Prache system, which is well known, a number of rubber stools are placed between the main foundation and an auxiliary block of concrete which carries the machine. These stools are each held in a special form of jack, which, when operated, compresses the stool sufficiently to allow it to be withdrawn when renewal becomes necessary. To this end the foundation is surrounded with a trench in order to give access to the stools. There are numerous instances of the use of the system in this country, where it has been successfully employed in connection with turbo-generators, large printing presses and other heavy machines.

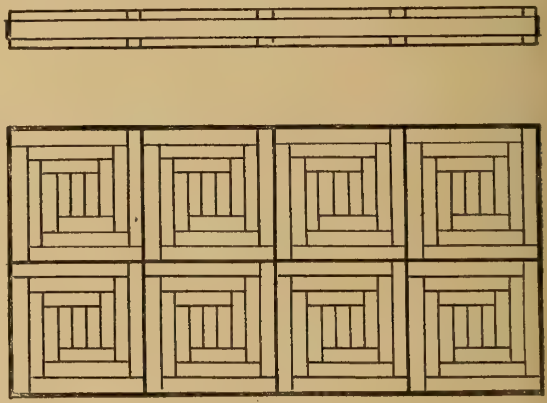


Fig. 2.—Built-up Cork Isolating Plate.

A further instance of the use of rubber comes from Germany, but this time it is employed in the form of thin sheets of rubber composition of $\frac{1}{8}$-in. thickness and upwards, according to the weight of the machine. A sheet of the above thickness is stated to be suited for weights up to 3 tons. An essential point of this system is that the sheet should make perfect contact with the surfaces between which it is placed, in order to exclude all air, and to this end it is necessary that the surfaces should be very smooth. By this means it is stated that holding-down bolts may be dispensed with, but the system is only advised by the makers for comparatively heavy machinery and where the centre of gravity is low.

The efficiency of cork as an isolator depends upon the manner in which it is applied. In practice it is made up into plates, which may either be composed of granulated scrap cork held together by some binding substance and subjected to pressure, or the same material relying for cohesion of the particles upon compression only and having no binding substance, or strips of virgin cork built up into a plate and held together by a suitable frame, as shown in fig. 2. The first of these is undesirable, because it is found that the binder fills up the pores of the cork and materially reduces its resiliency. The second is better in this respect, but under the heavy pressure and vibration to which it is subjected there is a natural tendency to disintegration. The third system is undoubtedly the best, and in practice the plates are specially built up to fit the particular foundation, and are surface hardened where the weight to be carried is considerable. They are also waterproofed and otherwise treated, in order that they may be able to resist the unfavourable conditions which usually obtain. If such plates are used directly under machines, which owing to their construction do not distribute the weight evenly over the whole area, it is essential that strong planks or plates should be placed between the two, as this will secure an even bearing on the surface. The following average results of a test made upon a cork plate of this type are of interest, as they indicate what may be expected from cork in the matter of resiliency :—

Original thickness under zero load	0·72 in.
Thickness under load of 350 lb. per sq. in. ...	0·50 „
„ immediately after removal of above load	0·626 „
„ 30 minutes after removal of above load	0·675 „
„ under load of 2,500 lb. per sq. in. ...	0·394 „
„ immediately after removal of above load	0·580 „
„ 30 minutes after removal of above load	0·608 „

The principle of the system employed by the British Anti-Vibration and Noise Co., Ltd., of Glasgow, is illustrated in fig. 3. It is a departure from the usual practice of employing a sheet of resilient material, as under this system the machine is supported at suitable points on a number of isolators, the type varying with the conditions. In the case of the device illustrated, the internal floating part of the isolator is rigidly connected to the bedplate by a stud. Three tension members support the floating portion, and the tension in these can be regulated by nuts, in such a manner that the weight of the machine is exactly compensated for. The stresses in the three tension members are transferred by means of the plates under the nuts to the buffers, which consist of a number of elastic plates built up in layers, and from these they pass to the rigid base which is fixed to the foundation by bolts. Between the floating and fixed parts it will be noticed that an additional buffer is placed, and the function of this is to absorb that portion of the vibration which tends to raise the machine above its position of equilibrium. It is claimed for these devices that they do not in any way affect the stability of the machine when once properly adjusted, and it is clear that they will absorb both vertical and horizontal vibrations, and also any combination of the two, that is to say, eliptical vibrations. By varying the design of the isolator it is possible to apply this device to practically any machine.

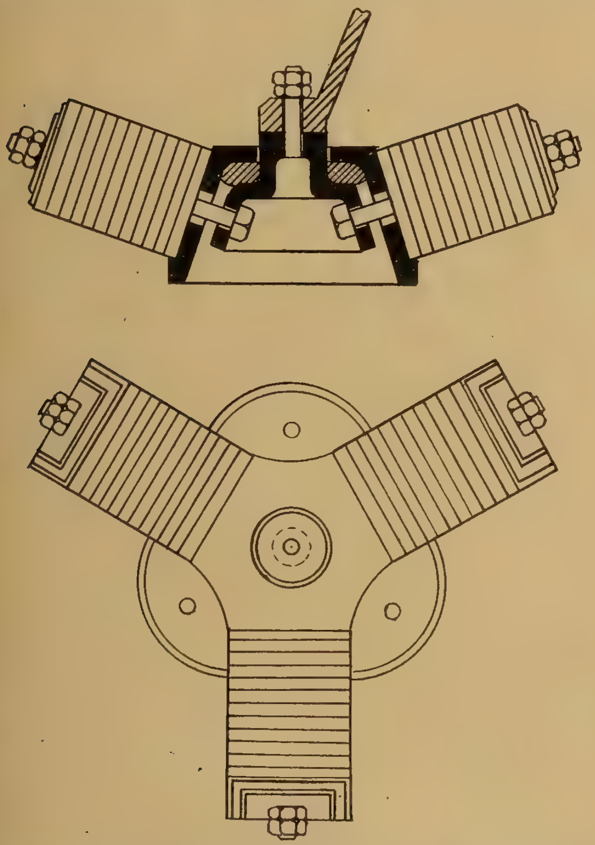


Fig. 3.—Isolating Device employing Buffers of Resilient Material.

A very comprehensive and valuable system of dealing with vibration troubles is that devised by Messrs. Mitchells, Ashworth, Stansfield & Co., Ltd., of London. The specially manufactured material supplied by that firm goes under the generic name of "Mascolite," and for purposes of isolation three grades are made. The first consists of a special proofed felt, which is supplied in thicknesses ranging from $\frac{1}{8}$ in. to 1 in. It is made of selected fibres of animal origin, and it is so treated that it will withstand damp, climatic changes, and the attacks of insects. The fibres are compressed and milled by special processes and machinery, so as to make a compact material by aid of the interlocking action of the fibres themselves. Each fibre is a microscopic capillary tube, the hollow centre containing a minute air space, and by means of a special proofing solution these are sealed and made dead air spaces. This type of felt is suitable for small foundations, or to meet cases where the vibration is not very severe, but for heavy machinery, or where disturbance is very marked, it is better to employ one or other of the remaining two grades. Of these, one is built up of alternate layers of felt and cork, ranging in thickness from $\frac{1}{4}$ in. to $1\frac{1}{4}$ in., or thicker if required, and the other is similar, but with the addition of a layer of vulcanized rubber. Alternatively, the felt and rubber combination can be supplied without the thin layer of cork. The pads are about 1 in. thick with a $\frac{5}{32}$ in. layer of rubber, but they are made to any specification and to cope with conditions out of the normal. Such isolators can be applied in one of two ways ; they can be placed under the main foundation on a light concrete bed as in fig. 4, or they can go directly under the bed-plate on the top of the foundation, fig. 5. In the latter case it is essential that the holes through the bed-plate should be bushed with $\frac{1}{8}$ in. felt, and a washer of the same substance, but $\frac{1}{4}$ in. thick, placed under the bolt washer as shown, otherwise vibration will be conducted to the foundation down the bolts. These built up isolators are constructed on the principle that sound and vibration will pass more easily through a material of one density than they will through one of varying density.

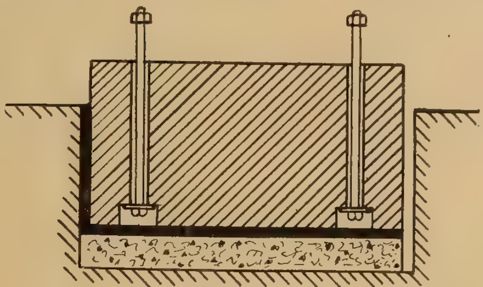


Fig. 4.—Isolated Foundation arranged for Belt Drive.

Mention has been made of the manner in which buildings, particularly those of the steel-frame class, conduct vibration and noise. To follow the matter clearly, it is necessary to understand that the disturbances set up by a machine or engine operating in such a building are primarily divisible into two classes, firstly, those which are communicated direct to the air and termed primary air vibrations, and secondly,

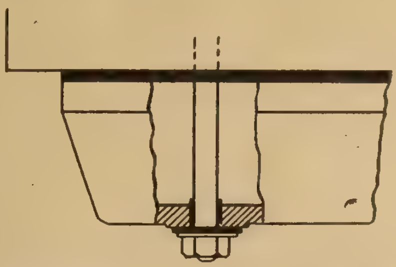


Fig. 5.—Arrangement of Isolator under Bed-plate.

those which emanate from the foundation and are communicated to the floors and walls. Primary air vibrations are sensible only in the room in which they are generated, unless there are openings into other rooms, as generally they are not sufficiently powerful to cause intervening walls and floors to vibrate. Foundation vibrations, on the other hand, travel very easily through the structure in all directions, and while not always perceptible themselves, they set up what are termed secondary air vibrations, and as the frequency and tone of these are the same as those of the primary air vibrations, they are very often confused with them. It will be seen, therefore, that every effort must be made to restrict the travel of vibrations emanating from the foundation, and in the case of a building this is most effectively done by isolating the foundation, and also all beams and columns in its vicinity. Where a machine is fixed to a hollow floor it may be isolated either by a pad directly under the base-plate, or by a similar pad placed between the floor and a secondary foundation of a few inches of concrete, but in either case it is necessary to use both isolating washers and bushings, as previously mentioned, so as to prevent the transmission of vibration to the floor through the holding down bolts. The isolation of columns and joists is performed in a very simple manner by placing suitable pads between them when erecting. Sheet lead and similar materials have been used, but in efficiency they cannot compare with a good felt cushion, which is found to be lasting, and not liable to be squeezed out. In view of the great pressures to which pads so placed are subjected, this latter is an important point.

ENERGY CONSUMPTION IN CONDENSER AUXILIARIES.

The present extensive employment of large condensing turbo-generators and the pressing need for economy in every stage of power development make it particularly important to ascertain and reduce to a minimum the energy consumption of condenser auxiliaries. According to modern standards, it is a comparatively small station which does not expend several hundred horse-power in condenser circulating water and air pumps (see fig. 1), and, as the steam consumption of these auxiliaries may easily amount to 5 or 10 per cent. of the total, even a trivial percentage economy represents a considerable annual saving, and is well worth securing. Where a complete installation of electric meters, steam and water-measuring instruments is provided, as is the case in many modern central stations, it is easy to keep a record of the energy consumption in auxiliaries from the daily log sheets, but there are other cases in which the methods described below, and based on an article by Klingenberg in the *E.T.Z.*, are applicable with advantage to the ordinary load curve which may alone be available in less elaborately-equipped stations. The methods are even more useful in connection with estimates relating to new works. There is then available an estimated load curve, and valuable assistance is obtained in selecting the best capacity for machine units.

An important advantage of the method is that it takes close account of the conditions of practice by introducing into its basic formulæ two factors—the utilisation factor and the working time factor—which eliminate much of the error due to arbitrary deductions from, or additions to, results derived from full load steam consumption data. The various curves and constants given below are based on average performance of modern turbo-plant, and do not represent "record" results achieved under exceptional conditions. Throughout, distinction must be made between those cases where condensing water is used once, and only once, and those where it is employed again and again after passing through a cooling tower or pond in the circulating circuit. Typical of the two cases are those stations using river water and those using coolers, of whatever type.

Assuming the steam consumption per hour of a given turbine to vary in direct proportion to its output, the total consumption is $(a + b)$ kg. per KW. where $a = A/W$ = light load steam consumption per KW. of full-load rating W of the turbine; and $b = B/W$ = additional steam consumption per useful KW. output. If h_1, h_2, h_3 = working hours per annum of the various machines; and n = mean annual useful power/total power installed = "utilisation factor"; then the main turbine steam consumption p kg. per KW.-hour is given by—

$$8{,}760\, n \times \Sigma (W) \times p = \Sigma (h\,.\,W)\,.\,a + 8{,}760\, n\,.\,b\,.\,\Sigma (W) \quad \ldots \quad (1)$$

the values of n and h being derived from actual or estimated load curves.

This equation may be simplified by introducing a "working time factor" $f = \Sigma (h\,.\,W)/\Sigma (W)$, and, if the installation consists of N machine sets of equal capacity and equal specific steam consumption, $f = \Sigma (h)/8{,}760\, N$ = total working hours of all machines/maximum possible working time. Then: $p = (f\,.\,a/n + b)$ kg. per KW.-hour.

The steam consumption of auxiliaries may be taken as practically constant at all outputs of the main turbine, the exhaust from steam-driven auxiliaries being usually admitted to the L.P. stage of the main turbine at all loads above 10 per cent. full load. Denoting by Q the hourly steam consumption of the auxiliaries, this corresponds to $q = Q/W$ kg. per hour per KW. full load rating of the main set. The auxiliary steam consumption per KW.-hour useful output $= \Sigma (h\,.\,Q)/\Sigma (W)\, 8{,}760\, n$, and, if all machines be of equal size $= q\,.\,f/n$ kg. per KW.-hour.

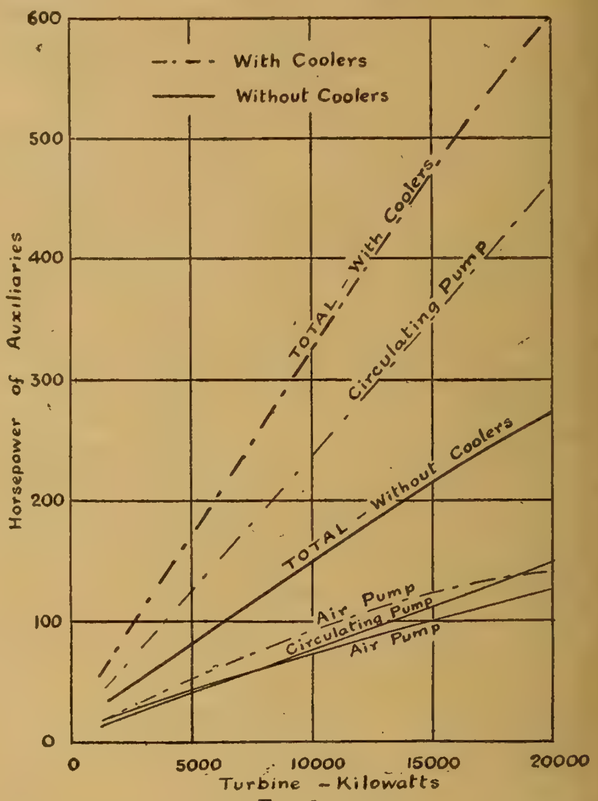


FIG. 1.

Expressed as a percentage of the total steam consumption, that of the auxiliaries $= r = 100\, Q\,.\,f/(Af + Bn)$ per cent. If all machines run continuously $f = 1$, and is a maximum whilst, if all machines are permanently fully loaded, $f = n$ and is a minimum. In the former case, $r = 100\, Q/(A + Bn)$ per cent., and is dependent on the utilisation factor, whereas in the latter case, $r = 100\, Q/(A + B)$ per cent., *i.e.*, is constant, and has its most favourable value.

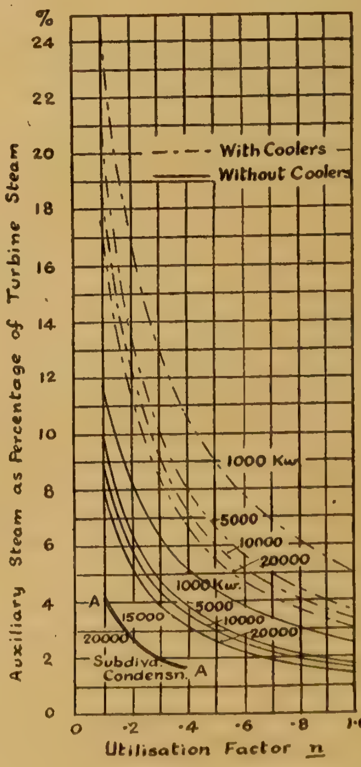


FIG. 2.

Average values of the factors Q A and B are given in Table I for turbine units of various capacities. If the auxiliary steam is to be expressed as a percentage of the main turbine, (and *not* the gross) steam consumption, the values to be taken for A are 0·83 and 0·71 times, those given for fresh water and cooled water working respectively. Average values of the power consumption of condensate and air pumps and of circulating pumps for turbines of various rated capacities are shown graphically in fig. 1. The curves in fig. 2 show the very considerable importance of steam consumption in auxiliaries, particularly in the case of small works using coolers and operating with a utilisation factor of 0·4 or less; in preparing these curves it has been assumed that $f = 1$, *i.e.*, that the turbines run continuously and under variable load. The curves at A show the considerable steam economy possible by operating only half of a divided condensing equipment in the case of large sets on light load.

Only in rare cases do the curves in fig. 2 apply directly to practical conditions. Generally the working time factor lies between the limits 1 and n, hence the actual percentage r lies between the values represented by the curves in fig. 2, and those represented by lines parallel to the axis of abscissæ through the lowest points of the curves (for which $n = 1·0$). The actual steam curve is derived by applying the above method to the recorded or estimated load curve of the station. Knowing the actual or proposed rating of each generating set the working hours per annum can be estimated for each, and so the working time factor evaluated for the whole installation. From the mean annual load curve there is derived a curve showing for how many hours per annum each load endures (and hence the hours' use of each machine per annum and the "working time factor" of the works). Thence follows a stepped curve showing steam consumption, according to the number of sets in use and the specific steam consumption of each; and finally a curve, the area beneath which represents total annual steam consumption. The latter area divided by the area beneath the "hours of each load per annum" curve, gives the steam consumption per useful KW.-hour; and the sum of the working hours for each machine times the auxiliary steam consumption divided by the annual total steam consumption gives the percentage r of auxiliary steam consumption. This method is applicable to an installation of machines of any sizes and any specific steam consumptions. The purely numerical method is simpler where, as is often the case, a number of similar sets of equal capacity are installed.

TABLE I.—Factors Determining Percentage Steam Consumption of Auxiliaries.

Full load turbine KW.	Without coolers.			With coolers.		
	Q	A	B	Q	A	B
1,000 ...	150	900	5,300	335	1,150	5,700
5,000 ...	470	2,700	25,500	1,085	3,500	27,500
10,000 ...	850	5,400	50,000	1,950	6,900	54,500
15,000 ...	1,170	7,700	74,500	2,750	9,800	81,000
20,000 ...	1,500	9,500	100,000	3,500	12,000	109,000

Q = Total auxiliary steam consumption (kg. per hour).
A = Light load steam consumption of main turbine per hour.
B = Additional steam consumption in main turbine per hour for useful output.

Using one, two, three or five, 20,000-KW. sets (plus one set in reserve in each case) to supply peak loads of 12,500, 25,000, 50,000 and 100,000 KW. respectively, the mean loads being 40 per cent. as great (*i.e.*, load factor = 40 per cent.):—The working time and utilisation factors, the total and auxiliary steam consumptions are then as below:—

No. of 20,000-KW. sets installed (one in reserve)	2	3	4	6
Peak load in KW. ...	12,500	25,000	50,000	100.000
Working time factor (f)	50 %	36·7 %	42·1 %	43·8 %
Utilisation factor (n) ...	12·5 %	16·6 %	24·9 %	33·2 %

	Without coolers.				*With coolers.*			
Total steam per KW.-hour (annual mean) in lb. ...	15·2	13·3	12 8	12·4	17·4	15·0	14·3	13·8
Relative ditto, per cent. ...	122·6	107·5	103·2	100	126·2	108·6	103·5	100
Auxiliary steam as percentage of total steam, per cent. ...	4·35	2·74	2·19	1·76	8·95	5·71	4·59	3·71

Naturally, one would not install two 20,000-KW. sets to supply a peak load of 12,500 KW. unless considerable extensions were certain in the near future, but the case is included as an extreme example. Since specific steam consumption changes little within wide limits of load it is desirable to install large sets, in the interests of ultimate capital economy in cases where extensions would otherwise be needed at an early date.

In the case of a smaller station, where three 1,000-KW. sets (one in reserve) are installed to supply mean and peak loads of 540 and 1,800 KW. respectively, the working time factor is 43 per cent., the utilisation factor 18 per cent., and the total steam consumption 16·3 lb. without and 18·6 lb. with coolers. The auxiliary steam consumption is approximately 4·8 per cent. and 9·5 per cent. in the two cases respectively, so that from these figures and those in the preceding summary it follows that under average conditions in power stations from 1,000 to 100,000 KW. rating, the steam consumption of auxiliaries ranges from 1·8 to 5 per cent. using river water and from 3 7 to 10 per cent. using coolers. This item in the power balance-sheet is particularly important in the case of small stations employing water coolers and operating with a poor utilisation factor (= mean useful/installed power). This fact should be borne well in mind by station engineers operating or contemplating the adoption of relatively small turbo units in provincial towns.

IGNITION MAGNETOS.

In *La Revue Electrique* of April 16th (published in June), M. H. Armagnat discussed at some length the principles and practice of magneto-electric machines used for ignition, &c., and as the subject is one about which little is known, though it is of considerable importance, we give below an abstract of the article.

As in this country, so also in France the Germans had secured the great bulk of the trade in magnetos, not by their own discoveries so much as by the thorough exploitation of foreign inventions; they made progress only by trial and error, and often put on the market so-called inventions which turned out to be huge mistakes. A careful study of the subject leads the author to the conclusion that the German control of the market was due, not to technical inferiority on the part of the French manufacturers, but to the lack of commercial organisation on their part, which can be quickly remedied.

After a brief historical sketch, in which he shows that the elements of both high and low-pressure sparking plugs, used in conjunction with induction coils and magnetos, were embodied in the patents of Lenoir (1860), Marcus (1883), and other pioneers before the internal-combustion automobile entered the field, the author describes the Simms-Bosch type of magneto with stationary armature, which was quickly followed by the Boudeville double-wound armature, a French invention; the condenser was added in 1902, when the first successful high-pressure magneto was introduced, and this type has now almost eliminated the low-pressure system of ignition—at any rate, in the case of the automobile.

There are two main types of magneto: that which acts at low pressure, by interruption of the circuit, and the high-pressure type. In the former case the current generated by the magneto is broken inside the cylinder of the engine by the mechanical separation of two metal parts, the "extra-current" spark which is then produced igniting the gaseous mixture. In the latter case, the current generated by the magneto is interrupted at the proper time by a device attached to the machine, and a high electromotive force is induced thereby in a fine-wire coil wound over the first—in fact, the armature becomes a rotating induction coil, in which the primary current results from the rotation instead of being derived from an external source. A compromise between the two systems employs a stationary induction coil between the magneto and the sparking plug. In all cases the most important function of the magneto is to generate the current.

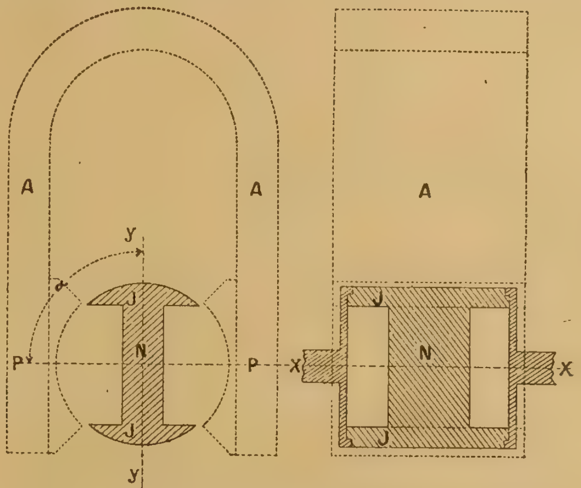


Fig. 1.—Diagrammatic Representation of Ignition Magneto.

The machine consists essentially of a rotor in the form of a shuttle, upon which are wound the primary and secondary coils, and a stator consisting of a row of horseshoe magnets with iron pole-pieces (fig. 1). The old Siemens "H" armature has been found superior to all other types for the purpose in view; it consists of a soft iron core N, with two pole shoes J, carried on spindles X X between the poles P of the permanent magnets A. The wires are wound on the core N and connected to insulated rings, which enable the current to be led away by rubbing collectors to the external circuit. Owing to the complex relationship between the flux through the core N and the angle α between the axis of the core $y\,y$, and that of the poles P P, the current generated cannot be calculated without determining this relationship by experiment; when this curve is obtained, the characteristics of the magneto can be determined.

Three methods are available for this purpose: (1) variation of flux; (2) rotating contact; and (3) the oscillograph.

In (1) the coil is connected to a ballistic galvanometer, and is sharply rotated through a small but constant angle, not exceeding 10°, always in the same direction, the corresponding deflections of the galvanometer being noted. A simple device for carrying out this operation is shown in fig. 2; it consists of two levers A and A′, fixed on the spindle C of the magneto by thumb-screws B B′, and capable of oscillating between the stops V_1 and V_2. The direction of rotation being that shown by the arrow, the two levers are first brought into contact with V_2, and screwed tight when the armature is in a known position. The levers are then sharply thrown over to the stop V_1, rotating the armature through the angle α, and the deflection of the galvanometer needle is observed. Next B is slackened, and the lever A is brought into contact with V_2, while A′ is kept hard up against V_1; afterwards B′ is slackened whilst A is kept against V_2, and A′ is brought back to V_2 and secured by B′. The cycle of operations is then repeated. The successive deflections obtained are proportional to the change while $\mathbf{B}_n - \mathbf{B}_{n-1}$ is the change of induction, $\theta_n = K\,(\mathbf{B}_n - \mathbf{B}_{n-1})$, of flux at each step, and if θ_n is the deflection for an angle α, where K is a constant; if α has been made very small, we can write—

$$\theta/\Delta\,\alpha = K\,(\mathbf{B}_n - \mathbf{B}_{n\ -1})/\Delta\,\alpha = K\,.\,\Delta\,\mathbf{B}/\Delta\,\alpha.$$

Plotting the angles as abscissæ and the values of the deflections as ordinates, adding the successive values in each case, so that—

$$\begin{aligned}\Sigma\,\theta &= K\,\Sigma_1^n\,(\mathbf{B}_n - \mathbf{B}_{n\quad 1})\\ &= K\,(\mathbf{B}_n - \mathbf{B}_o),\end{aligned}$$

we obtain the curve of induction as a function of the position of the armature between the poles, or $\mathbf{B} = f(\alpha)$, whilst if for the ordinates we plot only the successive values of θ for small and equal increments of α, we have $\Delta\,\mathbf{B}/\Delta\,\alpha = \phi\,(\alpha)$; the second curve is, to a first approximation, the derivative of the first curve, and if the increments of angle are not greater than 4° to 5°, the accuracy is sufficient for practical purposes. Fig. 3 is an example of the curves thus obtained.

Method (2) is the well-known Joubert contact method, in which a contact is made once in each revolution with a circuit containing a condenser and galvanometer, by which the instantaneous E.M.F. of the magneto armature is recorded when driven at constant speed, and by varying the position of the contact with regard to the coil a curve proportional to the strength of field at each point can be obtained. Lastly, the oscillograph gives by direct reading, with a high resistance in circuit, a curve similar to that last mentioned, or, if the oscillograph is shunted, the current curve can be obtained under practical conditions.

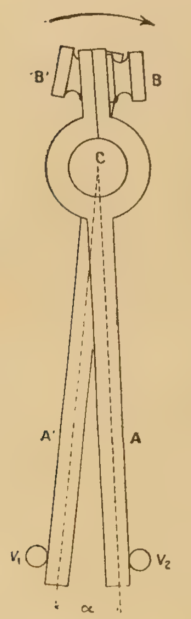


Fig. 2.—Arrangement for Effecting Successive Small Rotations.

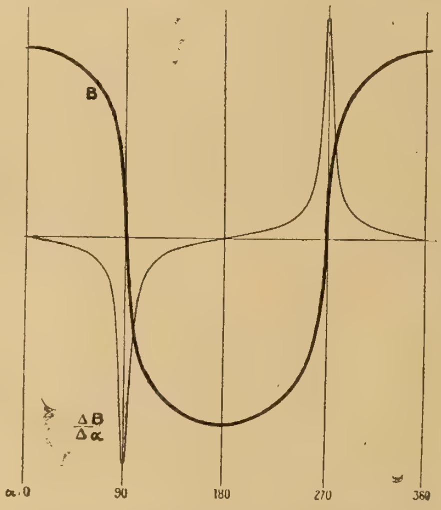


Fig. 3.—Curve of Magnetic Flux and its Derivative.

These three methods have their advantages and drawbacks. The point method gives an exact curve of flux, and the derived curve $\Delta\,\mathbf{B}/\Delta\,\alpha$ is very nearly that of $d\,\mathbf{B}/d\,\alpha$; with these two curves the current wave form can be predetermined, but no information is given as to the phenomena which depend upon the speed, such as those due to eddy currents and hysteresis. For this reason the oscillograph method is the best, but requires expensive apparatus, and the results obtained must be subjected to painstaking scrutiny in order to eliminate several causes of error.

Fig. 4 shows an oscillograph curve, which it will be seen differs considerably from the curve $\Delta\,\mathbf{B}/\Delta\,\alpha$ in fig. 3; whilst the latter is practically symmetrical about the maximum, the corresponding oscillogram shows a strong distortion. This is due to the fact that, as in the Joubert method, the current generated by the coil in energising the measuring apparatus is far from negligible.

This distortion of the curves has sometimes been attributed to hysteresis, but is only due to the current, for hysteresis is present to the same extent in the method by points, though, in the latter case, it is always masked by the errors of measurement.

Starting with a curve of flux that has been carefully determined, the instantaneous values of the current strength can be calculated by a method of approximation, based upon the formula:—

$$i = \frac{n\,S}{L}\,(\mathbf{B} - \mathbf{B}\ c) - \frac{R}{2\,\pi\,m\,L}\int i\,da$$

where i is the current at any moment,
S the cross-section of the iron core N,
n the number of turns of the winding,
$\mathbf{B}$ the magnetic induction in the core,
L the inductance of the circuit (assumed constant),
R the total resistance of the circuit,
m the speed in revs. per second,
α the angle between the axes of the core and of the pole-pieces.

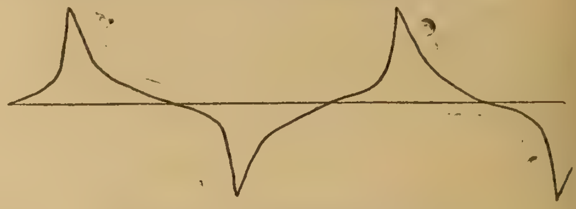


Fig. 4.—Oscillographic Curve.

Dividing the abscissæ into equal intervals as in fig. 5, each representing a very small angle β, and taking as origin the moment of closing the circuit, if we assume that the current strength varies linearly between these divisions, the successive ordinates have for values:—

$$\begin{aligned}i_o &= 0,\\ i_1 &= a\,(\mathbf{B}_1 - \mathbf{B}_o),\\ i_2 &= a\,(\mathbf{B}_2 - \mathbf{B}_o) - b\,i_1,\\ i_n &= a\,(\mathbf{B}n - \mathbf{B}_o) - b\,\Sigma_o^{n-1}\,i,\\ \text{where } a &= 4\,\pi\,m\,n\,S/(4\,\pi\,m\,L + \beta\,R)\\ b &= 2\,\beta\,R/(4\,\pi\,m\,L + \beta\,R).\end{aligned}$$

Experiment shows that the curves calculated in this way agree exactly with the curves obtained with the oscillograph, when the necessary precautions are taken; as mentioned above, owing to the small power of the magneto, it is difficult to intercalate the oscillograph in the circuit without upsetting the conditions materially, and hence it is often preferable to plot the curve of flux by points.

Fig. 3 shows that the flux curve and its derivative are far from sinusoidal; this, which would be a drawback in most electrical applications, is a considerable advantage in the case of ignition magnetos. The problem is very different from those ordinarily met with in electrotechnics; automobile explosion engines have a very wide range of speed, and the magneto must supply the ignition current under all circumstances at the right moment, even during the operation of starting the engine by hand. These extreme conditions require that the current furnished by the ignition magneto shall be strong enough at starting, and at a speed of 40 R.P.M., and yet shall not be excessively strong at a speed of more than 2,000 R.P.M.; so that the ratio of the limiting speeds in normal operation is of the order of 50. At very low speeds the strength of the current is approximately $i_o = 2\,\pi\,m_o\,n\,S/R\,.\,d\mathbf{B}/da$; on the other hand, at very high speeds we may say that $i_m = n\,S\,(\mathbf{B} - \mathbf{B}_o)/L$, where $\mathbf{B}_o$ is the value of the induction at the moment of closing the circuit and $\mathbf{B}$ the value at the instant considered. The object being to

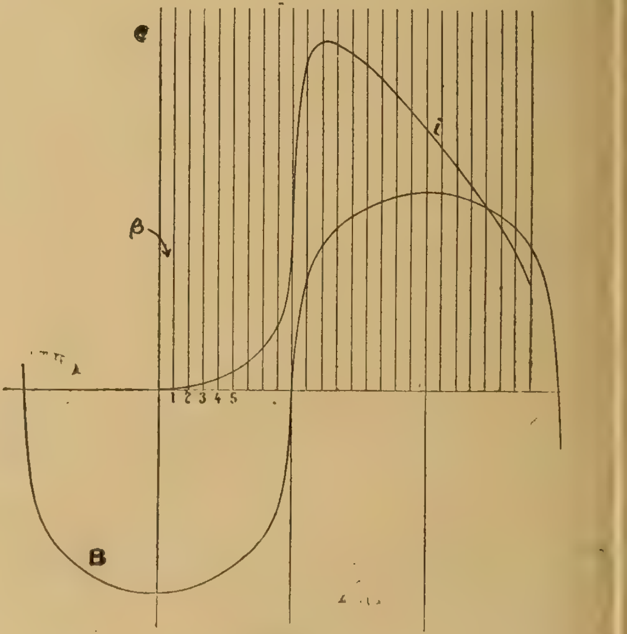


Fig. 5.

obtain a current i_o which shall be adequate for ignition at a very low speed m_o, and a current i_m at the maximum speed which shall not be excessive, we get from the ratio of the foregoing expressions: $\frac{i_o}{i_m} = \frac{2 \pi m_o L}{R} \; \frac{d B_r / d a}{B_r - B_c}$, from which we see that the greater the ratio $d B_r / d a : (B_r - B_c)$, the less may be the lower speed m_o, B_r being the induction at the moment of rupture of the circuit, and B_c that at the moment of closing the circuit. Taking the ratio between the maximum value of $d B/d a$ and $B_{max.}$, there results a characteristic coefficient z = (max. $d B/da)/B_{max.}$, to which we shall return later.

But it is not sufficient that the maximum current should reach a definite value; it is also necessary that this value should be obtained at an almost constant position of the rotating coil with regard to the pole-pieces, so as to obviate the need of adjusting the point of rupture for each speed. If we could neglect the resistance in circuit at high speeds, the maximum current i_s reached at the moment of great variation of flux would lead by 90° upon the maximum current i_m at high speed, represented by the summit of the curve of flux ϕ, and between these limits the spark would have to be continually advanced or retarded in order to secure good ignition by breaking the current at the right moment. Fortunately the limiting case indicated by the equation for i_m above is not reached in practice; thanks to the resistance R of the coil, the maximum intensity of the current is always attained near the point of reversal of the flux.

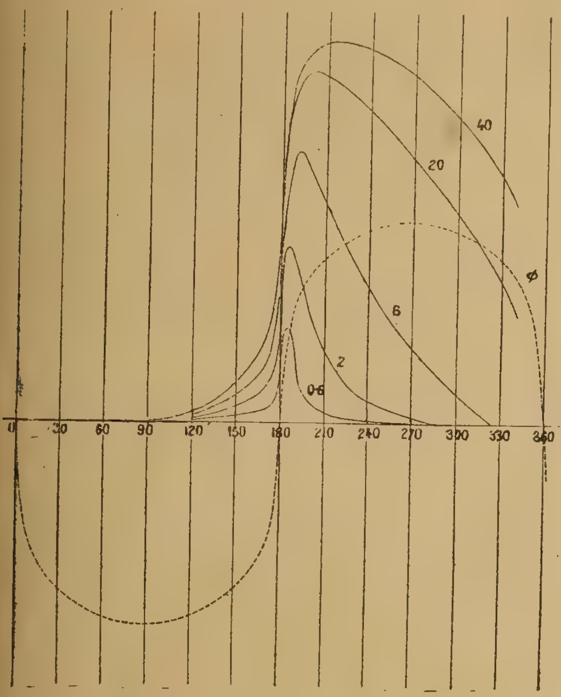


Fig. 6.

Fig. 6 shows the curves of current calculated for an average magneto, for which the flux curve has been experimentally determined. The intensities have been calculated for speeds from 0·6 to 40 revs. per second, for the coil on short circuit, that is, under normal conditions of operation before the spark, the circuit being closed at the moment of maximum flux. It will be seen that, while the speeds vary in the ratio 1 : 66, the maximum current increases only from 3·2 to 13 amperes, or in the ratio of 1 to 4. The coil used for this example had a resistance of 0·57 ohm and an average inductance of 0·012 henry; B_m was 13,700; s = 4·75 cm.^{2}, and n = 159 turns.

In order to obtain, with sinusoidal current, the same current strength at low speed, the magneto would have to be five times as powerful as it is with the Siemens H armature.

(*To be concluded.*)

The Electric Vehicle Committee.—At the last meeting of the Committee, held on October 1st, Mr. V. Mason took his seat as the representative of the Light Railways and Tramways Association. The Committee had submitted for its inspection, by the Krieger Electric Carriage Syndicate, Ltd., the first of the new "Ward" light delivery vans to arrive in this country from America. It was reported that the sales of No. 4 issue of the *Electric Vehicle* had been very satisfactory; it was decided that no further publicity work could be done at the present time other than to concentrate upon keeping the official organ going successfully. The further standardisation of details in connection with lead-plate batteries was discussed, and the Committee will now await the decision of the Accumulator Makers' Section of the B.E.A.M.A. upon its proposals.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Institution and Alien Enemy Members.

As the Institution of Electrical Engineers will shortly be resuming its meetings, I am writing to ask for the support of your paper to endeavour to get a statement from the President on behalf of the Council that it will follow the lead of the Iron and Steel Institute, to the effect that during the state of war between Great Britain and other countries, all Members Honorary Members, and Honorary Vice-Presidents, also Associates and others, who shall be subjects of such countries or States, shall forthwith cease to be members (and this also to apply to those of enemy origin, whether naturalised or not), as it is extremely undesirable that they should have the facility of attending the meetings of the Institution; also, that they shall be subject to re-election by the Institution as a body at the termination of the war, provided there can be found members sufficiently forgiving and willing to believe in the honour of these individuals to propose and second them.

As the Council of the Institution probably acts like the Cabinet of the Government, and does not read the papers, or pleads ignorance as to their contents, I trust that all Members, Associate Members, and others who pay subscriptions to the Institution will, if they are in accord with this suggestion (and I hope, as true Britishers, they will be), write to the secretary, informing him that they wish such statement to be made by the Council at the first meeting which is held.

It is useless to say that the Institution, as a scientfic body, cannot enter into national politics, when one views the base and inhuman ways in which the scientific world of Germany has assisted in the warfare which has been carried on by that nation, and it is quite within the bounds of possibility that such "honourable" methods of warfare as liquid fire and poisonous gas may have been introduced by some of our alien members.

The time has come, in my opinion (and, I trust, in that of your readers also), when we should keep all such Institutions exclusively for British-born subjects or members of our Allies only. I can quite understand that it might mean a somewhat hard parting with certain respected members of the Institution, but let those who have lost their dearest ones on the battlefield, and those who have them still there fighting for the defence of their home and country, remember that under no circumstances can a leopard change his spots.

Station Engineer.

[With the spirit of our correspondent's letter we cordially agree. The suggestion in the last paragraph, however, would raise difficulties in connection with neutrals, and might injure ourselves more than our enemies.—Eds. Elec. Rev.]

The A.E.G. Meeting.

Some of our friends are becoming alive to a very sinister feature in the electrical trade, in the form of the maintenance of German electrical interests in this country, both by the keeping alive of branches—A.E.G. or Electrical Co., &c.—and the importation of manufactured goods of quite obvious German finish.

Electrical engineers of experience must have noticed that, while the stock of German goods was exhausted shortly after the war commenced, there seems quite a good supply of goods at the present time, the finish and workmanship being very distinctly German. For many years I have been convinced, as the result of wide experience, that our traders and engineers have been hypnotised by the German fetish, and that, if they had taken the trouble to carry out exhaustive tests, under similar conditions between German and British goods, the supposed German superiority would have vanished; usually the balance comes out on the British side. As a nation we are so self-depreciating that German agents have not had a very difficult job in booming the superiority of their wares.

Union Jack.

Australian Electrical Trades Union.—According to an Australian newspaper, it was reported at the annual meeting of the Electrical Trades Union of N.S. Wales that there was a membership of 1,704. Despite the war, the financial year had been the most successful in the history of the Union. The Newcastle branch was on a sound footing, and had a membership of 90. In Sydney more than 350 positions had been filled direct from the Union office. Only financial members were recommended for vacancies. A fund for distressed members was desirable. The Union's relations with the main body of employers had been cordial throughout. Although cases had arisen in which it was found necessary to report breaches of awards, these had mostly occurred among the small irregular contractors and firms not primarily connected with the electrical industry. On the whole, trade had been unexpectedly good since August of last year. The falling-off in other directions had been largely counterbalanced by the activity of the Naval Department. A number of members had gone to the United Kingdom, where electricians were greatly in demand in connection with the work at the naval dockyards.

WAR ITEMS.

Electrical Plant Contracts during War Time.—An interesting discussion took place at a meeting of the Edinburgh Town Council regarding the contracts for the new electric power station at Portobello. The Electric Lighting Committee recommended the Council to accept (1) the estimate of Messrs. Fraser & Chalmers, Erith, for turbines and alternators (with Messrs. Vickers as the makers of the alternators), amount, £23,251; and (2) the estimate of Messrs. Fraser & Chalmers for condensing plant (with Messrs. Richardsons, Westgarth & Co., Hartlepool, as sub-contractors), amount, £7,611; delivery in the case of both contracts to be made in the summer of 1917. Supporting the recommendation, the Convener (Mr. Stevenson) said that in the opinion of experts steel would be much dearer after the war than it was now. They were, therefore, saving money by placing the order now. Vickers were doing a good deal of war work, and he had written to the firm asking whether that would not delay work on the Council's order. In their reply they stated that after full consideration of their present commitments for the Government they could say confidently they could deliver the goods within eight months of instructions. In the course of the discussion which followed, it was argued that the extension at Portobello could perfectly well be deferred without doing the least harm to the city, and that there was sufficient electric current at present to provide all the lighting inside the city. It was also contended that they should not encourage firms doing Government work to take on private work. Mr. Bruce Lindsay, in a vigorous speech, pointed out that the demand for electric current was going up, and that if they did not look ahead the electric department would be in a serious position in a few years. The Convener, replying to the critics, said he wanted to get on with the building at once, because they needed it, and because it was not true to say that they had sufficient machinery in hand just now to keep pace with the demand made upon it. At present there were people asking for power who could not get it. If they were not in a position to supply power to one large firm in the town, a new factory which was being built would stand doing nothing. On a vote the Committee's recommendation was approved by 35 votes to 11.

Air Raids and Fire Extinguishers.—The Chief Commissioner of Police of the Metropolis has issued a new warning to the public in connection with hostile air raids. We are requested to draw our readers' attention to the matter, and we give the following extract from the warning:—"Many dry powder fire extinguishers are much advertised. The Commissioner warns the public, as the result of experiments made, at his instance, by a competent committee of experts, that no reliance can be placed upon such appliances for effectively controlling fires such as are likely to be caused by bombs, explosive or incendiary. The Commissioner is advised, as the result of these experiments, that the provision, and prompt and intelligent use of water, or of sand, or of both, in dealing with such outbreaks of fire is the best, simplest and most economical safeguard."

The Lighting of London.—The following is a copy of a further official order that was issued on 7th inst.:—"As the result of the new lighting order and of the arrangements discussed at a conference with the lighting authorities held at the Home Office last week, the private and shop lighting of the London area has been brought generally within the required limits, which must continue to be observed. This, however, has had the effect of materially reducing the total illumination of the streets, and since the object to be attained by the reduction of lighting is not a near approach to complete darkness, but a uniform degree of subdued illumination throughout the area, it is believed that, in the process of equalisation which is now proceeding, the public lighting of both the main and side streets may be somewhat increased. Any changes in this direction must, however, be made only on instructions given by the Commissioners of the Metropolitan and City Police on the advice of the Anti-Aircraft Department of the Admiralty, who have made, and will continue to make, observations to ascertain what degree of lighting may be permitted."

German Connections in Australia.—A Reuter dispatch from Sydney reports Mr. Hughes, the Federal Attorney-General, as stating that, when war broke out, German control of trade and industry in Australia was very widespread and was gaining rapidly. It really appeared that the public of Australia was unable to be satisfactorily supplied except through German sources. Contracts, including some for Government and municipal works, aggregating millions of pounds sterling, had been entered into.

Exports to China and Siam.—A supplementary list of firms in China and Siam, to whom articles may be exported during the war, appears in the "London Gazette" for October 8th.

Patent Restoration.—An order has been made restoring letters patent No. 17,817 of 1907 granted to Augustus C. Hyde, for "Improvements in making electrically conducting joints in metallic-filament incandescent electric lamps."

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

13,681. "Electro-magnetic couplings." H. A. Cooper. September 27th.

13,697. "Dynamo or motor." H. W. Brown & J. Dollard. September 27th.

13,727. "Electric flashlight signalling instruments." J. W. Mander. September 27th.

13,733. "Sparking plugs." V. Joly. September 27th. (Complete.)

13,750. "Method of and means or apparatus for augmenting the effect of small electric currents." W. M. Mordey. September 27th.

13,754. "Stationary electrode for igniters." The Standard Co. September 27th. (Convention date, September 26th, 1914, United States.) (Complete.)

13,762. "Electric heating, boiling, and flat-ironing apparatus." J. Kluijtmans. September 28th.

13,769. "Loading coils for telephone lines." Western Electric Co., Ltd (Western Electric Co., U.S.A.) September 28th. (Addition to 12,434/15.) (Complete.)

13,774. "Electro-magnetic power transmission for motor-car." J. Dollard and H. W. Brown. September 28th.

13,788. "Electric generators." D. Suchostawer. September 28th.

13,801. "Electrical supply systems at constant current-strength and varying voltage." R. Thury. September 28th. (Convention date, June 16th, 1915 Switzerland.) (Complete.)

13,806. "Electric bells and the like." R. E. H. Lovelace, C. E. Ford, and Edison & Swan United Electric Light Co., Ltd. September 28th.

13,807. "Miners' electric lamps." G. A. Bellamy. September 28th.

[illegible],837. "Regulators for X-ray bulbs and like apparatus." C. G. Roch. September 29th. (Complete.)

13,852. "Hot-wire ammeters." Marconi's Wireless Telegraph Co., Ltd., and H. A. Ewen. September 29th.

13,869. "Horary electric meters." A. Aubert. September 29th. (Convention date, October 1st, 1914, Switzerland.) (Complete.)

13,877. "Ceiling-rose connector." C. E. Garratt. September 30th.

13,879. "Electric lighting for sewing machines and other machines and the like." J. F. Needham. September 30th.

13,886. "Dynamo-electric machines." F. A. Heys (Neuland Patents, Ltd., U.S.A.). September 30th. (Complete.)

13,888. "Dynamo-electric machines." F. A. Heys (Neuland Patents, Ltd., U.S.A.). September 30th. (Complete.)

13,899. "Apparatus for use in wireless telegraphy and the like." M. F. Sueter, R. M. Groves & B. Binyon. September 30th.

13,901. "Fittings for electric incandescent candle lamps." C. H. Burt and Huntalite, Ltd. September 30th.

13,902. "Thermic telephones." Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. September 30th. (Convention date, April 26th, 1915, Germany.) (Complete.)

13,904. "High-frequency dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). September 30th.

13,912. "Electro-magnetic power transmission apparatus." A. H. Neuland. September 30th. (Complete.)

13,915. "Construction of electric head-lamp reflectors." P. E. Correll. September 30th. (Complete.)

13,934. "Operating rotary converters and other alternating-current machinery. A. H. Railing & C. C. Garrard. October 1st. (Addition to 10,841/13.)

13,943. "Method of manufacturing the caps for electric incandescent lamps." C. E. Hunter. October 1st.

13,973. "Sound detecting and measuring systems." Western Electric Co., Ltd., & G. H. Nash. October 2nd.

13,984. "Portable electric-lamp apparatus." A. B. Crawford. October 2nd.

13,985. "Starting and ignition arrangements for internal-combustion engines." British Westinghouse Electric & Manufacturing Co., Ltd. October 2nd. (Convention date, October 3rd, 1914, United States.) (Complete.)

PUBLISHED SPECIFICATIONS.

1914.

14,125. Electrical Apparatus for Transmitting and Receiving Signals. Sir A. T. Dawson & G. T. Buckham. June 11th.

17,863. Electric Contact Apparatus, particularly for Telephone Systems. F. Brinkmann. July 28th. (October 24th, 1913.)

19,492. Internal-combustion Engine with Electrically-driven Charging Pump. Allgemeine Elektricitäts Ges. September 5th. (September 6th, 1913.)

19,854. Electric Signalling Systems, particularly for use in Mines. Sterling Telephone & Electric Co., and H. W. Barclay. September 16th.

19,977. Electric Lighting and Heating of Railway or other Vehicles. C. H. Vidal. September 19th.

20,687. Means for rendering Air, Damp, and Watertight, the Junction of Electric Wires or Cables with Boxes or Casings containing Electric Apparatus or the like. A. Holmes & T. H. Brierley. October 8th.

21,529. Telephone Switching Apparatus. Western Electric Co. & R. A. Mack. October 26th.

23,212. Electrical Coupling Devices. G. St. J. Day. November [illegible]th.

23,534. Electric Lamp-holders and Similar Couplings. A. A. Schaschke and Sharp. December 4th. (Cognate application, 3,106/15.)

24,293. Electric Starters for Engines, more particularly those for use on Motor-cars and the like. A. H. Midgley & C. A. Vandervell. December 18th.

24,766. Construction of Solid-metal Electric Vapour Lamps. H. J. S Sand. December 30th.

1915.

4,012. Mechanism for Electric Switches of the Push or Pull Type. Maricanola & Testa. March 13th. (March 14th, 1914.)

5,672. Brushes and Brush-holders for Magneto-electric Machines. C. C. W. Simpson. April 15th. (Divided application on 19,784/14, September 15th.)

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Vol. LXXVII.] CONTENTS: October 22, 1915. [No. 1,978.

Page
Economic Problems Suggested by the War 513
Lead 514
The Italian Electrical Industry 514
Fuel Economy 515
Decimal Coinage and the Metric System (*continued*) 516
The Research Laboratory of the General Electric Co., of New York (*illus.*) 518
Notes from Canada... 521
Correspondence—
  The Edinburgh Extension 521
  The A.E.G Meeting 521
New Electrical Devices, Fittings and Plant (*illus.*) 522
War Items 523
Legal... 523
The Salesman, by E. P. Bennett 525
Business Notes 526
Notes 531
City Notes 534
Stocks and Shares 535
Share List of Electrical Companies 536
Exports and Imports of Electrical Goods during Sept., 1915 537
Output of Coal and the Use of Electricity in Mines 538
Particulars of Electric Tramways in the Commonwealth of Australia 539
Notes on Faults in Cables, by E. P. Austin (*illus.*) 540
Ignition Magnetos (*illus.*) (*concluded*) 541
Trade Conditions after the War, by C. F. Mottram 543
Trade Statististics of Japan, 1914 543
New Patents Applied for, 1915 544
Abstracts of Published Specifications 544
Contractors' Column ... ... Advertisement page xx

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ECONOMIC PROBLEMS SUGGESTED BY THE WAR.

It is sometimes said by certain wiseacres that just as the war began suddenly so it will come to a sudden end. On the other hand, there are those who say that it will endure, so far, at any rate, as England is concerned, for a considerable period of time.

Whatever the period of its duration, it behoves those who are interested in trade and manufacture to watch its effect upon the great industries of the country, and to provide, as far as possible, for the future.

It is always best to take the cheerful view of things; to assume that the war will come to an end within a reasonable time; and that the Empire will arise triumphant, invigorated and strengthened by trials which have been nobly borne.

What will then be the state of affairs? The old order will have changed—giving place to the new. What will the "new" be like? It is idle to refer to the pages of history; for history records nothing like the present Armageddon. It stands apart from every other great war in every possible respect; but the fundamental difference, from the economic point of view, is that we shall here have an opportunity of studying the effect of war upon a gigantic scale upon modern industries.

We do not forget that in the early days of last century, Europe was convulsed from end to end by the Napoleonic campaigns; true, this country played very much the same financial part in those struggles that she is now playing in this; but those were days when industry, as we now know it, was in its earliest infancy. Even the steam engine was not much more than a toy!

The march of industrial progress in which England has taken so prominent a part will have been arrested during the present war. Much of the hard cash in the possession of this country at the outbreak of hostilities will have passed over to the United States, while there can be no question that incomes, whether earned or not, will be taxed very heavily for years to come. Income-tax, once raised, has a strange tendency to stay "up."

In his "Progress of the Nation," at page 687, Mr. Hirst tells us: "Mr. Gladstone's Budget of 1853, with its famous defence and criticism of the income-tax, was accompanied by a plan for the gradual reduction of that tax, and for its final extinction in 1860. . . . But these fair financial prospects were destroyed by the Crimean war, to meet the cost of which out of taxation as far as possible, Mr. Gladstone promptly doubled the income-tax, raising it from 7d. to 1s. 2d. in the £."

All this about a "little" war, in which we lost 28,000 brave men, and which added but £30,000,000 to the National Debt! It is important, however, to note that increase of debt imperfectly represents the financial sacrifice of the Crimean war, because, whereas before the war expenditure had not for 30 years and upwards reached £56,000,000, since the war it has never fallen below £64,000,000.

Having said this much on the larger economic results of the war, let us dwell upon one or two points which concern the industrial world.

Leaving out of account the possibility of invasion, a form of "frightfulness" to which the enemy may have recourse in the last resort, and ignoring the Zeppelin as a means of doing important damage, it is not likely that much material damage will be done to industrial property or machinery during the war. The factory may be turned over, for a time, to the manufacture of munitions of war; but the lathes and other machinery will remain, to revert, when the clash of arms has subsided, to their former uses.

It is the question of *personnel* which, at first blush, seems likely to give rise to the greatest difficulty at the conclusion of hostilities. No doubt many of those who are now fighting in the trenches will return to the workshop; but many valuable lives will be lost before peace can even be thought of. Again, those who do return will have lost something of their former efficiency. The military life creates a certain restlessness and disinclination for work indoors. Those who went away as youths in the prime of their manual dexterity will return as men who will take time to recover all their former skill.

It may be taken, therefore, that in the trades and industries which have given of their best skilled workers to the army, there must be a certain falling-off of efficiency as compared with the state of things before the war. But there is an important aspect of the matter which should not be lost sight of. Employment in the munition shops has been found for a whole army of workers. Whatever its troubles with Trade Unionists, the Government has apparently had but little difficulty in getting new workers (probably because the pay is good), and in this respect it differs from some of its predecessors.

What is to become of the munition workers after the war? This is one of the most interesting of speculations. By a relaxation of rules, the Trade Unions have allowed the unskilled to do skilled work. The skilled workman (so-called) is no longer in a close box. Much work heretofore classed as "skilled" is only so because the Trade Union rules make it so. After the war, the work of making munitions will come to an end; but the man who can make a fuse for a 4·7 shell is by no means an unskilled workman.

There are certain other factors which must be considered when discussing the probable condition of the Labour market after the war. While it is probable that for a time at any rate an army of officials will have to clear up matters connected with the war, the Civil Service will be, and will remain, considerably reduced. Indeed, the Retrenchment Committee has already taken the matter in hand. Vacancies, as they occur, are not being filled; and many an official whose office hours before the war were "10—4 and two hours for lunch" is compelled to do a real day's work. The time of soft jobs is over. In the result competition will be keener, and the man who is content to do honest labour for a reasonable wage will come into his own.

We must look for the inevitable reaction which will follow after the demand for munitions of war has been satisfied. Contracts with the Government will come to an end. The day of high prices for shells and fuses, the manufacture of which is unproductive in the larger sense, will pass away, and owing to the disorganisation of trade both at home and abroad, fresh orders will not be easy to obtain.

But there is another side to the picture. Our manufacturers have often had to complain, in the past, of German competition. By the process of peaceful penetration, the products of German manufactories were being sold in all parts of the world and, owing to subsidies from the German Government, were often sold at prices with which our commerce could not compete. After the war these conditions will have changed, there is reason to hope, for the better.

Our commercial lines of communication with foreign countries, although menaced, have not been completely severed. We have the entry to countless markets where no German goods have been seen since the beginning of the war—and, as far as our present export trade ability allows, we shall have accustomed the buyers to English goods. Further, it is to be remembered that by the time the war is over some people will have found it possible to do without German goods, while others will have learnt to manufacture the same articles for themselves.

Lead.

Lead has remained in a continually strengthening position, the arrivals coming forward from abroad being insufficient to meet the demands which, particularly in connection with Russia, have been upon a very large scale indeed. The contribution to the world's supply which has come from Spain shows this year a considerable diminution against the corresponding period of 1914, the Spanish exports for the seven months to July 31st indicating a falling-off of over 16,000 tons. The quantity shipped from Spain to the United Kingdom, however, for the nine months ended September 30th showed an increase of about 13,500 tons, while our total imports for the nine months were 33,000 tons to the good at 198,000 tons, compared with 165,000 tons. The larger portion of the increase arose from the greater contributions made by the United States, there being over 43,000 tons received from there, against 19,000 tons a year ago. The general merchant business in lead has been comparatively moderate, but the consumption in this country on account of munitions is enormous, and is likely to remain so for an indefinite period, while the position has become gravely complicated by the difficulties now being experienced in obtaining freight room for shipments from America to England. A large portion of the Russian business is being done direct from New York, while the closing of the Panama Canal, owing to landslides, is necessitating shipments being made overland to Seattle, and thence *viâ* steamer to Vladivostock. Italy is, of course, purchasing heavy quantities of lead, but most of the business in this connection is being done direct with Spain. The tightness of near deliveries has for some weeks past been a feature. This may be relaxed as pressing requirements are satisfied, but there is at least a chance of renewed stringency in the near position towards the beginning of next month. There seems every appearance of plentiful supplies existing in North America, but the shipping difficulties, to which allusion has already been made, constitute a formidable drawback to the transference of lead from producing districts in America to consuming areas in Europe.

The Italian Electrical Industry.

About two or three weeks ago we referred to the question of the promotion of British export trade with Italy, and set forth some of the difficulties which will have to be overcome in order to develop business relations with that country. It will now be of interest to hear the Italian side of the problem, which has been specially brought into prominence through the war. The case is put forward by Signor Fumero in a recent issue of *L'Elettricita*, and by way of preamble it may be stated that, although no countries are specifically mentioned, the author has directly in mind Germany and Austria-Hungary, if not Switzerland also. He remarks that until now foreign industry in the Italian market, especially with regard to deliveries to the State, has been in an enviable position as compared with the national industry. In fact, the former has furnished plant in different countries at remunerative prices, whereas foreign competition is not tolerated in principle in the matter of Government supplies in the countries which have exploited the Italian market, and which are effectively protected by high import duties. As a consequence the foreign firms have considered it proper to supply Italy as a means of realising indirect advantages, and at the same time increasing their production and decreasing their own general expenses, whilst direct benefits have been provided by the indirect bounties which those countries enjoy. The latter part of the statement apparently refers to the private bounties granted in Germany on the consumption of coal and iron and steel used in the manufacture of export commodities. This proves, in the opinion of Signor Fumero, that the 5 per cent. preference granted in Italy in favour of the national industry represents nothing of practical value. The prices to which it is necessary to descend in order to overcome foreign competition in electrical machinery are so low as to cause the Italians to make real sacrifices, notwithstanding this apparent protection of 5 per cent. It is therefore contended that the State should emulate foreign countries by the adoption of the principle that what is needed by the public Administrations and the railways (and tramways), based upon public concessions, and which can be made in the country, must be acquired in the country. Why, it is asked, should the Italians leave their door open, when foreign countries close their markets in the face of Italian industry?

It appears that a Government Commission is engaged upon the question of revising the Customs tariff. In this connection the author suggests, for the consideration of the Commission, the advisability of studying whether it would not be equitable to re-arrange the new duties on electrical machinery and parts thereof. For instance, it is hinted that the duties on these should not be less than £1 8s. per cwt. on machines weighing less than one ton, and £1 per cwt. on machines and transformers of a weight exceeding one ton. Apart from this measure of protection against imports, Signor Fumero considers that a further means of excluding foreign competition should be adopted by the stipulation, in connection with all deliveries of electrical machinery required by State Administrations, that Italian firms exclusively should be called upon for tenders, and that they should be placed under the obligation to construct the plant in Italy in the same way as is practised abroad; and a similar observation is made in regard to contracts for public or local authorities and holders of concessions, in so far as the producing capacity of the country is concerned. In order to safeguard the legitimate interests of concessionaires —obviously private owners of tramways and electricity works—it is suggested that the Government should reserve the eventual power of settling the maximum prices beyond which the right of national exclusiveness should cease. This proposal, although not definitely expressed, would probably also apply to public or State contracts. It is further held that in contract conditions the State should not be able to delay the acceptance of delivery or of payments, and that the latter should be made in instalments so that the manufacturers should not become the bankers of the State, the inference being that payments are now unduly prolonged and capital is locked up and development of the industry prevented.

The author also discusses other problems which are declared to hamper the progress of national industry. Among these are mentioned the burden of taxes and other charges which affect more directly the production and consumption of electrical energy, and which, it is contended, should be reduced with the object of promoting installation work and the use of electricity. More important still from the manufacturing point of view is the question of transport. Signor Fumero argues that the rates on the State railways ought to be lowered, as well as those charged by the subsidised shipping companies, and that the reduced charges should also be applicable both to manufactures for exportation and to the raw materials needed by the electrical industry. The author is of opinion that all these matters should be taken in hand now while the nation is at war, so that when the world contest is over and the commercial struggle is resumed, Italian manufacturers would possess a flourishing, vigorous and vital industry. The Italian motto, therefore, is, according to Signor Fumero, Italian work for Italian industry. The same guiding principle has recently been adopted in France, Spain and Russia; it has long existed in Germany and Austria-Hungary, although very little information is now obtainable concerning the Dual Monarchy. But even if we accept the principle as it stands there are doubtless many classes of manufactures in which one nation may complement the requirements of another, and it is for us to ascertain in what particular directions we can develop reciprocal trade with Italy. Except in these respects part of the policy advocated by the Italian author is of such a profoundly Protectionist sentiment that there would be no scope left for the development of electrical trade with Italy if this policy were endorsed by the Customs Commission and the Government. At the same time the real object in view, apart from the promotion of national industry, may be said to be the complete emancipation of the country from Germanism, and in this effort the Italians do not by any means stand alone at the present time, and will not do so when the time arrives for the conclusion of new treaties of commerce.

Fuel Economy.

The importance of economising in every possible way has been forcibly brought home to us of late by the utterances of Cabinet Ministers, the imposition of fresh taxes, and the rise in cost of all kinds of commodities, and will be still more emphatically impressed upon our perceptions in coming years, as our burdens grow heavier. Not only does this necessity affect the individual in his private concerns—by restricting his spending power, it reacts upon all distributing undertakings, and, moreover, it bears directly upon the latter and upon all public bodies in view of higher taxation, wages, and interest on borrowed capital. The nation, as a whole, must cut down expenditure to the utmost, and one of the most important directions in which economy can be practised is in the consumption of fuel, which constitutes our most valuable natural store of wealth. We therefore offer a hearty welcome to the appointment of a Committee by the British Association for the promotion of this object, which is announced in our "Notes" columns to-day. The function of the Committee is to consider the whole question of fuel economy and the better utilisation of coal from a broad and national standpoint, in order to urge upon the Government and the community generally at this juncture the need of systematic scientific control of fuel consumption on public lines, as a direction in which large national economies can be most healthfully and advantageously realised in the immediate future. That there is abundant scope for the activities of such a Committee is a notorious and regrettable fact. Great progress has undoubtedly been made during the past 20 years, and the influence exerted in this direction by the electricity and gas undertakings of this country unites these rivals in an honourable alliance; both have done splendid work in reducing the production of smoke—so markedly demonstrated in our great cities by the diminution in the prevalence of fogs—and in improving the methods of utilisation of coal, but there still remains a vast field for invention and enterprise. We cannot withhold a tribute of appreciation to the gas undertakings, which, unquestionably, use coal to far greater advantage than electricity works; there is no doubt that the gasification of coal and the recovery of by-products is the only method of its utilisation that can be regarded as scientific and economical, and we look forward to the time when, by the co-operation of the gas and electrical industries, this system will be made standard practice. But pending the realisation of that ideal, there is plenty to be done, and we congratulate the B.A. on once more taking the lead.

DECIMAL COINAGE AND THE METRIC SYSTEM.

(*Continued from page* 486.)

Taking now the questions in order, the first is: "Do you employ the metric system in your correspondence with foreign clients?" This is very generally answered in the affirmative. Messrs. G. P. Wall, of Sheffield, say they employ it "exclusively" in all correspondence. Messrs. Eckstein, Heap & Co., Ltd., of Manchester, will "be pleased to employ the metric system in correspondence with foreign clients if this can be made at all general"—but it seems to us that there is no need to wait for others in this regard. Many say, "When required." Some firms that express themselves strongly in favour of the metric system nevertheless do not employ it in their correspondence. The Bastian Electric Heating Syndicate, Ltd., of London, and Messrs. W. R. Sykes Interlocking Signal Co., Ltd., London, both reply, "Yes, invariably." Messrs. A. P. Lundberg & Sons say "Not usually, but will make a practice of doing so in future correspondence with foreign clients." Messrs. Ward & Goldstone, of Manchester, say that they "adopt with equal facility the metric system or the present standard English system." and in connection with their foreign trade they invariably quote and supply on metric measurements to meet the convenience of their clients. Messrs. C. A. Vandervell & Co., London, make it a rule to correspond with their foreign clients in their own language, measurements, and coinage; "naturally the latter are usually in the metric and decimal systems." Messrs. Erith's Engineering Co., Ltd., London, have done so since 1893. We need not give further quotations in this connection, as the majority is so heavy, and most firms simply answer "Yes."

We may point out that in most cases the advantages of the metric system can be very largely availed of in correspondence, tenders, etc., even where the system is not used in the shops. All that is necessary is a set of conversion tables, and a correspondence clerk with sufficient intelligence to use them properly. Now that lady clerks are coming more extensively into vogue, all difficulties on this score should soon be overcome! As we shall show later, it is a mistake to suppose that the metric equivalents for English measures involve a string of decimals; never more than two decimal places are necessary, and then only if an accurate fit is required; the dimensions to bolt-holes for foundations, overall sizes of a motor, etc., need only be stated to the nearest millimetre, and weights will hardly ever be required to a gramme.

The second question related to the use of (*a*) metric weights and measures, and (*b*) foreign coinage, in catalogues and price lists for foreign circulation. As regards the former, the same considerations apply as in the case of Question 1—the metric equivalents can be inserted with ease, and the additional space occupied is well expended; but there is no need for any additional space to be occupied, unless the lists are intended also to serve the needs of the Dominions and the United States—the English measures may be omitted altogether. Surely the very first consideration in dealing with foreigners, in the face of fierce competition, should be to make it as easy as possible for the potential buyer to understand what we offer him, and therefore to put our offers in his language, of which the metric system is an essential part. As regards the second part of the question, we have already referred to the difficulty due to variable rates of exchange, a difficulty which is aggravated at present, and is likely to persist for some time after the conclusion of hostilities. Another obstacle is the fact that whilst the metric system is the same everywhere, each country has its own system of coinage, and although the coins in many cases have the same value, or very nearly so, they are known by different names—or worse, the same name is applied to coins of different denominations, as in the case of the dollar, krone, etc. To meet this difficulty, pending the adoption of a decimal system in this country, we suggest that price lists for circulation on the Continent (and in many other countries) might, with advantage, be priced not only in English units but also in terms of francs, the equivalent values of which are known all over the world. The exchange difficulty is not insuperable; it can be met by a proviso, with tables showing how the prices would be varied in the event of a change in the rate. It is very significant that a considerable proportion of our correspondents use foreign coinage in their lists. For instance, Messrs. G. P. Wall use metric weights and measures, and give prices "exclusively" in terms of foreign coinage. So do the Associated Battery Co., Ltd., of Penge, S.E. Messrs. Eckstein, Heap & Co., however, "think it would be a mistake to make out tenders for abroad in foreign coinage" on account of the variation in exchange. Messrs. Donovan & Co., of Birmingham, "find it exceedingly difficult to quote in foreign coinage at present owing to uncertainty of rate of exchange." Messrs. Fredk. Braby & Co., Ltd., London, have the same difficulty. The General Electric Co., Ltd., have catalogues in foreign coinage, and use the metric system in correspondence and catalogues. The Wardle Engineering Co., Ltd., also answer questions 1 and 2 in the affirmative. Several of our correspondents point out that much of their foreign business is done by their agents, who have special catalogues prepared for local distribution; of these, Messrs. C. A. Vandervell & Co. and Messrs. Ozonair, Ltd., name eight languages in which their catalogues are printed. Messrs. John Tullis & Son, Ltd., Glasgow, intend to use metric weights and measures, and francs, in a forthcoming French catalogue.

The British Insulated & Helsby Cables, Ltd., use the metric system in some of their catalogues, but do not give prices in terms of foreign coinage; on this question they write:—

> We appreciate the advantage of describing our manufactures in terms of metric weights and measures as far as our foreign clients are concerned, but we certainly are very doubtful of the advisability of pricing our manufactures in terms of foreign coinage. There is, perhaps, no great objection to this in normal times in dealing with countries where exchange is fairly stable, and, in point of fact, we not infrequently do this when requested, but in dealing with many countries it would be an extremely risky proceeding, and would, we consider, introduce too much of the speculative element into our transactions.

The "Z" Electric Lamp Manufacturing Co., Ltd., say:—

> We are now actively engaged in completing our arrangements for increasing our foreign trade, and recognise that the first thing necessary to enable us to do this is to have all catalogues printed so as to be intelligible to the *natives* of the country for whom they are intended.

The Bastian Electric Heating Syndicate, Ltd., use the metric system and foreign coinage in a French list, and are having others prepared in other languages. Messrs. Griffiths Bros. & Co., London, and Messrs. J. H. Tucker & Co., of Birmingham, follow the same practice, and so do the Pulsometer Engineering Co., Ltd., Reading, except as regards coinage. Messrs. W. F. Stanley & Co., Ltd., London, and The Park Royal Engineering Works, Ltd., London, are inserting metric equivalents in their new catalogues now in preparation. The London Label Co., Ltd., "always quote in the language and coinage and measurements of any foreign country." Messrs. D. H. Bonnella & Son, Ltd., say they

> propose to make use of the metric system with any further catalogues issued, although we have not done so in our previous issues; but in view of the numerous inquiries received from abroad it is necessary that we should do so.

Mr. Robt. W. Paul, London, Messrs. Mawdsley's, Ltd., Dursley, and Messrs. Ward & Goldstone have made similar arrangements in preparation for the return of normal conditions.

The foregoing quotations are fairly representative of the whole; some important firms, whilst issuing catalogues in foreign languages and not only using the metric system, but also stating prices in terms of the local coinage, prefer to remain anonymous. Our general impression is that there is a strong tendency towards the more general introduction of metric weights and measures into catalogues, but that the difficulties met with in connection with the rates of exchange, and the absence of a universal system of coinage, greatly hinder the adoption of the local coinage.

Question No. 3 was intended to ascertain to what extent the metric system is already in use in our workshops, and the replies make it clear that in very many cases it is employed for some classes of work. Comments on this question are few. Messrs. Premier Electric Heaters, Ltd., Birmingham, and Messrs. Connolly Bros., Ltd., Manchester, say: "Yes, as far as possible." The Westminster Engineering Co., Ltd., London, say "No," but add, "We sometimes get drawings from customers with dimensions in metric system, and find no difficulty in the shops with these." Messrs. Ward & Goldstone, Manchester, say they "adopt with equal facility the metric system, or the present standard English system," and "find the use of metric weights and measures in our wire and cable works of immense convenience." Messrs. Best & Lloyd, Ltd., Birmingham, reply, "Yes, but not exclusively." Messrs. Isenthal & Co., Neasden, also reply "as far as possible," though certain standards in English measures have to be conformed to for convenience; their letter will be reproduced later. Messrs. Willans & Robinson, Ltd., Rugby, replying in the affirmative, say, "We believe that we may claim to be one of the first, if not the first, mechanical engineering manufacturers in this country to have adopted the metric system"—a claim which, to the best of our knowledge, is justified. Messrs. Wilson Hartnell & Co., Ltd., Leeds, say: "Yes, for all electrical work, measurements and calculations, for all work for Willans & Robinson and a few others; for Vickers, inches decimally divided." Messrs. G. P. Wall, Sheffield, say, "Quite as much as the English system." A firm of instrument makers say they "use either the English or metric system, according to which is more convenient for the particular work," but prefer to remain unnamed. Mr. C. C. Mason, joint managing director of the Cambridge Scientific Instrument Co., Ltd., in an interesting letter which we will reproduce later, states that his company uses the millimetre as a unit of length for practically the whole of its manufactures, but both systems of units are used on the same drawings, according to convenience; English and metric weights are also used equally in the workshops.

This question is so closely related to question No. 4 (*b*) that we cannot say much about it without risk of a great deal of repetition when discussing the latter; it is difficult also to separate questions 4 (*a*) and 4 (*b*), as so many of our correspondents deal with them in combination. They are really connected only by one common factor—the use of the decimal system alone instead of the quaint mixture of binary, ternary, and other systems met with in our English standards—but that is a factor of fundamental importance, the basis of the world's system of numeration. We regard the replies to question 4 as by far the most important; the other questions relate only to what manufacturers have done under the existing conditions, as a matter of policy or convenience, whereas this question elicits their views as to whether those conditions should be perpetuated or drastically amended. As we have pointed out, four-fifths of our correspondents favour the latter course, many of them very emphatically. The London Shafting & Pulley Co., answering "yes" to both questions (4 (*a*) and 4 (*b*)), add: "All our patterns and gauges are to English measurements; we should be pleased to alter them if the metric system were generally adopted." We congratulate this firm on its unhesitating and whole-hearted adhesion to the system, whilst we suggest that, with a few exceptions, alterations to patterns and gauges would not be required. The Associated Battery Co., Ltd., of London, reply, "Yes, certainly," to both questions, and remark that "English people are so conservative that it does not appear probable that any alteration will be made unless it is made compulsory." The Wardle Engineering Co., Ltd., Manchester, tersely vote "Yes, most emphatically!" Messrs. Duncan Stewart & Co., Ltd., Glasgow, who issue some of their catalogues in Spanish and Dutch, agree with us "that it would be of great assistance in conducting foreign business if the metric system was in general use in this country." Messrs. Venner Time Switches, Ltd., London, write "Emphatically, yes!" Messrs. H. T. Boothroyd, Ltd., Bootle, would "like to see the metric system universal," but unless it were universal they could not see their way to adopt it. The British Mica Co., Ltd., London, say, "Most emphatically," and add that "foreigners are not likely to understand our ridiculous antediluvian tables." The British Thomson-Houston Co., Ltd., Rugby, answer "Yes, because they are scientifically correct, though the changes would be difficult and expensive to put into effect." Messrs. Connolly Bros., Ltd., Manchester, say: "From a practical personal experience obtained in England, on the Continent, and in the United States, we are of opinion that an immense saving in otherwise unnecessary calculations would be ensured. We know of no drawbacks in our business." This is particularly interesting, because a well-known firm of cable makers holds the opposite view, as will be seen later. The British Insulated & Helsby Cables, Ltd., point out that the question

> is largely one of individual opinion, and the subject has not been discussed nor any pronouncement made as to the views of the company as such. We think, however, that we can safely say that from the engineering point of view the adoption of metric weights and measures would be of great advantage to all concerned.

Messrs. Ferranti, Ltd., Hollinwood, say: "We consider that the matter is one of great importance, and should be pushed with all the power at your command." Messrs. W. E. Burnand & Co., Sheffield, say:

> We think the general adoption of a straight decimal system would save much time which could be more usefully employed than in learning our conglomeration of largely unrelated weights and measures, would reduce errors (more time-saving), and induce a better general sense of proportion, with an immense cumulative benefit that it is worth a lot of trouble to bring about.

Messrs. D. H. Bonnella & Son, Ltd., make goods to special requirements,

> and consider that if there could be uniformity in the measurements used, it would be a considerable advantage, as some customers employ the ordinary system, some mm., and others decimals. We certainly think that your efforts in advocating the adoption of the metric system should receive the support of all manufacturers.

Messrs. Etchells, Congdon & Muir, Ltd., Manchester, write:

> We are in receipt of yours of the 15th inst. on the subject of decimal coinage and the metric system. We are entirely in accord with the movement to promote the above, not only for the Continent, but for home use also.
>
> There are, however, some difficulties in an undertaking like ours, in which our trade has been in the past entirely in the home market. The large number of specialities which we make being planned on the British system, you can appreciate the difficulty of converting their dimensions to metric at once.
>
> In view of the importance of the matter indicated by your letter, we are preparing to adopt decimal coinage and the metric system when dealing with foreign countries, and we may say that we are now opening out in this direction with a fair amount of success.
>
> We are much obliged for your bringing this matter to our notice, and we think that under your able guidance something may be done with what is, apparently, a somewhat difficult matter.

(*To be continued.*)

THE RESEARCH LABORATORY OF THE GENERAL ELECTRIC CO., OF NEW YORK.

A recent issue of the *General Electric Review* contains an interesting description, by Mr. L. A. Hawkins, of the research laboratory of the General Electric Co., of New York, of which the following is an abstract.

This laboratory, started on a small scale 14 years ago, has grown to be one of the largest of its kind, and its work has given it a wide reputation.

Its present staff of 150 employés is now located in a modern seven-story building shown in fig. 1, and occupies the greater part of four floors and the basement, a floor space of 66,500 sq. ft.

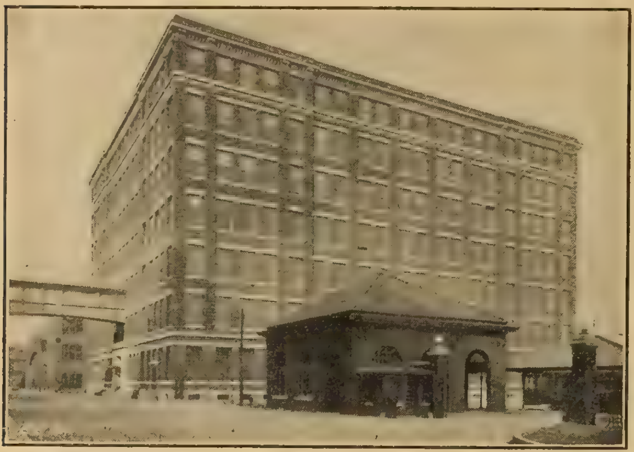


Fig. 1.—Research Laboratory Building, General Electric Co., of New York.

In the basement are the laboratory power plant and chemical store-room. Power is supplied from outside at 250 volts, D.C., three-wire system, and at 40 cycles, 3-phase, 120 volts. In the laboratory power plant are 16 machines which deliver power at different voltages, and at frequencies ranging from 25 up to 2,000 cycles. Through transformers, currents as high as 12,000 amperes, and voltages up to 200,000 may be obtained. A switchboard comprising 28 transfer sections makes it possible to connect any machine to any one of the 118 delivery panels distributed through the laboratory.

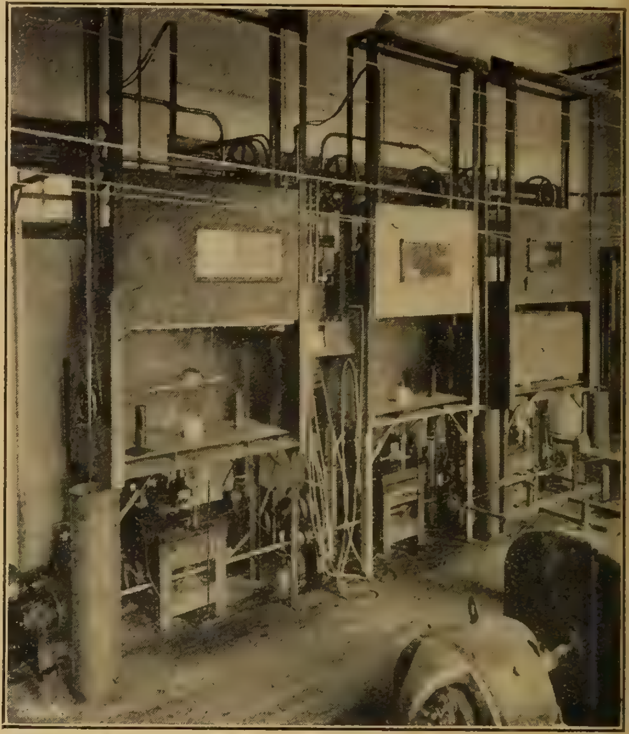
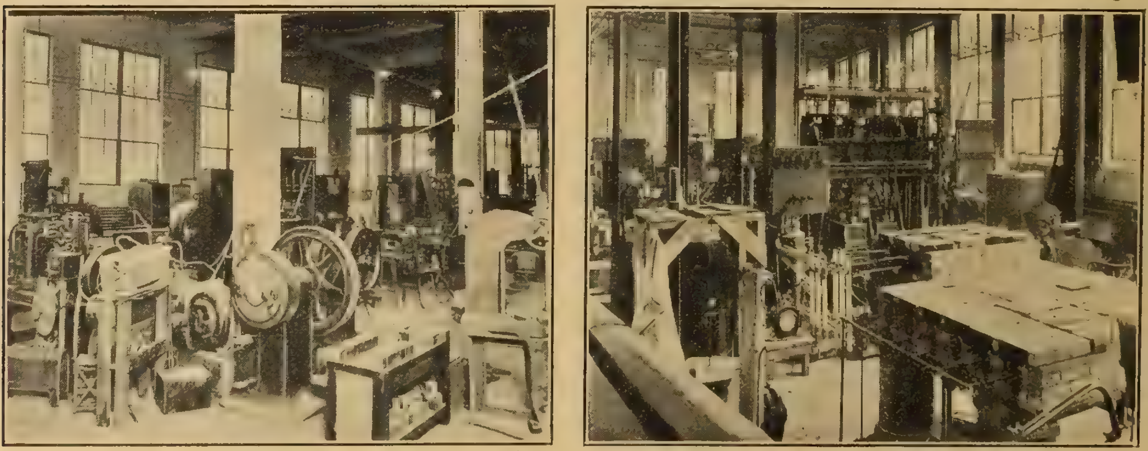
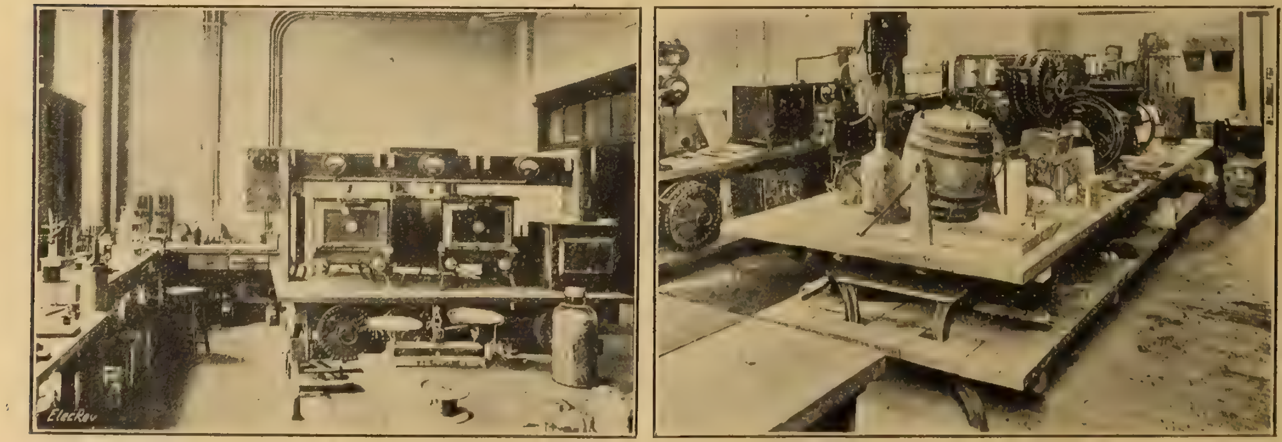


Fig. 2.—Exhaust Ovens for Coolidge X-Ray Tubes.

Figs. 3 and 4.—Views in Furnace Room.





Figs. 5 and 6.—Rooms for Insulation Work.

In the power plant there are also a liquid air machine, an air compressor, and two vacuum pumps, one two-cylinder, 12 in. by 12 in., and the other, three-cylinder, 8 in. by 10 in.

All wiring and piping are carried in horizontal ducts 8 ft. by 5 ft. running above the corridors through the laboratory. There are 35 miles of wire, ranging in size from No. 6 up to 2,000 c.m. The building is piped throughout with city water, river water, illuminating gas, compressed air, vacuum, high-pressure hydrogen, low-pressure hydrogen, oxygen, high-pressure steam, and for vacuum cleaning; distilled water may be delivered by gravity to any room, and 250 motors, 80 transformers, and 60 vacuum pumps are distributed through the building.

In a one-story addition, shown in figs. 3 and 4, are located a number of furnaces, including a porcelain kiln, a frit furnace, two pot furnaces, three calorising furnaces, two brush firing furnaces, all gas heated, and two large vacuum furnaces, electrically heated. There is also a furnace for argon purification. Disk grinders, crushers, a pulveriser, two large sets of rolls, 5 in. by 8 in., and four smaller sets, eight swaging machines, 10 punches, and a 60-ton hydraulic press are installed. The larger electric furnaces of the laboratory, including a two-ton arc furnace, are in a separate building.

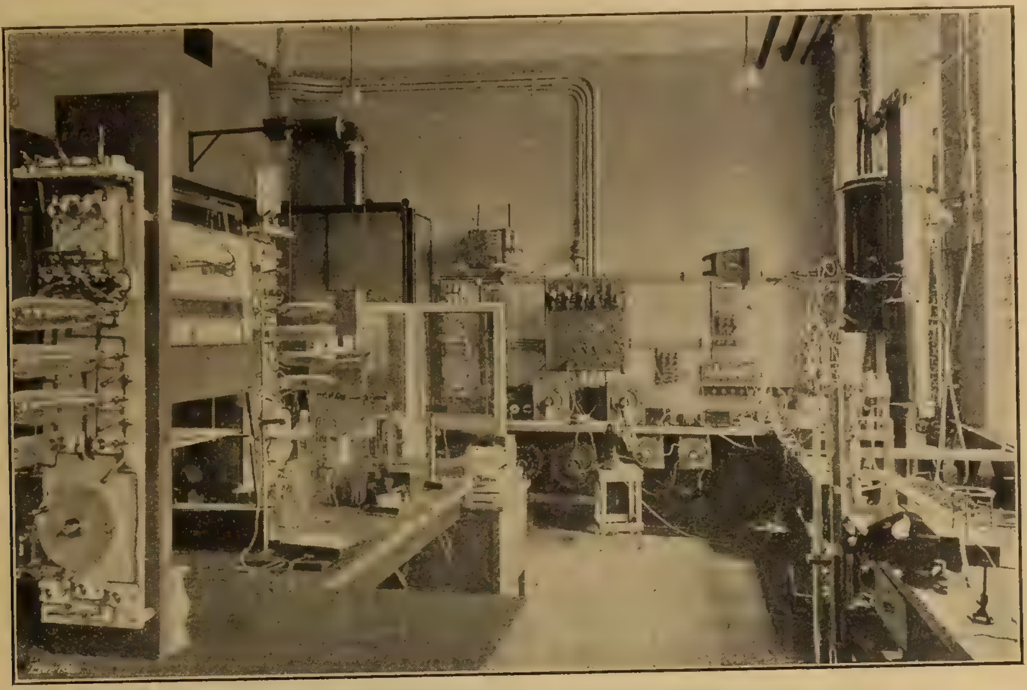


Fig. 7.—Room for Lamp Experiments

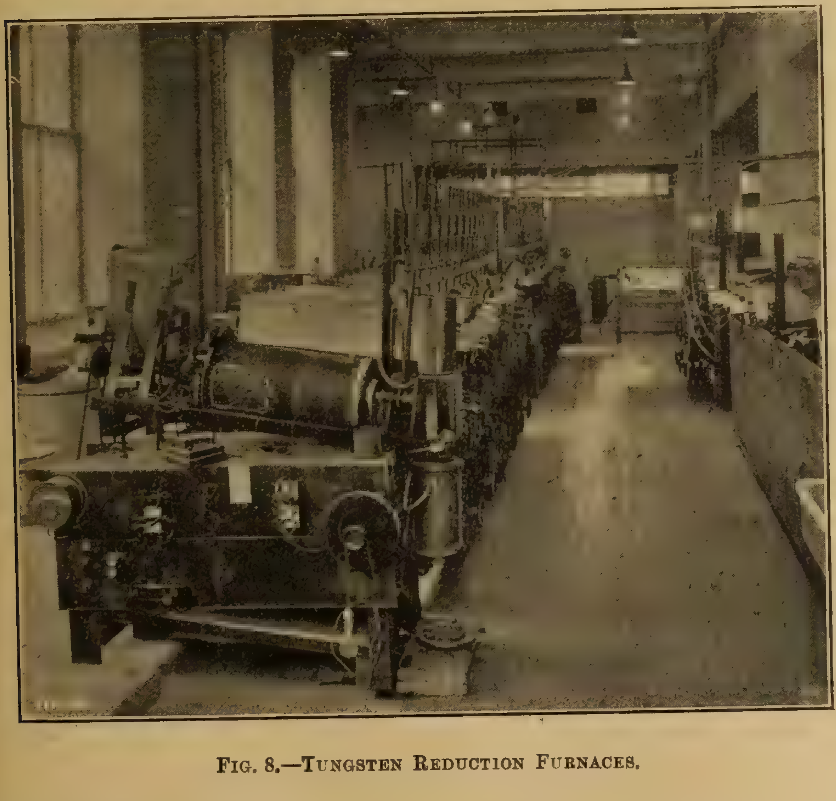


Fig. 8.—Tungsten Reduction Furnaces.

The calorising furnaces, just mentioned, are used for giving to metal parts heat-proofing treatment. The argon furnace purifies argon gas for use in experimental incandescent lamps.

On the first floor of the laboratory are offices, the library of 1,400 volumes, three experimental rooms used for X-ray investigation, and the machine shop. The equipment of this shop includes a milling machine, a lathe, 20 in. by 16 in., two smaller engine lathes, four bench lathes, a shaper, a radial drill, two drill presses, a sensitive drill, a forge, and band saw and sharpener, and 100 linear ft. of bench space.

The second floor is occupied by research work on insulation, by production work on the Coolidge X-ray tube, and by the carpenter shop. The equipment for the insulation work includes a paint grinder, barrel mixers, compound mixers, electric drying ovens, a vacuum impregnating machine, a hydraulic press with steam attachment, a 60,000-volt set for testing dielectric strength, and apparatus for measuring insulation resistance hot and cold.

Views of two of the rooms devoted to insulation work are shown in figs. 5 and 6.

Because of the importance of insulation in electrical apparatus, the laboratory continuously devotes much time to it. Many new moulded compounds have been produced, improving and reducing the cost of countless devices. Improvements have been made in varnished cloth, enamels, and other standard insulations, and new types of insulation have been developed, such as the mineral insulation used in the sheath wire now in production for heating devices.

So much has been published lately on the Coolidge X-ray tube that it needs no description here. It is manufactured entirely in the laboratory. The equipment for production and experimental work comprises a Waite and Bartlett machine, a Snook-Röntgen machine, a Scheidel-Western machine, a large static machine, a Waite and Bartlett table for fluoroscopic work, a stereoscopic display frame, a Schiedel X-ray coil, a Kelley-Koett tube stand, two Kny-Scheerer interrupters, six exhaust ovens, three of which are shown in fig. 2 equipped with Gaede molecular pumps, two Arsem vacuum furnaces, and a tungsten tube furnace.

In addition to the Coolidge tubes, the laboratory manufactures targets for the standard type of tube, comprising a tungsten disk embedded in a copper block.

The analytical laboratory is on the third floor. The work tables are covered with glazed roofing tile. There are two double hoods, a work table equipped for electrolytic work, and a draft-proof balance room.

On this same floor is the work on transformer steel and other alloys, with an equipment comprising a set of small electric furnaces for making alloys, eight small electric annealing furnaces, two vacuum furnaces, three melting furnaces, a set of rolls, a potentiometer and Wheatstone bridge, a Burrows permeability apparatus, storage batteries, a photomicrography outfit, and chemical balances. Even a slight decrease in transformer core loss is of great importance because of the enormous aggregate of transformers in use, most of which have their supply voltage on them 24 hours a day, so that their core loss is a continuous waste. For this reason continuous research on transformer steel seems justified, even though the results seem small. As for the other work on alloys, there are always demands for new characteristics, mechanical, electrical, or chemical, so that hundreds of special alloys have been made and tested in the laboratory. Also composite metals have been developed, such as "Binel metal," that is, steel coated with a thin layer of Monel, the natural copper-nickel alloy which stands high temperatures with very little oxidation, and composite wire for special purposes, such as gold-coated tungsten and molybdenum as a substitute for platinum in dental work.

On the same floor are diamond drilling and jewel polishing machines, and apparatus for testing motor and generator brushes. The quality of the brush has so great an effect on the operation of direct current motors and generators that the laboratory has given much time to developing new grades of brushes better suited to the various machines than any grade formerly on the market. In this way they have made it possible to clean up a number of complaints on motor operation, and in other cases to improve the operation or to lower maintenance costs.

The lamp work is located on the fourth floor. From its beginning, the laboratory has devoted a large part of its efforts to the improvement of incandescent lamps, and has originated the metallised carbon filament lamp, the drawn-wire tungsten lamp, and the gas-filled lamp, thereby gradually sextupling incandescent lamp efficiency. If one stops to compare the status of incandescent lighting fifteen years ago with what it is to-day, and considers how much of the phenomenal advance has been due to those three developments, he will need no argument to convince him that the research laboratory in the electrical industry has justified its existence.

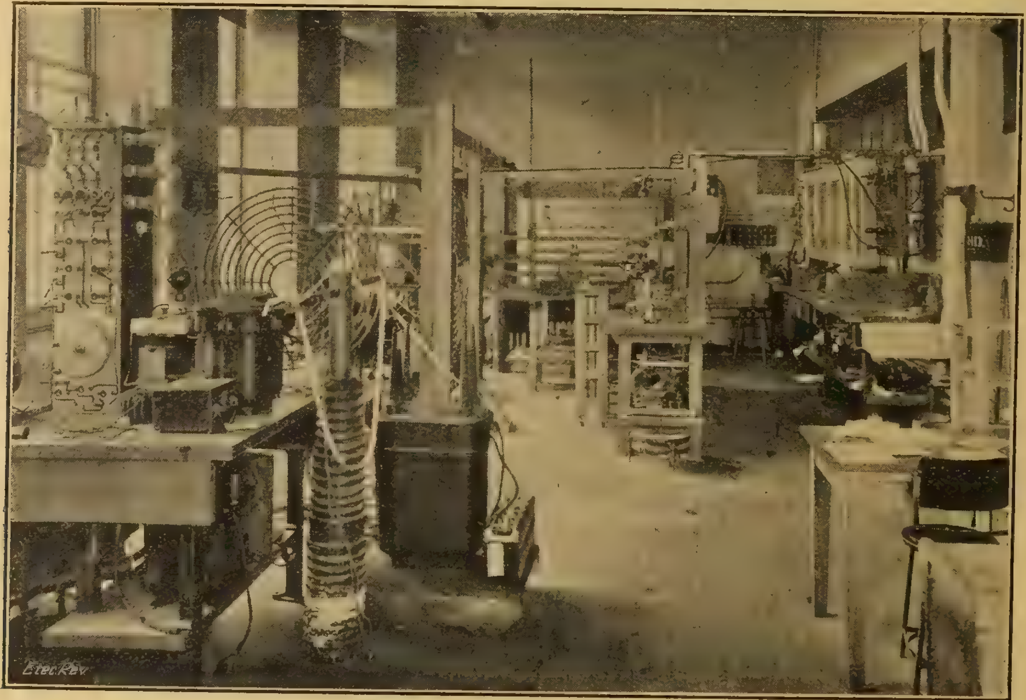


Fig. 9.—Room for Vacuum Tube Experiments.

The laboratory equipment for lamp work comprises a small but complete factory for lamp manufacture with a maximum capacity of about 100 lamps per day. There are four large and four smaller exhaust ovens of standard type, three special ovens for special exhaust, a Thomson welding machine, three sets of apparatus for making arced joints, one for pinched joints, two filament winding machines, two different types of apparatus for making pure nitrogen, from air and hydrogen, and from tank nitrogen and ammonium carbonate, respectively, apparatus for purifying argon, and a gas density balance. For testing lamps there are three Lummer-Brodhun prism photometers, two portable photometers, one flicker photometer, one Lummer-Brodhun precision photometer, and an optical pyrometer for filament temperatures calibrated up to the melting point of tungsten, 3,450 deg. K. A storage battery, 30 amperes, 170 volts, is used for the photometric work. The life test has a capacity of 60 kw. and facilities are provided for obtaining voltages from 0 to 250 in one-quarter-volt steps. A Tirrell regulator maintains constant voltage on the bus-bars. Additional circuits are provided for "shop tests" of 120 volts a.c., and 125 and 250 volts d.c., and also an outdoor series circuit of 6.6 amperes equipped with compensators for the high-current series lamps.

A colour booth for studying colour values of glasses, apparatus for studying residual gases in vacuum lamps, and apparatus for photographing filaments while burning, are included in the equipment.

One of the experimental rooms for lamp work is shown in fig. 7.

There is a photographic dark room on this floor.

Part of this floor is devoted to production work, including a room for chemical purification of tungsten oxide, a battery of electrically heated hydrogen furnaces, shown in fig. 8, for oxide reduction, with a capacity of 50 lb. of metal a day, and a room for the assembly and grinding of tungsten contacts for use in spark coils, magnetos, relays, etc. One large room, of which a view is shown in fig. 9, is devoted to the study of phenomena in very high vacuum. This work has thrown much light on the characteristics of the electron emission from hot filaments under various conditions, and the results have been published in recent papers by Dr. Langmuir. The phenomena of pure electron emission, resulting from operating a hot tungsten filament in a vacuum so high that there is not sufficient residual gas to produce ionisation, have been utilised in the Coolidge X-ray tube and in the high voltage rectifier known as the kenotron. A number of improvements in wireless transmission also have been made possible by this investigation. For this wireless work a smaller room has been fitted up as a sending and receiving station, and an antenna, over 800 ft. long, composed of two wires spaced 16 ft. apart, has been strung between steel towers on the roofs of the laboratory and another building. Before this large antenna had been erected, wireless telephonic communication between the Schenectady and Pittsfield plants had been successfully obtained, and wireless messages received from Berlin, San Francisco, and Honolulu.

The laboratory is continually conducting researches of a purely scientific nature and publishing the results, in an endeavour to contribute its share to the progress of scientific thought, which is rapidly enlarging, modifying, and clarifying our conceptions of the fundamental things underlying all physical sciences. These investigations may be initiated because of their scientific interest, without any definite practical object in view, but it has been already said that every marked advance in science has resulted sooner or later, directly or indirectly, in important effects on industry, and these laboratory investigations have certainly nearly always had these practical results. The study of electron emission, and the various practical utilisations of the principles discovered, is a case in point. The gas-filled lamp, now known as the Mazda C, had its origin in the results of an academic study of the laws governing the loss of heat in small wires, coupled with the results of an investigation of the evaporation of tungsten. The metallised filament lamp resulted from experiments with a high-temperature vacuum furnace. In none of these cases was the practical result foreseen when the research that made it possible was started.

It should not be supposed, however, that all the important achievements of the laboratory have been thus brought about. Many of them, of which drawn tungsten wire is a notable example, were the result of persistent and resourceful effort directed from the beginning toward a perfectly definite goal. Other examples are the sheath wire, with mineral insulation, now in production for heating devices, the magnetic electrode for luminous arcs, and the commercial development of the mercury arc rectifier.

Of course, even in those cases where unforeseen practical results are made possible by the new insight into fundamentals, gained from purely scientific research, they seldom first appear in fully developed form, like Athena sprung from the brain of Zeus, but much work, inventive and experimental, specifically directed to the end in view, is usually necessary before that end is reached.

A third kind of work which constantly requires the attention of the laboratory and occasionally demands the full application of its resources, is that which arises from the specific problems of factory production, such as the improvement of processes, the location of hidden troubles, and the development of new or better materials. Much of the work on insulations and alloys falls within this class, together with countless special investigations, each of which may be the work of a few hours or may extend over months or even years.

The General Electric Co., of New York, maintains other laboratories than the one described. There are laboratories at the Lynn and Pittsfield plants, which specialise on the production problems of those works. There are lamp development laboratories at Harrison and Cleveland which develop and standardise new processes, materials, and lamp designs, for the lamp factories. There is the Physical Laboratory at Cleveland, which conducts researches of a highly scientific order in the physical and physiological aspects of light and illumination. There is the Illuminating Laboratory at Schenectady, devoted to illuminating engineering, the selection of the best lighting unit and the best method of utilising it for a given lighting system. There is the Consulting Engineering Department Laboratory devoted to general and special engineering problems and particularly to the investigation of high-tension phenomena. There is the Testing Laboratory, investigating and testing the physical and chemical properties of materials. There is the Standardising Laboratory, in charge of the standardisation of all instruments, developing new instruments, like the oscillograph, and investigating and developing test methods. In addition to the activities of all these laboratories, the various engineering departments conduct many special tests which they are specially equipped for handling and investigations which sometimes amount to research work of a higher order. Research in general, however, is delegated to the Research Laboratory, which was organised and equipped for that purpose.

In conclusion, we are indebted both to the General Electric Co., of New York, and to its allied concern, the British Thomson-Houston Co., of Rugby, through whose courtesy we are enabled to illustrate this article.

NOTES FROM CANADA.

[From our Special Correspondent.]

The Quebec Streams Commission proposes to build a dam on the St. Francis River in order to increase the water-power storage and tide over low-water conditions, it is said that 6,000 H.P. years will be added in this way. The estimated cost is £80,000, and the low-water level of Lake St. Francis will be raised some 27 ft.

Welland, a small town not far from Niagara Falls, Ontario, seems destined for greater things; two large companies, utilising electric power on a fairly big scale, commenced operations there not very long ago, and a third is now asking to be supplied with 4,000 H.P. Being close to the source of power, electric energy is naturally sold at a low figure there. The company last referred to is probably the one recently formed to undertake the smelting of zinc. Large quantities of this metal are mined in this country, but no smelting has been done; for this all the metal was sent into the States. As an outcome of the demands of the war, however, it has been deemed advisable by the Shell Committee that smelting should be carried out in Canada, and several plants are being erected in various places for this purpose. Brass also is to be made in the Dominion; thus, Canada will soon be making every portion of the shells she is turning out, since the manufacture of the ingredients of high explosives was commenced some time ago.

The work of the Hydro-Electric Power Commission of Ontario goes on apace. Originally, some five or six years ago, a contract for 100,000 H.P. as a maximum was entered into with the Ontario Power Co. at Niagara Falls. At the time, the contract was laughed at by many wiseacres, who declared that it would take 15 or 20 years to reach such a demand for power. Sir Adam Beck, the chairman of the Commission, recently stated publicly that the average daily power consumption during the past six months was 75,281 H.P., and the Commission is already making use of the entire 100,000 H.P. originally contracted for. The load has increased as follows since October, 1910:—

Up to December, 1912, over 38,000 H.P.
Up to December, 1913, over 48,000 H.P.
Up to December, 1914, over 70,000 H.P.

Besides, the rate of increase shows no decline.

Plans for "Hydro Radials," as they are called, being electric railways to link up practically all the more important sections of south-western Ontario, have already been prepared, covering an area nearly as large as England; and though it is unlikely that much will be done during the war, there is little doubt of this work going ahead rapidly when times become more normal.

New towns and villages are being connected up to this immense system every month almost, and in the rural districts many farmers are taking power for doing nearly all the work of the farm, greatly assisting both the farmer and his wife.

The Commission is supplying power to many municipalities for waterworks pumping, which can be done, in most cases, economically, especially if there be a high-level reservoir or an elevated water tank enabling pumping to be done during off-peak hours.

Where electric power is installed for pumping in this way, and is supplied only from one source, the fire underwriters insist that there shall be a stand-by plant. These stand-by plants are usually steam, 40 lb. or more pressure being kept up in the boilers all the year round. Keeping steam up in this way runs into a good deal of money per annum, so the Commission is now making a trial of the use of centrifugal pumps direct-coupled to high-speed gasoline engines, instead of steam plant, thus reducing stand-by charges almost to zero. For small towns, up to 15,000 or 20,000 inhabitants, there is every prospect that this arrangement will prove very satisfactory. Such gasoline-driven sets have other advantages over steam plant in that they take up very much less space and are cheaper in first cost.

Canada is known to have plenty of water power, but the following seems to show the fact up pretty clearly, especially as applied to the vicinity of Vancouver:—The City of Vancouver, wishing to own its own electricity supply, recently tried to get information regarding suitable sites. No less than seven proposals were made to the city offering water powers within 180 miles; the power available varied from 3,000 H.P. to 100,000 H.P.

It is not often that one hears of a Spanish company securing an order for engineering work in any British territory, but it is announced that the Niagara Spanish Aero Car Co., representing the Estudios y Obras de Ingenieria, of Bilbao, are building an aerial railway across the Niagara Whirlpool; the span will be about 1,800 ft. The line will be erected for sight-seeing, and it will be operated by a 200-H.P. electric motor; about 30 people will be taken in the car at one journey. Anyone who has seen the whirlpool and its surroundings can imagine what it would feel like to be hanging over the top of it.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Edinburgh Extension.

The appeal for more munitions, which you make on page 482 of the current issue, is one which in the North, at any rate, is being made to everyone who can help at all; and yet, on turning to page 512, we find that Vickers—of all people—are allowed to undertake the manufacture of alternators for an ordinary municipal extension. Had the plant been for Sheffield or Barrow, one could better understand it; but Edinburgh; ye Gods!

From various advertisements one gathers that all important armament firms are in urgent need of men for actual munition work, but by no stretch of imagination can one see that this plant could be brought under this heading. If additional machinery be wanted for the factory now being built, surely temporary plant of some kind could be laid down.

One hears that the country is now being organised on efficient lines in order to win and end the war. Is this a sample of it?

W. H. B.

The A.E.G. Meeting.

Seeing "Union Jack's" letter in this week's Review *re* the superiority of British electrical machinery, I should esteem it a great pleasure if you could spare me a few lines. The writer has been ten years in a large mill in the North—five as shift engineer and five as electrician, doing the rewinds, repairs, etc., etc. Our firm has about 300 3-phase motors in use from 160 H.P. downwards; about one quarter are German (Union Co.) and three-quarters British. A few weeks ago the writer counted seven Unions in for rewind and one British, this allowing for the numbers in use, is 21 : 1 against the German motor!

In another case we had a 7½-H.P. Bruce Peebles motor on a heavy gear drive for five years; taking it away for thorough overhaul, we installed in place of it a 9¾-H.P. Union motor; it was literally all to pieces in three months!

We have had in use four generators of British make for from six to ten years; in no case have they needed electrical repairs, and the only mechanical repair was a small exciter shaft snapping at a flaw; these machines run night and day. Lately a foreign generator has been put into use; it burnt out on its trial run at one-third full load after running four to five hours. Another case: This week we removed a 15-H.P. E.C.C. motor that has been driving a fan for eight years, night and day, for overhaul; the bushes did not need renewing. Most of our Union motors run their rotors on their stators in less than six months!

When a report of a breakdown comes in our shop, the cry is "Another Union motor, I suppose?" We have no other make of German motor in use, so that the writer cannot say for other makes. These few facts can be vouched for by at least a dozen electrical men.

British Electrician.

In spite of the correspondence in your columns, the Electrical Co. are still busy striving to unload their wares upon an unwilling public. Only this morning we have received a trade price list from this firm. We sent it back to them with a covering letter, in which we stated that we had no intention of doing any business in future with German firms, and, moreover, we should refrain from trading with English firms who were supplying their company with goods. We hope other electrical contractors will adopt a similar course.

E. P. Allam & Co.

London, W.C., *October 12th*, 1915.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Hoffmann Roller Bearings.

We illustrate in fig. 2 the application of roller journal bearings and a ball thrust to the shaft of an electrical machine, by the leading British makers, the Hoffmann Manufacturing Co., Ltd., of Chelmsford.

The superiority of the short roller over the ball bearing for carrying the journal load (except in the case of small motors) is now generally recognised, and such short roller bearings are shown in our illustration. The shaft is located by means of a double thrust bearing; for normal conditions quite a small thrust bearing is sufficient, but where the thrust load from gearing has to be dealt with, the size must be increased acccordingly. The bearing parts are guaranteed by the makers to very fine limits, and with reasonable accuracy in the machining of the shafts and housings—such accuracy as is possible in any well-equipped machine shop—success is assured.

It is claimed that there will be no measurable signs of wear in these bearings after years of running, provided they are kept clean. To ensure this the best practice is stated to be to keep the end covers of the pedestals where they approach the shaft as broad as possible. These covers should be bored not more than ·004 in. larger than the shaft diameter (the absence of wear in the bearings makes this perfectly feasible) and a number of grooves or recesses—not a thread—turned in them. If grease is forced into the housing until it exudes at these covers, it will help to keep the bearings free from foreign matter. Where the machines are to run in specially dusty positions, extra precautions may be taken. Particulars as to the proper allowance for the press fit of the inner race and the other parts are readily furnished by the Hoffmann Co.

We understand that a number of well-known makers are now using the Hoffmann bearings on all their machines, and that practically all others are prepared to quote for machines so fitted, and show a tendency to use them more and more extensively every day. The advantages of reduction in friction, particularly in starting effort; grease lubrication instead of the old troubles from oil working its way into the windings; perfect reliability and freedom from breakdown under continuous working conditions—an increasing number of motors are kept running practically 24 hours a day under present conditions, is causing users to pay more attention than previously to the type of bearing fitted. The complete absence of wear permits of a smaller air-gap, and the roller bearing machine is also much neater in appearance and shorter. Manufacturers who are using the bearings as standard practice confirm that a roller-bearing machine can be produced more cheaply than one fitted with plain bearings; there is a considerable reduction in fitting and machining expenses. On a vertical machine the ball or roller bearing is almost essential from the point of view of the difficulty of retaining lubricant that is always a feature of plain bearings.

Parsons Paraffin Lighting Set.

Amongst the firms who have had many years' experience on turning out an engine fit for continuous full power duty is the Parsons Motor Co., Ltd., Town Quay Works, Southampton, so well known in connection with paraffin machinery for marine propulsion. We illustrate a plant by this company, of 3½-KW. output; the engine is coupled to a Mather & Platt dynamo, and the normal speed is only 900 R.P.M. The working parts of the engine are the same in size as the marine engines, which are built to pass the requirements of all authorities.

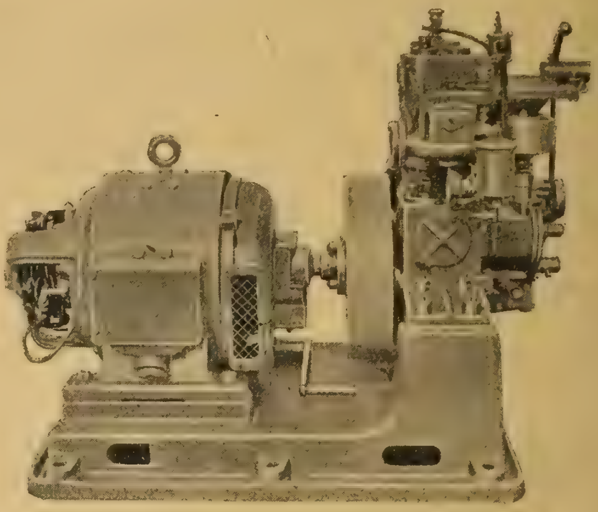


Fig. 1.—3½-KW. Parsons Petrol-Electric Set.

This particular plant is one of three for country house lighting, but the company has built many very much larger plants, up to 90 H.P., for various military camps about the country, in some cases there being half-a-dozen large engines in one generating station.

The engine is remarkably clean in running, and closely governed by means of the company's enclosed high-speed governor, which is gear-driven as shown; it is fitted with its own water circulating pump, and is simple and flexible to handle.

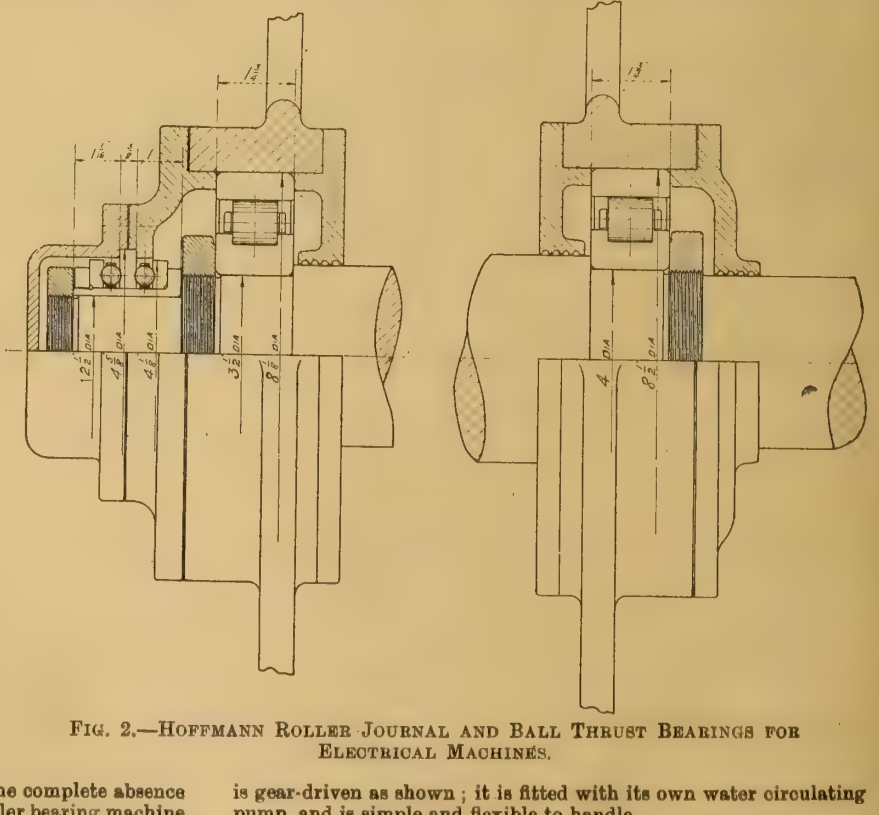


Fig. 2.—Hoffmann Roller Journal and Ball Thrust Bearings for Electrical Machines.

The coupling between the engine and dynamo is driven through six pins and collars, which allows the armature spindle to float endwise.

Advertising Window Signs.

. 3 shows a window sign designed and made by SIMPLEX UITS, LTD., of Garrison Lane, Birmingham, for the new show- of the Glasgow Corporation Electricity Department, which pened last week. During the present trying times for shopers, when the lighting restrictions in large towns are strictly rced, it is useful to remember that windows lighted in this are well illuminated without flooding the street with light or blinding the observer.

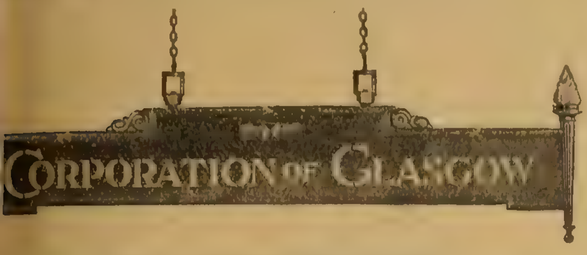


FIG. 3.—SIMPLEX WINDOW SIGN.

WAR ITEMS.

ntraband of War.—The *London Gazette* for October 15th ains a new Proclamation, revising the list of articles to be ted as contraband of war. In Schedule I are enumerated the cles that will be treated as "absolute contraband," and in edule II those to be treated as "conditional contraband." They ude the following :—

Schedule I.

athes and other machines, or machine tools capable of being loyed in the manufacture of munitions of war.

mery, corundum, natural and artificial (alundum), and carborum in all forms.

ange-finders and their component parts; searchlights and r component parts.

ubmarine sound-signalling apparatus.

lotor vehicles of all kinds, and their component parts.

he following metals :—Tungsten, molybdenum, vanadium, um, nickel, selenium, cobalt, hæmatite pig-iron, manganese, trolytic iron, and steel containing tungsten or molybdenum.

sbestos.

luminium, alumina, and salts of aluminium.

ntimony, together with the sulphides and oxides of antimony.

opper, unwrought and part wrought; copper wire; alloys and pounds of copper.

ead, pig, sheet or pipe.

in, chloride of tin, and tin ore.

erro alloys, including ferro-tungsten, ferro-molybdenum, ferronganese, ferro-vanadium, and ferro-chrome.

he following ores :—Wolframite, scheelite, molybdenite, mangae ore, nickel ore, chrome ore, hæmatite iron ore, iron pyrites, per pyrites and other copper ores, zinc ore, lead ore, arsenical and bauxite.

Schedule II.

uel, other than mineral oils.

ailway materials, both fixed and rolling stock, and materials telegraphs, wireless telegraphs, and telephones.

ussian Electrical Industry.—At a recent meeting of the ak Current Section of the Central Military Industrial Comttee, the question of the requirements of the electro-technical lustry in Russia was considered. The President stated that the ak current industry in Russia was satisfactorily established, as many years past both telegraphic apparatus and signalling paratus had been made in Russia, thanks to the Chief Department of sts and Telegraphs and the Marine and Engineer's Departments, ich gave their orders exclusively to Russian factories. The nistry of Ways of Communication, on the contrary, very freently gave the orders to foreign houses for many items. It was plained that the development in the production of various appaus was obstructed by the scarcity of raw materials and motors. eat need was experienced in respect to ebonite, iron and carbon, o silk for insulators, in the cable works. Considering the diffilties in connection with the provision of labour, it was decided agitate for a change in the law respecting the employment of nale and minor labour. At the meeting at which the foregoing s stated, it was shown that, thanks to the changes in the techcal conditions demanded by the Departments, the productivity of e factories had grown by 50 per cent. A desire was expressed r the suppression of the fines introduced by the Departments for e unpunctual execution of orders, which, as a matter of fact, are together abortive, for the penalties are really paid by the Treasury elf; the manufacturers take good care to calculate a percentage their prices to stand against such fines. A great hindrance to e development of the electro-technical industry consists in the quirements of the departments for apparatus to be made in types iown only to certain firms. The section confirmed the suggestion hich has been frequently raised regarding the necessity for a mplete change in the qualifications for workmen and specialists the electrical branches of the Army. It was shown that during e war a whole series of important productions that had not isted before the war had cropped up in Russia. Thus, for example, the firm of Siemens & Halske are now making Röntgen regenerator installations better in quality than those made abroad. The factory of Phedoratzky is making Röntgen tubes, &c. Besides this, two firms have come into existence for the manufacture of measuring instruments which were not produced in Russia previous to the war. The question of the causes why the production of small motors of a quarter to half horse-power had not been solved in Russia before the war was explained by the absence of an effective Customs system in Russia, at all events in respect to these goods. The section declared itself in favour of establishing differential tariffs for the importation of engines and motors into the country.

British Exports and the American Exchange.—The American Exchange rate difficulty was discussed at a recent meeting of the executive council of the Associated Chambers of Commerce of the United Kingdom, and a resolution was passed in which the opinion was expressed that among the methods available for the purpose of meeting the difficulty are :—

(*a*) The reduction of the importation of articles of luxury by means of import duties, at least during the period of the war.

(*b*) The stimulation, on the part of the British Government, of the export of goods produced within British territory—such stimulation to take the form of assisting commercial effort.

(*c*) Inasmuch as debts due to Great Britain in the form of American Railroad bonds have been purchased in this country for export and sale in America as a means of adjusting the trade balance against Great Britain, steps should be taken to supplement or substitute the export of capital in the form of securities by the export of merchandise.

Tramway Supplies in War Time.—In the October number of the *Tramways and Light Railways Association Journal* it is stated that in view of the difficulty experienced by members in obtaining supplies of steel tires and other materials during wartime, the Council has appointed a Special Committee to deal with the matter. The Committee consists of Messrs. Harry England, Fred Bland, and J. B. Tippetts. Members of the Tramways and Light Railways Association are requested to communicate particulars of any difficulties that they may be experiencing in the above connection to the Secretary of the Association.

Australian Metal Refining.—A Reuter dispatch from Melbourne states that as the result of conferences of the interested parties, Mr. Hughes announced last week that arrangements had been made whereby the whole copper output of the Commonwealth suitable for electrolytic treatment would be treated in Australia. He also announced that a British group had secured the Imperial Government's approval of their suggestion to distil in Great Britain the whole Australian output of zinc concentrates.

Prohibition of Steel Exports?—It was stated in Scottish iron and steel circles on October 13th that, so pressing is the Government demand for iron and steel, than an embargo is to be placed on exports of steel. This probability is being forced upon the Government, as deliveries are falling far behind in consequence of all makers having a surfeit of orders. It is already assured that the output for the current year will far eclipse anything in the history of British trade.—*Financial Times.*

From the Front.—Another of our readers with the British Expeditionary Force in France writes under date October 11th :— "It is very refreshing to have your journal again, to read notes and news relating to the electrical world. I assure you that the weekly copies will be looked forward to here, and will meet with a warm welcome."

LEGAL.

MEXICAN LIGHT AND POWER CO.

IN the Chancery Division last week, on a motion on behalf of T. G. Scott, a receiver was appointed of any assets of the above company in this country.

DEALINGS IN MARCONI SHARES.

IN the Court of Appeal, on Friday, October 15th, before Lords Justices Swinfen Eady, Phillimore and Pickford, the hearing was commenced of the appeal by Mr. Samuel Segar, a shareholder in the English Marconi Co., in the action which he unsuccessfully brought against Mr. Godfrey Isaacs for alleged breach of an agreement to take over certain shares, or to pay the difference between their purchase price and sale price.

Mr. Leslie Scott, K.C., Mr. Gordon Hewart, K.C., and Mr. Beazley appeared for the appellant, and Mr. Greer, K.C., Mr. Schwabe, K.C., and Mr. Arthur Sims for the respondent.

MR. GORDON HEWART opened the appellant's case. The hearing was continued on October 19th and 20th, and it is expected to occupy some days further.

NEWHOURS AND OTHERS *v.* NORTHERN LIGHT, POWER AND COAL CO., LTD.

IN the Chancery Division, Mr. Justice Younger heard this action, in which the plaintiffs, as holders of first mortgage bonds in the defendant company, sought to compel the company to call a meeting of bondholders with the object of removing the present trustees and appointing new ones.

The company, which was Canadian, had its offices, and held its meetings, in London, and it was formed for the purpose of supplying light and power to Dawson City, with works and plant in the Yukon territory. In June of 1909 it issued first mortgage 5 per cent. debenture bonds to the amount of $2,500,000, and by a trust deed these bonds were secured on all the property of the company. It was provided by the trust deed that the trustees might, at the request of the company, or if 75 per cent. of the bondholders stepped in to protect the property of the company, convene a meeting of bondholders. The plaintiffs claimed a declaration that under the provision the company should convene such a meeting, or, in the alternative, that the Court should grant an injunction restraining the calling of any other meeting to consider the matters referred to in the plaintiffs' requisition.

The defendants did not deny their refusal to call the meeting required by the plaintiffs, and persisted in their refusal to call such a meeting. Their case was that the plaintiffs' requisition was not a proper one, and that the meeting if called would be ineffective, as it would have no power to do the acts and things specified as the objects of the meeting. It was further alleged that one of the plaintiffs had been notified of the company's intention to call a meeting, and the meeting was in fact called by notice dated March 17th. The main question was the inability of the meeting to carry out its proposed objects, and it was argued for the defence that the Court had no power to make a mandatory order on the company to call a meeting.

On Wednesday his Lordship delivered his reserved judgment. He held that the plaintiffs were substantially right and the defendants substantially wrong throughout the proceedings, and, although he did not think that any useful purpose would be served by ordering a meeting to be convened now, the plaintiffs were entitled to a declaration that the company were bound to convene a meeting of bondholders of the company in compliance with the plaintiffs' requisition of June 21st. The company must pay the costs of the action, which would include the costs of the preliminary motion that had been made.

Beattie v. Barton Wright.

Before Mr. Justice Ridley and a special jury in the King's Bench Division on Tuesday and Wednesday, Mrs. Ellen Eliza Beattie, of 131, Maida Vale, N.W., brought an action against Mr. E. Barton Wright, of Pembroke House, Oxford Street, W., claiming damages for personal injuries alleged to have been sustained while receiving electrical treatment for rheumatoid arthritis in the knee.

Defendant denied that he was proprietor of this electrical system for treating disease, and said that any contract entered into was on behalf of the Radium Electro-Emanation Co., Ltd., of which he was a salaried servant. He denied liability, and said that if Mrs. Beattie was injured the burn was caused solely by her negligence, in that she had been verbally warned before treatment of certain possible dangers. Mr. G. Thorn Drury, K.C., and Mr. R. P. Croom Johnson were counsel for the plaintiff, and Mr. David White appeared for the defendant.

Counsel, in opening the case, explained that Mrs. Beattie saw a circular of what was there called the Bartitsu Institute, containing a number of testimonials, and she was favourably impressed by what she read there. The circular indicated that the Institute was a palatial affair, whose upkeep, Mr. Barton Wright stated, cost £7,000 a year. Plaintiff called about October 30th, 1914, and the defendant undertook to give her treatment, for six guineas, by three different methods—diathermy, by which a high electric current was passed through the affected joint; a light bath; and rotary massage. Mrs. Beattie was asked to bear as much heat as she could while the electric current was being applied; and the method was that moistened pads were placed on either side of the knee, and the current of electricity was delivered into these pads. Mrs. Beattie called out more than once during the operation. Mr. Barton Wright was described as a gentleman of magnetic personality. Something must have interfered with his magnetism on this occasion—for he was nagging at the nurse during the whole time the treatment was going on. At its conclusion Mrs. Beattie noticed that her knee was red and inflamed. She proceeded from the institute to the Florence Nightingale Home, where a daughter of hers was undergoing an operation, and there showed her knee to the nurses. They sympathised with her, and dressed it for her. Mrs. Beattie persisted in the treatment for several days, and felt some sort of temporary relief from it, as she was informed would be likely; but a burn developed, and an electrical burn took a long time to heal. She was in bed five weeks as a result, and during that time had to be lifted in and out of bed. This was in consequence of what Mr. Barton Wright described as a "soothing and exhilarating treatment."

Giving evidence, the Plaintiff declared that during the treatment Mr. Barton Wright was in a particularly bad temper, and the nurse, who applied the electricity, was extremely nervous in consequence. She felt very sorry for her.

Mrs. Beattie, in cross-examination, admitted that on a previous occasion she had received electrical treatment under another system, when she suffered certain effects of burning.

His Lordship (to Mr. White): Do you put that forward as any reason why you should burn her again?

Mr. White replied that he was seeking to show that Mrs. Beattie knew there was a possible risk of burning by electrical treatment. The defendant told her he could have put the matter right at once if she had gone to him instead of accepting treatment for the burn elsewhere.—The hearing was adjourned.

Osram Lamp Works, Ltd., v. Pope's Electric Lamp Co., Ltd.

This action was mentioned in the Court of Appeal to the Master of the Rolls and Lord Justices Bankes and Warrington, when by arrangement between the parties, their Lordships directed that the hearing of the appeal from the recent decision of Mr. Justice Joyce should not commence before November 8th.

Sunderland v. Economisers, Ltd.

This action was before Mr. Justice Ridley and a special jury the King's Bench Division, on Tuesday, October 19th. The c was the suit of Mr. Wallace Sunderland, of Horringham Terr Leeds, against Economisers, Ltd., of Queen Victoria Street, Lond claiming damages for alleged wrongful dismissal from his post sole selling agent for the company in the area of Yorksh Derbyshire, Nottingham and the City of Lincoln. The defence that his dismissal, on April 4th, 1913, was in accordance with terms of his agreement of April 18th, 1912, and in consequence the fact that he was not carrying out his duties satisfactorily.

Mr. McCall, K.C., for the plaintiff, read letters in which chance of supplying economisers to various electricity works discussed, including the electricity works at Halifax. One let from the defendants to their agent, dated May 3rd, 1912, said "Probably you have seen the advertisement in the Electric Review inviting tenders for a 360-tube fuel economiser for county borough of Halifax tramways, Mr. W. M. Rogers M.I.E.E., borough electrical engineer." These economisers, a Mr. McCall, consisted of an arrangement of tubes in series plac at the end of the boiler, which raised to a high temperature water which was passed into the boiler, and used the wa gases from the furnace for heating the water so passed to boiler. There were various economisers on the market, and th effected a great saving in fuel and provided an extremely profita trade for established firms which dealt in them. They were request in connection with electrical plant, and at other importa works. The plaintiff had been with Messrs. Green & Co., man facturers, Wakefield, and Economisers, Ltd., were incorporate about the time of Mr. Sunderland's appointment as agent, to g as much as they could of the trade in economise which had gone to Messrs. Green and to other make One of their letters to the plaintiff said: "We want to supp economisers in the West Riding to show Messrs. Green we ca compete with them, so to speak, at their own back door." M Sunderland was appointed not at a salary, but for five years on 5 per cent. commission on the net cash received by the firm f the business he obtained, with a proviso that in respect of economisers sold to boiler-makers and engineers the commissio should be 2½ per cent., and that no commission should be payab on orders received for economisers from boiler and steam-engi insurance companies in the area, unless the economisers were be installed in the area.

Plaintiff stated that he was handicapped in the beginning the lack of printed matter, and the delay in producing an econ miser which could be pointed to as a sample, and he did not g fairly to work until December.

In answer to Mr. Clavell Salter, K.C., in cross-examination, admitted that defendants wrote complaining that they could not g answers to their letters or detailed accounts of the firms on who he called. He had promised, he explained, to report when the was anything to report. He received in February a letter informi him that other agents made weekly reports, and if the defendant could not get detailed statements from him, they must ask him give up an agency which was both useless to himself and to the In answer to that, on March 11th he sent a Telephone Director for the West Riding, with the names of various firms marked red ink on whom he had called.

Mr. Justice Ridley: In plain English, what was the use o sending a book like that?—Plaintiff, answering a further questio by his Lordship, said he was also travelling in superheaters an trying to get orders for furnaces, but this business did not clash with his canvass for economisers. He made four or five hundre calls in the entire district. It took a year or two to build up connection for a new article like this when the district wa already well supplied with economisers, and a £200 economise would last 20 years.

The Jury stopped the hearing on the conclusion of the plaintiff' evidence, and said they were satisfied he had no case. His Lord ship accordingly entered judgment for the defendants.

Brook v. Burnard.

At the Lambeth County Court, before Judge Parry, on Monday, Messrs. E. Brook, Ltd., engineers, of Huddersfield, brought an action to recover £27 10s. from Messrs. Burnard & Co., Ltd., described as dairy engineers, of Lambeth, S.E., being the price of a 6-H.P. motor, with starter fitted with no-voltage release and pulley. Defendants did not appear, nor were they represented. Mr. Tetlow, solicitor for plaintiffs, said the motor was required for refrigerating purposes. The defendants had written a letter stating that the motor was not ordered by them, but they had not put in an appearance. Edward Hopkinson Smith, on behalf of plaintiffs, formally gave evidence of the ordering by, and delivery to, the defendants of the motor.

His Honour gave judgment for the plaintiffs for the full amount claimed, with costs.

Adnil Electric Co., Ltd.

In the Companies' Winding-up Court on Tuesday, the petition of the Acme Electrical Manufacturing Co. for a compulsory order to wind up the Adnil Electric Co., Ltd., came before Mr. Justice Astbury. Counsel stated that petitioners' debt was £58. The respondent company was insolvent and could not carry on business. All the officials were resident in Germany. A provisional liquidator had been appointed.

His Lordship made a compulsory order.

THE SALESMAN.

By E. P. BENNETT.

salesman may be considered the life-sap to any cor- as upon the results of his activities the success of all tries depend. The manufacturer can produce ntly and in abundance, but if the manufacturer is not rted by the efforts of a carefully-trained salesman for lisposal of the materials produced, at profit-bearing , the manufacturer's position is one of uncertain lation. Advertising will do much to help, but the what indefinable personal touch of the salesman is red to make for the certainty of a lasting success.

w best can the salesman be trained for his particular s? The methods adopted in the U.S.A. are very ugh and elaborate, and might appeal to many in this ry who realise the successes obtained by that country ally in the commercial world. The American manu- rers will probably select from the Universities the educated, whose appearance and bearing make them than ordinarily attractive, and starting with a course e factory, they will see that the future salesman is made acquainted with the methods of production, handling, ing and dispatch. In fact, the training means actually ing for a definite period in each of the departments ioned, and going from there to a course through the nistrative offices, and on to a special preparatory school e set methods of approach, attack, and the displaying mples, are learned. The student is finally made to go igh the performance of obtaining an interview, and rsing the firm's special mission to one of his own tors, with the intention of selling as to an actual t. The defined lines of approach, the set formula, are ed, and arguments advanced, all upon the lines of the ous instruction right up to the "good-day" and exit. l the salesman is considered efficient, the training is nued. This method must be of immense value, especi- so with works and office experience, but it can by no s ensure success of the learner's ensuing efforts, aracter and temperament finally play an important

is is perhaps more marked when the markets to be ed lie in this country. Here the buying is more often by the various heads of the firm or department, than e specialised buyer, who, trained for his work, is not adily affected by the salesman's personality and general ing, as by his clear and concise methods of introducing displaying his goods.

salesman in this country is too often selected for reasons apart from considerations of suitability for the posi- . When using the word "salesman," it is intended to ey the meaning of travelling representative rather than inside departmental man, for whose training it is ssary to proceed on quite different lines.

he really successful salesman is born and not made. The essential to success must be a real desire to cultivate rt—for an art it is—training, as in all art, being ssary to bring to perfection the latent capabilities, h, if they do exist, will quickly make their appearance, being noted, opportunities given to acquire the neces- knowledge to enable the individual to pass into his er sphere. This knowledge could well be imparted on lines adopted by the manufacturers in the States, but out the degree of rigidity which renders the future ing mechanical, with the possibility of resulting in ssant repetition of the acquired formulas, regardless of temperament, character, or station of the interviewed.

training would probably cover a period of three years, rds the end of which the learner should be given inter- s of minor importance, being brought into touch first the clients visiting the works, from then to the smaller rs in the locality, and, if possible, under the guidance experienced salesman, well up to the ways of the road, owledge of which can only be gained by experience.

rior to the commencement in earnest, the now trained man should be interviewed by his principal, and care- instructed in his new duties, the principal clearly ating the limit of the salesman's authority, the scope of his abilities, and, not least in importance, the many dangers that will be encountered by a young salesman now left to his own resources, away from the supervision of his former instructors. A word of warning from the principal at this important period will often prove the starting of a successful career, and is too often omitted by the directors of English companies, which is probably due to their reluctance to seemingly interfere in any way in the private affairs of their subordinates. It must be remembered that the "representative is the firm," and as such their conduct should not, through ignorance, be allowed in any way to reflect to the discredit of the firm.

A year's working would generally be sufficient to determine whether the salesman is specially adapted for pioneer work or district travelling, and his subsequent duties will be shaped accordingly. The future now rests with the man himself, who must cultivate adaptability, rapid perception of character, as in no two interviews will he encounter the same temperaments. The buyers' moods must be carefully noted and interest taken in his sports, or hobbies, and the best times to seek an interview recorded. The districts to be opened up should be carefully tabulated, and names and addresses of firms, departmental buyers, and times for interviews, recorded on a card-filing system, an outline of the results of each interview being entered on the cards. Readiness to impart useful information regarding your own manufactures, and a good knowledge of your competitors' materials and ruling market prices, are all valuable assets to good salesmanship, and tend to secure the goodwill of the buyer, and will, with polite perseverance, be sure to secure accounts of value, and a repetition of orders.

Having procured a good connection the salesman should be carefully watched by means of the daily reports issued to the head office, and a weekly inspection of the card file, against the possibility of "resting," or the tendency of the salesman to become too set with one particular clique to the avoidance of the more difficult and less congenial interviews, remembering, while your good friends will look after your interests, you have to look after the interests of the others to maintain even a possible chance of "getting in" and securing orders. Should the tendency to rest become marked, and a friendly warning from the directors go unheeded, a change of locality to be worked, or a short period put in at the factory or office, will often bring the salesman up to his original enthusiasm. When possible, an encouraging word from the directors should be given, as to-day the work of a salesman is especially hard, and the results of a week's rebuffs are bound to reflect in the working of the man. This depression can often be cleared away by a few well-chosen words from the "chief."

Where firms employ more than one salesman, opportunities should be given for intercourse between them at least every quarter; the idea adopted by some firms of calling a meeting with the directors and departmental managers in attendance, is a good one. The ideas collected are useful, both for the salesmen and for those on the manufacturing side.

Remuneration of the salesman is not being dealt with here. It depends too much upon the class of concern to which the salesman is attached. The set salary and expenses plus a commission on the turnover above a certain figure, is probably the best of all arrangements, and calculated to meet the interests of both sides.

It will be found advisable in the early days of the salesman for the firm to name the hotels in the various localities visited, where the salesman is to make what is in effect the firm's address during the visit to the town being worked. This is not a difficult matter, and is a point of probably more importance than some concerns seem to believe by their apparent lack of interest in the matter.

If the salesman does not show up to advantage in the first year of his working, a different locality might with advantage be given to him. If in the new district no signs of success are indicated, it may be taken for granted that the man's proper vocation has been missed, and dealt with accordingly.

Unfortunately, some salesmen soon fall victims to the well-worn cry of "Price." Where there is known to be good business obtainable, and provided the quality of the firm's manufactures is right, and their service is good, this cry should be promptly stopped. It does not want a salesman to dispose of the cheapest materials. The price cry is really a disease of the salesman, and, like laziness, requires effectively dealing with.

With the goods up to market standard, backed with prompt dispatch and efficiency in the counting house, with attention given to the requests in the daily reports, success then lies with the salesman, who, working quietly and conscientiously, making the best use of his personality and persuasive powers, together with his knowledge acquired through his special training, will make for the success of his own career, and secure dividends for his firm.

The influence of such a salesman will be felt years after the man has retired. The newcomer will get perhaps a little tired of the many kind inquiries after his predecessor, but how much these inquiries will reflect to the credit of the salesman, and their value and help in maintaining the company's turnover, only the firms who have been fortunate enough to retain the services of such a salesman really know.

BUSINESS NOTES.

Consular Notes.—CHINA.—Consul-General Sir E. H. Fraser, in his report on the trade of Shanghai for 1914, refers to the period as one of depression, showing a decrease of 5,000,000 taels in imports and one of 30,000,000 taels in exports as compared with 1913. The initial causes of the restriction of trade were local and direct—a prolonged drought impeded transport on the inland waterways, the terrorising march of the brigand White Wolf, and the seige of Tsingtau and the military operations in Shangtung, which affected the railways and coasting lines from the North, for which Shanghai is a terminus. The indirect causes were even more important than those arising from the local unrest. The European war was the principal factor in disturbing the commercial life of the port. The Consul refers to the effect of war conditions in their bearing on these remote markets of China.

The heavy fall in exports can be traced to the difficulty of financing cargoes at the moment when the China staples were ready for shipment ; the complete removal of German shipping from the China seas and the reduction of British tonnage—owing to the deflection of many vessels to the service of the State—resulted in an ultimate increase of rates by 115 per cent. on seeds and 40 per cent. on general cargo as compared with the quotations in February, 1914. A drop in exchange followed as a natural sequence of war conditions, the rates for telegraphic transfer falling from 2s. 7⅝d. per tael in May to 2s. 1⅞d. in November, thus handicapping the importer of foreign goods, whilst exporters were unable to take advantage of the situation owing to lack of tonnage and lack of demand. In view of the fact that the Shanghai market is so closely linked with the markets in Europe it is only surprising, when reviewing the trade of the year as a whole, that the situation was not more disastrous. One is forced once more to the conclusion that there is great resilience in the China market, and that it is able to weather heavy storms.

The Shanghai merchants have encountered many adverse circumstances during the past few years. The revolution of 1911-12, the collapse of the rubber boom, the failure of the native banks, the second revolution and considerable over-trading in 1913, have all tended to shake the stability of the market and, when news was received of the outbreak of war, the gravest apprehensions were felt as to the effect on the trade of the port.

These apprehensions were to some extent justified. Merchants have suffered, and China has borne some share of the common war burden. At the same time the lull has proved beneficial in many ways ; it has prevented the over-trading to which this market is somewhat prone ; it has resulted in the melting down of considerable quantities of superfluous coins, and has thus improved the currency situation ; the business of the native banks has been conducted on sane and cautious lines ; and the foreign banks have had ample funds at their disposal and have encouraged all legitimate business. The close of the year indeed showed a sounder tone in the market than has been experienced for several years and, if only Shanghai is willing to work slowly and steadily through the war period, there is every prospect of great commercial development in the near future.

The conservative methods of British merchants have shown considerable modification in the last few years under pressure of severe competition from their commercial rivals. Closer co-operation, a fuller knowledge of conditions in the interior and a more thorough appreciation of the needs of the Chinese market are already producing good results, and the conditions of the trade conducted from this centre demonstrate that the British merchant is inclined to do better business when stimulated by the pressure of adverse circumstances.

British firms in the United Kingdom, or in other parts of the British Empire, who are desirous of obtaining information in regard to this market, or of finding openings here, are recommended to apply either to this Consulate-General direct or to the Director, Commercial Intelligence Branch, Board of Trade, London. Questions as to trade conditions and openings in specific lines should clearly defined ; it is impossible to deal satisfactorily with reque for general information.

Reference is made to the important part which is being pla by local industries. During 1914 almost all the mills added c siderably to their spindles, additions were made to existing pl and machinery, and new mills were erected. "There is no do that the Chinese are improving their methods of management, a the Japanese are taking a very active part in this industry Shanghai."

Iron and steel bars, plates, angles, &c. In the early part 1914 very low quotations were being made for this class material, mostly by Continental works, and large contracts w booked for shipment up to and including January, 1915. Ord for Shanghai storekeepers alone amount to, roughly, 5,000 tons quantity far in excess of normal demand.

In referring to iron and steel, it is stated that the latter end 1914 found the market decidedly short of supplies, and Shang prices reached a very high point, bringing handsome profits those who held stocks. New contracts made since August h mostly been for American material, the prices quoted by works the United States being far below British quotations. This course is only natural in view of war conditions in the Unit Kingdom, and there seems no prospect of British works being a to compete until some time after hostilities are at an end. would be an advantage if some British works would place stoc in the hands of reliable representatives—especially in the ca of mild steel bars for reinforced concrete work, for which there a constant and growing demand.

"The importation of machinery and the installation of elect lighting apparatus in China is worthy of the closest study British firms who are interested in the machinery market. Chi shows a vigorous and increasing demand for electricity in all branches. The Shanghai Municipal Electricity Works suppli over 40,000,000 units during 1914, as compared with 21,000,0 units in the previous year ; 1,500 radiators have been installed Chinese houses, and small motors are very popular. The instal tion of plant in the interior requires special measures and cann be attempted without efficient local representation. The busin was largely in the hands of German firms, mainly because th were willing to undertake entire contracts and to finance the British firms, however, have realised the possibilities of the mark and those who have been sufficiently enterprising to meet t local conditions are being amply repaid for their trouble, whil their work has given the greatest possible satisfaction to t Chinese companies on whose behalf the contracts have been und taken. British installations have recently been completed for t great cities of Soochow, Changchow and Yangchow in the pr province of Kiangsu, and for Ningpo in the province of Chekian whilst a very large number of smaller plants and dynamos ha been supplied for lighting small towns, missions and factories."

MADEIRA.—H.M. Consul (Captain James Boyle) in his repo for 1914 says :—"Importations direct from Germany were, course, immediately suspended, but as Dutch steamers fro Rotterdam have always called here regularly, it is likely th some German goods arrived by that route. The United States a very much alive to the opportunities now offered by the war f introducing their goods into Portugal and Madeira. Trade journa and catalogues are being freely sent to merchants and shopkeepe in Madeira, and are printed in Portuguese, very well drawn up a profusely illustrated, and are certainly well fitted to tempt pu chasers to make a trial of American goods to replace those usual imported from Germany. The present high rate of exchan handicaps the importer considerably, whilst the factories Portugal, started and built up under the protection of the ve high Customs tariff, are able to produce and sell low class goo at a lower rate than it is possible to import them from abroa British groceries and provisions will always be preferred he despite the heavy duties on them."

Electric light fittings and appliances, which have been comin from Germany mostly for the last few years, would, if offered low prices, command a ready sale.

If British manufacturers would make a study of the conditio of the market a most profitable business would arise, and busine between Madeira and the United Kingdom would increa considerably.

Motor Lorry Accident.—On Wednesday last week large motor lorry loaded with about four tons of copper met wit an accident, mounting the pavement and completely wrecking pa of the front of the premises of Messrs. E. P. Allam & Co., 107 an 109, Gray's Inn Road, London, W.C. Besides breaking the pla glass, it broke the whole of the pavement lights and damaged th basement hoist.

Dissolutions and Liquidations.—Venner's Ele trical Cooking and Heating Appliances, Ltd.—A meetin of creditors is called for Tuesday, October 26th, at 85, Londo Wall, London, E.C., to consider the question of appointing a joi liquidator.

Jones & Horsfield, boiler and pipe coverers, &c., Broomsta Works, Denton.—Messrs. E. Jones and D. Hague have dissolve partnership. Mr. Jones attends to debts and continues the busine under the same style.

For Sale.—Messrs. John Jackson & Co., of Glasgov have for disposal eight generating sets and condensing plan ranging from 800 to 125-kw., which can be seen in Londo A number of steam and water valves are to be sold by the Boroug Electrical Engineer, Tunbridge Wells. Particulars are given our advertisement pages to-day.

Catalogues and Lists.—Lamp makers have not been behindhand in assisting us all to shade our lamps in these days of lighting restrictions and air raids. The latest shade received is one which can shade one side of the lamp only, and it allows the advice "Use 'Z' lamps" to stand out neatly in letters of light, with a Union Jack and the words "British made" in a circle of light, below it. Copies can be obtained from the Z Electric Lamp Manufacturing Co., Ltd.

The Edison & Swan United Electric Light Co., Ltd, Ponders End.—Illustrated leaflet, No. L 3,117, giving a few particulars and prices of Royal Ediswan radiator lamps; also an enclosure card with particulars of house service and motor panel boards.

Messrs. Holophane, Ltd., 12, Carteret Street, S.W.—"Holophane Scientific Illumination" is the title of a handbook recently issued by Messrs. Holophane, Ltd., containing a series of reproductions of photographs of actual lighting installations carried out on the Holophane system of illumination. A preface points out the supreme importance of the proper shading of light sources, and the necessity of using scientifically-designed appliances for this purpose. The Holophane glassware, which is made in England, fulfils this requirement, and is backed up by the expert knowledge of the staff and abundant engineering data, which are at the disposal of their clients. The present handbook comes within the latter category; it is divided into sections illustrating effectively various typical classes of interiors, such as churches, municipal buildings, commercial offices, clubs, restaurants, libraries, railway stations, shops—a remarkable collection indeed, showing that the Holophane system of illumination is capable of being adapted to any class of building or style of architecture. The book is one which electrical contractors and architects will find very useful for reference purposes, as well as highly instructive.

Inquiries from Lyons for British Accessories.—H.M. Consul at Lyons says that a local agent wishes to represent a British manufacturer of electrical apparatus. Also that a dealer in electrical lighting accessories of all kinds, who cannot satisfy orders owing to shortage of local supplies, wishes to get into communication with British firms making such accessories. The names, &c., of the inquirers can be ascertained at the B. of T. Commercial Intelligence Branch in London.

Trade Fair Abandoned.—The Birmingham Trades Fair arranged for the spring of 1916 will not be held, the B. of T. being of opinion that the metal trade will be too busy with war orders for manufacturers to give it attention.—*Times.*

Trade Announcements.—The business of Messrs. T. G. Poole & Co., of 16, John Dalton Street, Manchester, has been purchased as a going concern by Mr. D. C. Bate, of 40, Brazennose Street, Manchester, and it will be continued as usual under the personal supervision of Mr. Poole, whose services have been retained. Mr. Bate's original business in connection with the supply of motors, starters, &c., will not be in any way interfered with.

Messrs. Feld Bros. & Co., Ltd., announce that their head office and new works are now at 326, Goswell Road, London, E.C.

From Monday next the offices of the Western Union Telegraph Co. will be removed from 26, Old Broad Street and Broad Street House, E.C., to its new premises at Western Union House, 22, Great Winchester Street, E.C.

Bankruptcy Proceedings.—A. F. Hawdon, electrical engineer, Gosforth.—November 6th is the last day for the receipt of proofs for dividend by the Trustee; C. Woollett, Official Receiver, 30, Mosley Street, Newcastle-on-Tyne.

Book Notice.—"The Post Office Electrical Engineers' Journal." Vol. VIII. Part 3. October, 1915. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

Roller Bearings.—The Hyatt roller-bearing department of Messrs. Broom & Wade, Ltd., has recently completed delivery to Messrs. Vickers, Ltd., for 500 3-in. diameter Hyatt roller-bearings for the line shafting in a new works which is entirely equipped with same. Other recent orders include some 50 2½-in. and 3-in. for Sir W. G. Armstrong, Whitworth & Co., of Elswick, 40 3-in. and 3¼-in. for Messrs. Dunsmuir & Jackson, of Govan, and 75 3½-in. for the North British Diesel Engine Works, of Govan.

LIGHTING AND POWER NOTES.

Aberystwyth.—Street Lighting.—The T.C. has accepted an offer from the Chiswick Electricity Supply Corporation, Ltd., to light one pilot lamp only on each post from 30 minutes after sunset to 30 minutes before sunrise, at £2 5s. per lamp per annum.

Ayr.—Annual Report.—Mr. Roland Marshall, the burgh electrical engineer, in his report, states that in spite of a reduction of 21·9 per cent. in the number of units sold for lighting purposes there was, during the past financial year, an increase of 3·6 per cent. in the total number of units sold for all purposes, due principally to the large increase of 57 per cent. in the number of units sold for power. There was a total reduction of 82,822 in the number of units sold for private and public lighting purposes, which was due to the restricted lighting. The revenue showed a decrease of £448 for the year. There was a net surplus for the year of £1,248, which had been placed to the credit of the reserve fund, which now amounts to £5,351. The amount expended on coal showed a decrease of £513, a result due to the use of very low-grade fuel, made possible by new stoking apparatus installed last year.

Barnsley.—Works Extensions.—The Electricity and Lighting Committee, with the consent of the Council, has appointed Messrs. Crawshaw & Wilkinson, the architects for the extensions to the electricity works, at a commission of 4 per cent.

Barnes.—Coal Supply.—Tenders for a six months' supply of coal having been received, the Lighting Committee consider that none of the prices quoted are sufficiently attractive to warrant its recommending the Council to enter into a contract. The engineer has been instructed to purchase supplies in the open market, to obtain a supply sufficient for four weeks for storage purposes.

Barrow.—We understand from Mr. H. R. Burnett, chief electrical engineer, that our statement last week that his Electricity Committee was recommending an increase in the price of electricity, is incorrect. Mr. Burnett adds that this question is unlikely to be considered at Barrow, as owing to the abnormal increase in output the working costs, despite a large increase in the price of coal and labour, have been largely reduced. He adds that during the quarter ended June 30th nearly 2,000,000 more units were sold than during the corresponding period of last year, and it is probable that a similar, or greater, increase will be recorded during the remaining quarter of this financial year.

Year's Working.—The report of Mr. Burnett, the borough electrical engineer, on the last financial year's working of the electricity department, shows that, owing to the great demand of local industries, the output sold reached 3,597,410 units, as compared with 2,081,317 units in the previous year, the power units representing 56 per cent. of total as against 34 per cent. in 1913-14. The maximum load reached 2,285 kw., and the load factor remained nearly stationary at about 18 per cent. Owing to the favourable load conditions and despite increased charges, the works costs fell from ·98d. to ·69d. per unit, and the total cost from 1·32d. to ·92d. per unit—a reduction of 30 per cent. Briefly, the undertaking yielded a revenue increase from £20,149 in 1914 to £26,585 in 1915; a gross profit increase from £8,689 to £12,717, and a net profit increase from £513 to £3,163—the result being £2,650 in excess of the previous year's result, and a record. During the year a 2,000-kw. 3,000 r.p.m. B.T.H. turbine set, with switchgear by the same firm, was installed, also a 30,000-lb. Stirling boiler with underfeed stokers, and other work carried out in connection with cooling towers, feed pumps, economisers, &c. Mains and sub-station extensions have also been undertaken, including the installation of three 500-kw. rotary converters. A number of street arc lamps have been replaced by 500 and 300-watt half-watt lamps. At March last 345 motors of 2,412 h.p. were connected to the supply, while the electric heating and cooking apparatus on hire totals 605, an increase of 193 apparatus in the year. The total includes 43 ovens and 321 electric irons. Mr. Burnett stated that a further phenomenally large increase in output during the current year is assured, and that owing to this and the modern plant in use, a further reduction in generating costs is anticipated.

Bidford-on-Avon.—E.L. Scheme.—A parish meeting was held last week to consider an E.L. scheme for the parish, proposed by Mr. Best, of Bradford, under which it is intended to form a local company to carry out the project, and to supply current for lighting at 6d. per unit, and for cooking or power at 3d. A resolution was passed in favour of the scheme, and requesting the Alcester R.D.C. to give the promoters reasonable encouragement in their endeavours to carry the same into effect.

Bo'ness.—Plant Extension.—The T.C. has approved of the proposals of the National Electric Construction Co. to install temporarily two 100-kw. Diesel oil engines. It is also proposed to make temporary extensions to the power house, and the cost is estimated at £7,000. The extensions are necessary by reason of a contract which has been entered into by the company with a new consumer.

Bungay.—E.L. Scheme.—Mr. C. H. Best, of Bradford, has approached the U.D.C. with reference to an E.L. scheme for the district, and is seeking the attitude of the Council towards the project. The Council has decided to obtain further information from Mr. Best.

Chesterfield.—Loan Sanction.—The T.C. has received sanction to a loan of £5,000 for additional plant at the electricity works. On account of reduced street lighting, the Electrical Energy Committee has allowed a rebate of £150 per annum on the cost.

Continental Notes.—Russia.—The Pereyaslavl T.C., in the Government of Poltava, is considering whether to construct an electric lighting system, or to buy up the existing private one; a Committee has been appointed to advise on the subject.

The Smolensk T.C. has decided to buy up the local tramway and electric systems, for which purpose 500,000 roubles have been allocated.

The Kieff Town Council has decided to give electricity free to hospitals and analogous institutions from the plant which it has just sequestrated.

It is proposed to extend the electric station of Tiflis. The capacity of the present plant is 900 h.p. The recommendation is to install two Diesel motors, each of 600 H.P., at a cost of 200,000 roubles.

At Astrachan, in view of the impossibility of obtaining carbons for street lighting, it is proposed that the Town Committee shall adopt other lamps.

SPAIN.—A feature of the electric power transmission line which is at present being established between Penarroya and La Carolina, a distance of about 90 miles, in order to connect the power station of the Compania Mengemor with the works of the Sociedad Minera y Metalurgica de Penarroya, is that the masts carrying the line are being constructed of armoured cement. The masts, which range from 36 to 50 ft. in height, are being made in accordance with the Aligerad system of the Compania Constructora de Postes de Cementos Armado, of Madrid.

Dover.—COTTAGE LIGHTING.—A report on the lighting of 12 cottages at the pier, presented to the Corporation Electricity Committee, shows that the receipts, after deducting the cost of lamps, was 4·66d. per unit, a better result than was anticipated. The engineer recommends the further development of the system. A request to reduce the cost of current supplied to the Lord Warden Hotel has been refused.

Eston.—E.L. PETITION.—The U.D.C. has received a petition from 162 ratepayers asking that steps be taken for procuring a supply of electricity from local purveyors. The Council has informed the petitioners that it is powerless to deal with the matter, and intimated that those requiring electricity for lighting and heating should communicate directly with the firms supplying it in the district.

Glasgow.—HOSPITAL LIGHTING.—Some time ago the Health Committee accepted the offer of the Clyde Valley Electrical Power Co. to supply electricity for the proposed hospital at Robroyston at the rate of 1¼d. per unit, with a guaranteed annual bill of £150 for five years, on condition that the T.C. erected a small transformer house and paid the cost, amounting to £750, of erecting the overhead wires. Subsequently the company offered in lieu to run an underground cable, subject to a guaranteed annual consumption equal to £300, with an adjustment depending on coal prices, and the latter offer was accepted.

Gravesend.—MAINS EXTENSION.—The T.C. has decided to lay an additional cable to supply Messrs. Henley, who need practically double their present amount of current. Messrs. Henley will bear the capital cost of the cable and maintain it, and the Council will allow an annual rebate of £80, the equivalent of the charge required to liquidate the capital outlay over the period of the life of the cable.

Heywood.—BULK SUPPLY.—The T.C. has been informed that it was anticipated that the work in connection with the bulk supply of electricity would be completed in a fortnight's time. After then the Council would be in a position to receive the whole of its supply from Bury.

Holywell.—LAUNDRY PLANT.—The L.G.B. has informed the B. of G. that it cannot approve of the proposal to install electric plant for the workhouse laundry, not being satisfied that the economy effected by the installation would cancel the cost within a reasonable period. The B. of G. has referred the matter back to the House Committee for further consideration, it being considered that by the installation, sufficient would be saved to cover the outlay in three years.

Ilkley.—E.L. LOANS.—Following a minute of the D.C. to the effect that it was in negotiation with the L.G.B. for sanction to a loan for extensions of cable services, the clerk to the Council has made a detailed statement on the financial position of the electricity scheme generally. The estimated cost of the undertaking, it is stated, was £18,000, and the L.G.B. had sanctioned the borrowing of that sum. The actual payments to date amounted to about £14,000, but the engineer estimated that £20,500 was required to complete the scheme. This estimate could now be regarded as fairly definite, as the scheme was nearing completion. The new minute was to secure the raising of a loan for the extra £2,500; and though the L.G.B. had intimated that loans could not be sanctioned, the Council is asking that it may be allowed to spend not more than this sum to complete the works, and that formal application for borrowing powers be deferred until the end of the war; the Board is also asked to favourably consider the matter then. The number of consumers is, so far, disappointing, though twice the number promised to take a supply of electricity. It is calculated that the town must expect a loss of £2,000 on the undertaking next year, equivalent to an 8d. rate.

Kilrea (Co. Derry).—At a meeting of the Derry County Council, a deputation of the people of Kilrea requested that the poles and electric wires used by Mr. W. B. Bolton in the electric lighting of the town be removed, and that permission be granted to Mr. Robert Peden to erect the necessary poles and wires and plant for lighting the town. It was alleged that Mr. Bolton supplied the current only when he thought fit, and that a large number of the consumers had notified that they would not take any further supply from him, so unsatisfactory were the conditions. On behalf of Mr. Bolton it was stated that he had sunk what capital he had in the plant and fittings, which had cost him £600. The whole income was £102 per annum, and it was insufficient, the townspeople not supporting him. The Council adjourned the matter pending a report by its surveyor.

Leigh.—ELECTRICAL SHOWROOM.—The Chairman and deputy-chairman of the Electrical Committee hold the view that for the present it is not desirable to open a showroom of electrical fittings, but at a meeting of the T.C. last week several members expressed disappointment that the matter had been shelved, and an amendment was carried that the matter should be referred back for further consideration.

London.—BERMONDSEY.—Regarding the recent alleged smoke nuisance at the generating station, the Electricity Committee explains that the work of substituting chain grate stokers for the three underfeed stokers is, owing to war conditions, progressing very slowly, and that immediately the stokers are installed it will be able to reduce the smoke to a minimum.

Manchester.—A letter of protest against the Barton power station scheme has been addressed to the L.G.B. by Mr. P. Percival, secretary of the Manchester Ratepayers' Association, who states that, having secured extensive borrowing powers on the strength of helping in the production of munitions, the Electricity Committee is now letting it be known that it is not intended to provide more than an empty shell, instead of a large new station, during the continuance of the war.

Newport (Mon.).—The L.G.B. has sanctioned the raising of £8,327 by the T.C. for a refuse destructor. The Committee has deferred for the present the request of the Electric Vehicle Committee that the Council should contribute an annual subscription. The borough electrical engineer has reported that, owing to the shortage of staff in the distributing department, he proposed to transfer an engineer-in-charge from the works to that department, and to fill the vacancy thus created by the appointment of another assistant.

Penang.—GEORGE TOWN ELECTRICITY DEPARTMENT.—The report of Mr. O. V. Thomas, the manager, on the 10th year of working (1914) of the municipal electrical undertaking, shows that 1,460,413 units were sold, as compared with 1,291,061 units in the previous year. The revenue amounted to $281,595.5, an increase of about 9 per cent.; the gross profit was $154,804 (17 per cent. on average capital expenditure), and out of this, interest, sinking fund, depreciation, renewals and reserve contributions amounting to $96,912, or 10 per cent. on the capital, were made. The generating station is now equipped with two Hornsby and four Babcock boilers, two 100-KW. and two 300-KW. Allen-Westinghouse and two 500-KW. Browett, Lindley-E.C.C. high-speed steam generating sets with ejector condensers, the cooling water being pumped from a settling pond supplied by gravity from a tidal river. One sub-station is equipped with a balancer-booster and Tudor battery, while the other contains a balancer set for the lighting circuits, and a motor-generator for supplying the tramways from the lighting bus-bars. The distributing network is on the three-wire system, at 460 and 230 volts. At the end of the year 1,919 consumers were connected, with an aggregate demand of 68,467 30-watt lamps, including 1,676 fans. The total costs amounted to 8·68 cents per unit sold, and the works costs to 7·24 cents. On the mains 21 faults occurred, 15 in paper-insulated vulcanised-bitumen sheathed cables, two in rubber-insulated connections in pillars, and four in paper lead-sheathed cables—the latter being due to mechanical damage and subsidence. It is interesting to note that the department has felt the effects of the war in the matter of rising prices and difficulty in obtaining materials.

Portstewart.—At the meeting of the Derry County Council, it was suggested that the petrol lamps at Portstewart Harbour shauld be replaced by electric lamps. The surveyor was directed to obtain an estimate of the cost.

Sligo.—ASYLUM LIGHTING.—Mr. A. Scott, architect, reporting to the District Asylum Committee on the lighting of the institution, stated that he had tried to get an electrical firm that would undertake the work, but had failed. Several members said the gas was unsatisfactory, and it was agreed that Mr. Scott should be asked to go further into the matter.

South Africa.—The applications for subscription to the recent loan of £75,000 for the Corporation Town Municipal electricity extensions amounted to £205,830.

Stroud (Glos.).—E.L. SCHEME. — The U.D.C. has approved of a plan of proposed works under the E.L. order, submitted by Messrs. Edwards & Armstrong, Ltd., subject to terms submitted to the firm.

Swindon.—OVERHEAD LINES.—The T.C. has applied to the B. of T. for consent to use overhead lines to the factory of Messrs. Gundry, Newcastle Street, for the transmission of current, at a pressure of 440 volts.

West Bromwich.—The T.C., owing to the demand for current for power, has decided to discontinue connecting private houses for lighting purposes. The Electricity Committee has been authorised to negotiate and enter into a contract for the supply of power in bulk, and to put down the necessary converting plant.

Worcester.—PRICE INCREASE.—In order to meet the increased cost of coal, the T.C. has decided to increase the price of current to private consumers for lighting, power and heat by 10 per cent.

Windsor.—Street Lighting.—The T.C. has decided, in agreement with the Electrical Installation Co., to suspend the existing public lighting contract from September 17th last on the following conditions:—That the company replaces existing high c.p. lamps by others of a new type, the annual charge to be reduced from £434 to £314, and the contract to run for four years on the old conditions when normal lighting conditions are resumed.

TRAMWAY and RAILWAY NOTES.

Blackpool. — Contract Tickets. — The Tramways Committee has decided to recommend that tramway passengers' contract tickets be increased from £3 to £4 per annum. According to a report prepared by Mr. C. Furness, the tramway manager, the number of contracts issued has increased from 922 in 1911 to 1,466 in 1915, and the revenue from this source from £2,516 in 1911 to £4,146 in 1915. Twenty per cent. of the passengers were contract holders, and their average fare worked out at a fraction above ½d., as against an average fare of 1½d. received from each paying passenger. The average working expenses per passenger were slightly over ¾d., and the contract system meant a loss to the department of something like £2,000. Mr. Furness suggested sectional contract tickets at £4 per annum, and combined contract tickets covering all routes, at £6 per annum. The Tramways Committee considered that sectional contracts would be somewhat complicated, and decided to recommend that the whole system should be continued, the price of contracts, however, being raised from £3 to £4 per annum. If the T.C. approves, the higher charge will come into force on November 1st.

From April 1st to October 7th the tramway receipts were £1,040 more than during the corresponding period of last year, and the decrease of £8,800 recorded at the end of July by comparison with the corresponding period of 1914 has, of course, been entirely wiped out.

Continental.—Italy.—Messrs. Aroedi Grippa e Ca., engineers, of Milan, have submitted a scheme to the Italian Ministry of Public Works for the electrification of the secondary and complementary railways of Sicily. The scheme has been drafted by the Engineer Chauffourier. The network proposed to be electrified comprises 11 secondary lines, with two branches, serving 25 cities and towns; and 7 complementary lines, with two branches, serving 28 cities and towns. The estimated present coal consumption on this network is 70,000 tons, of a value of £140,000, on which a saving of £40,000 would be effected were this network electrically worked. Owing to the extent of the network, the scheme advocates the adoption of single-phase working at 11,000 volts. The distribution is to be made from a transformer and conversion station at Nicosta, which will be supplied from the central station of the Società Elettrica della Sicilia Orientale. This supply will be distributed at 50,000 volts to 14 sub-stations, where it is to be stepped down to 11,000 volts. The distribution network will be supported on iron standards. The modest working margin £24,000) which the financial side of this large scheme shows hardly justifies its realisation, says *L'Electrotecnica*.

Dewsbury.—Tramway Accident.—A runaway tram- ar practically demolished a boot shop and a considerable portion f the Scarborough Hotel, in the Market Place, last week. Through some cause unknown, control was lost of an Earlsheaton ar coming into the Market Place down the Wakefield Road, which t that place is very steep. On previous occasions when cars have verrun the points, they have always been brought to a standstill n the setts. On this occasion the car ran down the hill at a great peed, crossed the setts and crashed into the building. The shop nder the hotel was ruined, the wall collapsing and the car being mbedded to a depth of 2 or 3 ft. The upper part of the building collapsed later in the day. Seven persons were injured, but, for- nately, all are reported to be making satisfactory progress towards recovery. The lady conductor was injured in jumping off he runaway car.

L. & S.W. Electrification.—It is announced that the irst electric section of the South-Western Railway, between Waterloo, Putney, and Wimbledon will be opened for service on Monday next. A 20-minutes' service will be given, the journey ccupying 24 minutes, as compared with 30 minutes required by he steam trains.

Leeds.—Female Labour.—The Tramways Committee as given authority to the general manager (Mr. J. B. Hamilton) o arrange for the employment of women as tramcar conductors. he step has been rendered necessary by the increasing shortage of ale labour and a resultant curtailment of services. Where pos- ble, preference will still be given to men who are ineligible for ilitary service. The women will be paid 5d. per hour, the same mount as is paid to the men on this work, and their week is xpected to be one of 60 hours, making their wage 27s. 6d. There ave been several hundred applications for the work. It is pected, also, that women will be employed as car cleaners.

London. — Female Conductors.—The Metropolitan olice authorities have now announced their willingness to issue cences to suitable women to act as conductors of omnibuses and amway cars, thus enabling the London tramways to fall into ne with the large provincial undertakings.

Manchester.—Half-Yearly Report.—The working of the Corporation tramways undertaking up to September 30th resulted in a total revenue of £480,692, compared with £467,681 and £470,754 for the corresponding periods of 1914 and 1913 respectively. The working expenses were £278,106, compared with £295,448 and £287,449 in 1914 and 1913 respectively. To the working expenses for the half-year, however, there had to be added £45,522, in respect of war service allowances to men and dependents of men serving at the Front, and, in addition, there was £78,585 for interest, sinking fund, &c., bringing the total expenditure to £402,213, compared with £372,351 and £358,778 for the same periods of 1914 and 1913. The surplus was £78,479, as against £95,330 in September, 1914, and £111,976 in September, 1913. The number of car-miles run was 9,435,921, compared with 9,972,567 and 9,769,574 in the corresponding periods of 1914 and 1913, but the revenue per car-mile was 12·023d., compared with 11·076d. in 1914. The general revenue was 12·224d., as against 11·252d. a year ago, and the expenses per car-mile were 7·073d., as against 7·109d. in the corresponding period of last year. It was stated at the meeting that of £23,500 raised for relief funds on the tramway systems of the country, Manchester had contributed £14,000.

Penang.—George Town Tramways. — During the ninth year of operation, the municipal tramways carried some 5,600,000 passengers, as against the 4,900,000 in the previous year; 504,000 car-miles were run on the system which covers 11½ single track miles. The total revenue amounted to $153,014 and the operating costs to $92,616 or 18·38 cents per car-mile.

Perth.—Mr. W. G. Snell, Corporation Tramways manager, reports that for the past four weeks 162,918 passengers were carried on the cars, giving receipts amounting to £799, an increase over the same period last year of over £100.

Rochdale.—War Wages.—Following the second refusal of the Tramways Committee to make a permanent advance of wages to tramway men in lieu of a bonus, the workmen's Trade Union has asked that the matter should be referred to the B. of T. for arbitration. The Tramways Committee has asked representatives of the Union to meet it this week on the matter.

South Lancs.—Collision.—Two cars on the South Lancashire Co.'s tramway system, between Walkden and Little Hulton came into collision on Monday morning. The cars were travelling on a single line and a dense fog prevailed. Both drivers escaped injury, as did also the few passengers who were on the cars at the time.

TELEGRAPH and TELEPHONE NOTES.

Revision of Tariffs.—In the House of Commons last week, the Postmaster-General stated that the increase in the charge for ordinary 12-word telegrams from 6d. to 9d. had been accepted by the country without protest. Short-distance telegrams, which were remunerative, had been largely replaced by telephone messages, whilst long-distance telegrams, which did not pay, had increased in number. Nevertheless, the cost of telegrams on the average was slightly under 8d. each, compared with 8d. in 1885. The total loss on the telegraph service was £1,200,000 a year. The Press had objected to the proposed increases in the rate for Press telegrams, and these had been revised, and would not come into force until the end of next year. The present cost of Press telegrams by day was 1s. per 75 words for the first copy and 2d. for each additional copy, and as nine-tenths of the telegrams were sent at the copy rate, the average receipts for Press telegrams were only 3d. per 100 words by day and 4d. by night. Sixty per cent. of the Press telegrams were sent at the day rate, and only 64 per cent. of them were published. The additional revenue expected from ordinary telegrams was £410,000, and from Press telegrams £60,000. The Post Office expected also to effect a saving of £70,000 a year owing to the reduced traffic, and hoped to increase the saving to £200,000. Eventually, the improvement in revenue and reduced expenditure should amount to about £740,000. In future the Press rate will be 1s. per 60 words by day and 80 words by night, and 3d. per additional copy.

Cable Repair.—The submarine cable which connects Mull, Coll, and Tiree with the mainland, and which was interrupted on August 23rd, has been repaired, and communication now goes on by the usual channels. During the six weeks of interruption the wireless stations on the West Coast maintained communication.

Australia.—It has been decided by the Federal Government to transfer the wireless branch of the Postmaster-General's Department to the control of the Minister of the Navy.

Wireless Telephony.—We understand that the successful experiments which resulted in telephonic communication without wires between Arlington and San Francisco were carried out jointly by the American Telephone and Telegraph Co. and the Western Electric Co., in co-operation with radio stations under the urisdiction of the U.S.A. Navy Department.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—December 7th. P.M.G.'s Department (various States). Non-encrusting zincs, carbon and manganese powder, manganese chloride, chloride of ammonia, porous pots (2 in.), outer jars for cells, carbon blocks, resistance boxes of 5,000 ohms, &c. See "Official Notices" October 15th.

SYDNEY.—December 6th. Municipal Council. 33,000-volt outdoor transformers and switchgear. Specifications (10s. 6d.) from Electric Light Department, Town Hall.

December 20th. Metropolitan Board of Water Supply and Sewerage. Centrifugal pumps and electric motors at the Marrickville low-level pumping station.

November 4th.—P.M.G. 58 miles lead-covered cable (11 items).

January 12th, 1916. N.S.W. Railway and Tramway Department. Two water-tube boilers, &c., for the Zara Street power house, Newcastle. See issue of October 8th for further particulars.

January 31st, 1916. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

MELBOURNE.—December 14th. Deputy P.M.G. Eleven sections of a lamp-signalling trunk-line switchboard, and other material necessary for increasing the equipment of Melbourne trunk exchange from 108 to 240 lines. Schedule 1,207.*

December 14th. P.M.G. For delivery in all States, 18,670 common-battery wall pattern telephones, manufactured in Australia. Sched. No. 1,264.

January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

PERTH.—December 8th. 294 accumulators, and power board complete, for P.M G.'s Dept. See "Official Notices" October 8th.

Bradford.—November 13th. Corporation, Twelve months' supply of lamp fittings, insulating material and tramway stores for the Tramways Committee. Specifications from the Tramway Offices, 7, Hall Ings.

Cape Town.—November 5th. Corporation. One 4,000-K.V.A. (or alternatively smaller or larger, according to whichever can be delivered earliest) steam-turbine-driven alternator; also one 1,000-KW. converting plant. Specifications, &c., from Messrs. Davis & Soper, 54, St. Mary Axe, E C.*

Dublin.—October 25th. Corporation. Alterations and additions to electric lighting of public baths and wash-houses, Tara Street. Specifications from the City Electrical Engineer, Fleet St.

November 4th. Great Northern Railway Co. (Ireland). Twelve months' supply of stores, including a number of electrical items. See "Official Notices" October 15th.

Glasgow.—The chief electrical engineer has been authorised by the T.C. Electricity Committee to order transformers and switchgear to put down in munition works, at an estimated cost of £1,777.

Grimsby.—November 4th. Corporation. House service boxes (lead), and fittings; house fuse boxes and fittings. See "Official Notices" to-day.

Lanark.—November 1st. The District Committee of the Middle Ward of the County of Lanark invites tenders for executing the electric lighting works at Hairmyres Colony, East Kilbride. Schedules from the consulting engineer, Mr. William Arnot, 163, Hope Street, Glasgow.

London.—November 3rd. L.C.C. Installation of 193 wiring points, 240 lights, at Thornfield Road Elementary School, Coverdale Road, Hammersmith, W. See "Official Notices" to-day.

HAMMERSMITH.—October 26th. Borough Council. Supply of 150 tons per week of through and through free-burning Welsh steam coal for the hand-fired boilers at the electricity station. Mr. G. G. Bell, Borough Electrical Engineer, Electricity Works.

Manchester.—October 27th. (*a*) Coal conveying plant, new coal hopper, &c.; (*b*) water cooler; (*c*) two electrically-driven circulating water pumps; (*d*) turbine-driven boiler feed pump for the Electricity Department. Specifications, &c. (£1 1s.), from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

New Zealand.—DUNEDIN.—November 3rd. City Council. Insulated and bare copper wire for a period of two years.*

November 3rd. City Council. One 3,000-volt regulator.*

Spain.—November 15th. The municipal authorities of Noblejas (Province of Toledo) are inviting tenders for the concession for the electric lighting of the town during a period of five years.

York.—October 28th. N.E. Railway. Six or twelve months' supply of telegraphic apparatus, wire, and line stores. See "Official Notices" October 15th.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Cape Town.—For the supply of low-tension feeder cable, joint boxes and disconnecting pillars for the Corporation electric lighting department, six tenders were received. The three lowest are as follows:—

Siemens, Ltd.—Cable, £4,324; straight through boxes, £36; end boxes, £39; total £4,399.
S.A. General Electric Co.—Cable, £4,674; straight through boxes, £74; end boxes, £62; total £4,810.
Telegraph Manufacturing Co.—Cable, £4,780; straight through boxes, £58; end boxes, £40; total £4,878.

In order to make Messrs. Siemens's tender comparable with the other tenders received, it was necessary to add a figure to allow for the rise in both copper and lead, and also a figure for increased freight and insurance. These figures brought the total tender to £4,667, which was finally accepted. With regard to two disconnecting pillars, the only tender received was that of Messrs. Siemens, Ltd, for £172, and that also was accepted.

Colchester.—The T.C. has accepted the tender of Messrs. Mellonie & Goulder, Ltd., for 250 tons of Cresswell screened nut coal for the electricity works, at £1 4s. 6d. per ton.

Glasgow.—The Tramways Works and Stores Committee has recommended acceptance of the following:—

Special trackwork.—Edgar Allen & Co., Ltd.
Switchboard for head office.—Mavor & Coulson, Ltd.
Electric heaters for Govan depôt.—Archd. Watson & Co.; Crompton and Co., Ltd.
Woodworking machine irons.—C. D. Monninger, Ltd.

Government Contracts.—List of new contracts for September, 1915:—

War Office.

Distribution boards.—Cable Accessories Co., Ltd.; Cranmer & Cheshire; Dorman & Smith; E.M.F. (1914), Ltd.; Forward Electric Co., Ltd.; Galsworthy, Ltd.; General Electric Co., Ltd.; D. Hulett & Co., Ltd.; Ingram & Kemp, Ltd.; Kartret Engineering Co.; Rainsford & Lynes; Sun Electrical Co., Ltd.; W. Whitehouse & Co, Ltd.
Electric cables and wire.—B.I. & Helsby Cables, Ltd; Craigpark Electric Cable Co., Ltd.; J. Frankenburg & Sons, Ltd.; A. Green, Ltd.; I.-R., G.-P. & Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Liverpool Electric Cable Co., Ltd.; St. Helens Cable & Rubber Co., Ltd.; Saxonia Electrical Wire Co., Ltd.; H. W. Smith & Co., Ltd; Ward and Goldstone; Yorkshire Cable Co., Ltd.
Electric cells and parts.—J. C. Fuller & Sons, Ltd.; Siemens Bros. and Co., Ltd.
Electric lamps.—Bulpitt & Sons, Ltd.; Edison & Swan U.E.L. Co., Ltd.; E. Griffith & Sons, Ltd.; A. Lyon & Wrench, Ltd.
Lamps and lanterns.—C. Collins, Ltd.; General Electric Co., Ltd.; J. Hicks & Sons, Ltd.; Jones & Foster, Ltd.; Kitson Empire Lighting Co.; Lyon & Wrench, Ltd.; G. Polkey, Ltd.; Pope's Electric Lamp Co., Ltd.; Rippingill's Albion Lamp Co., Ltd.; Sherwoods, Ltd.
Electric lighting.—H.M. Gun Wharf, Devonport: W. G. Heath & Co.

India Office.

Cells.—Chloride Electrical Storage Co.
Core.—Siemens Bros. & Co., Ltd.
Insulator cups.—Bullers, Ltd.
Switchboard.—Peel-Conner Telephone Works, Ltd.
Wire.—Shropshire Iron Co., Ltd.
Wireless telegraph apparatus.—Marconi's Wireless Telegraph Co.

H.M. Office of Works.

Incandescent electric lamp supply to August 31st, 1916.—British Thomson-Houston Co., Ltd.; Dick, Kerr & Co., Ltd.; Pope's Electric Lamp Co., Ltd.; The "Z" Electric Lamp Mfg. Co., Ltd.; Foster Engineering Co., Ltd.

Post Office.

Protective apparatus.—Walters Electrical Mfg Co., Ltd.
Telephone apparatus.—British L. M. Ericsson Mfg. Co, Ltd.; Peel-Conner Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Submarine cable.—Eastern Telegraph Co., Ltd.; I.-R., G.-P. & Telegraph Works Co., Ltd.; Telegraph Construction & Maintenance Co., Ltd.; Union Cable Co.
Battery cells.—Siemens Bros. & Co., Ltd.
Chloride of ammonia.—Brunner, Mond & Co.
Telephone cords.—London Electric Wire Co. & Smiths, Ltd.; Phoenix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.
Metallic filament.—British Thomson-Houston Co., Ltd.; Edison & Swan U.E.L. Co., Ltd.; General Electric Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.
Telephone lamps.—General Electric Co., Ltd.
Bronze wire.—F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).

Holmfirth.—The District Council has accepted the tender of Messrs. Roy & Co. for the supply of a cooling tower and a water tank at the new electricity works

London.—METROPOLITAN WATER BOARD.—The following tenders have been accepted:—

Edison & Swan United E.L. Co., Ltd.—Fuseboards in cast-iron cases, £82.
Callender's Cable & Construction Co., Ltd.—Coils, 110 yds., taped and braided, V.I.R., 600 megohm grade, £116.
Sterling Telephone and Electric Co., Ltd.—Special stethoscope receiver cases, £88.

L.C.C.—The Council has received the following tenders for the supply of an electric lighting main in connection with the lighting of refuges on the Victoria Embankment:—

W. T. Henley's Telegraph Works Co., Ltd.	(accepted)	£114
Callender's Cable & Construction Co., Ltd.		116
B I. & Helsby Cables, Ltd.		117
W. T. Glover & Co., Ltd.		118

The following tenders have been received by the London Education Committee for installing electric light at the Winchester Street School, Finsbury:—

Napier, Kimber, Ltd.		£110
" " (alternative)	(accepted)	104
Alpha Manufacturing Co.		146
Automobile & Electrical Equipment Co.		162
A. Hawkins & Sons		165
Tredegars, Ltd.		172
Titan Lift Co, Ltd.		181
G. Weston & Sons, Ltd.		232
T. W. Vaughan & Co. (1914), Ltd.		242

The Education Committee has received claims from Messrs. Defries & Goldman, Ltd., for additional allowances on their contracts for installing electric light at four schools, owing to the increase in the price of materials between the time of the acceptance of their tenders and the commencement of the work. During the Committee's recent recess the chairman, as a matter of urgency, approved conditionally the undermentioned allowances:—Woolmore Street, Poplar, 20 per cent.; Star Lane, Fulham, 10 per cent.; Senior Street, Paddington, 10 per cent.; The "Victoria," Hammersmith, 10 per cent.

The Committee, in February, 1914, accepted the tenders of Messrs. A. Hawkins & Sons, amounting to £369, and the Alpha Manufacturing Co., amounting to £463, for installing electric light in the Ranelagh Road, St. George, Hanover Square, and Vernon Square, Finsbury, schools, respectively. Messrs. Hawkins & Sons now submit a claim for £13 10s. in respect of the increased cost of materials consequent on the war. The Committee considers the claim reasonable, as, owing to the strike in the building trade, it was not possible to give the order to commence until the following September. The Alpha Manufacturing Co. have also submitted a claim for delay under similar circumstances, and have agreed to accept the sum of £12 10s. in settlement.

Malvern.—The U.D.C. has accepted the tender of the South Wales and Cannock Chase Coal and Coke Co., for the supply of boiler slack to the electricity works for a year.

Margate.—The T.C. has accepted the tender of the Rapid Magnetting Machine Co., Ltd., at £135, for a magnetic separator for the dust destructor, comprising one electro-magnetic separator, one 10-amp. dynamo, a 1 H.P. motor and starter, and a switchboard, including fixing.

Muizenberg (Cape Province).—The following tenders were received for electric lighting and bells at a new boarding house:—

		Light.	Bells.
Clyde Engineering Works	(accepted)	£229	£52
Edward A. Shaw & Co.		246	51
Cunningham & Gearing		265	72
Koch & Dixie		284	65
R. G. Jack & Son		333	62

Newport (Mon.)—The Corporation Electricity Committee has received the following tenders for the supply of converting plant:—

		KW. capacity.	
British Thomson-Houston Co., Ltd.		250	£1,128
Alternative	(accepted)	264	1,173
British Electric Transformer Co., Ltd.		330 K.V.A.	297
General Electric Co., Ltd.		300	1,081
Alternative		500	1,616
Bruce Peebles		350	1,390
British Westinghouse Co.		300	1,309
Siemens Bros. Dynamo Works		275 300	1,255
Blackburn Corporation (second-hand plant)		250	670

The Electricity Committee has resolved to accept the alternative tender of the British Thomson-Houston Co., Ltd., together with an extra-high-tension 6,000-v. feeder panel, subject to the price being satisfactory.

The Electricity Committee has approved the action of the engineer in obtaining 100 to 120 tons of coal from Messrs. James and Emanuel at 13s. 6d. per ton, and has resolved (1) to accept the "spot" lot offered by the firm at 13s., and (2) to contract for the following coal for delivery up to August next:—

James & Emanuel.—3,500 tons of Tirpentwys, 13s. 3d. per ton.
Crumlin Valley Collieries, Ltd.—1,000 tons of Haffodyrynys, 13s. 3d. per ton.
Partridge, Jones & Co., Ltd.—2,500 tons of Mynydd Black Vein, 13s. 6d. per ton.
Bedwas Navigation Collieries Co., Ltd.—2,500 tons of Bedwas small, 15s. 4d. per ton.

It is also proposed to purchase 150 tons of Messrs. John Vipond and Co.'s "washed" small coal, at 16s. per ton, in order that the engineer may be in a position to report as to the properties of such coal.

Ramsbottom.—The U.D.C. has accepted the tender of Messrs. J. Wolstenholme & Son for a motor and pump for lifting sludge at the sewage disposal works, for £241.

Stratford-on-Avon.—The Joint Hospitals Committee has accepted the tender of Messrs. Booth & Bomford, Ltd., for the installation of internal telephones at the hospital. at £18.

Sunderland.—The T.C. has accepted the following tenders on behalf of the Electricity and Lighting Committee:

Ferranti, Ltd.—1,500-KW. E.H.T. cubicle.
Dearborn Chemical Co., Chicago.—900 lb. Dearborn Water Treatment.
Brunner, Mond & Co., Ltd.—Alkali.

Tynemouth.—The Electricity Committee has accepted the tender of the Cowpen Coal Co., Ltd., for coal.

West Bromwich.—The T.C. has accepted the tender of Messrs. R. H. Longbotham & Co., of Wakefield, for a second-hand turbo-alternator and generating plant; and that of Messrs. Field and Bradley for 3,000 tons of slack coal for the electricity works.

Worcester.—The Electricity Committee of the T.C. has accepted the following fuel contracts:—

Underwood & Co., Ltd.—1400 tons Birch Coppice best screened beans or d.s. nuts, 19s. 11d. per ton.
South Wales and Cannock Chase Coal Co.—1,920 tons of Highley seconds bright slack, 14s. 6d. per ton.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, October 22nd. At 8 p.m. At 39, Victoria Street. Paper on "Safety Precautions for Transmission Machinery," by Mr. W. V. H. Capps.

Oct. 29th. At 8 p.m. Paper on "Electric Clocks," by Mr. W. B. Prince.

Physical Society of London.—Friday, October 22nd. At 5 p.m. At Imperial College of Science, S.W. Papers.

Manchester Association of Engineers.—Saturday, October 23rd. At Grand Hotel, Aytoun Street. Paper on "Notes on Some Recent Researches," by Prof. J. E. Petavel.

Institution of Electrical Engineers (Western Local Section).—Monday, October 25th. At 5.30 p.m. At Merchant Venturers' Technical College, University of Bristol. Address by the Chairman, Mr. D. E. Roberts.

(Birmingham Local Section).—Wednesday, October 27th. At 7 p.m. At the University, Edmund Street. Chairman's address, by Col. J. F. Lister.

Post Office Telephone and Telegraph Society.—Monday, October 25th. At 6 30 p.m. At the I.E.E., Victoria Embankment, W.C. Presidential address by the Postmaster-General, followed by an address on "Telephones, Provincial Organisation and Development," by Mr. R. A. Dalzell.

Institution of Mechanical Engineers.—Friday, October 29th. At 8 p.m. At Institution of Civil Engineers, Great George Street, S.W. "Thomas Hawksley" lecture on "The World's Sources of Fuel and Motive Power," by Dr. D. Clerk, F.R.S.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, October 29th. At 7.30 p.m. At Bolbec Hall, Newcastle. General Meeting.

University College (University of London).—Friday, October 29th. At 5 p.m. First of six lectures on "Electric Heating and Electric Furnaces," by Prof. J. A. Fleming, F.R.S.

Association of Mining Electrical Engineers (Lancs., Cheshire and North Staffs. Branch).—Saturday, October 30th. At 6.30 p.m. At Grosvenor Hotel, Deansgate, Manchester. Presidential address by Mr. G. S. Corlett. Paper on "Colliery Electric Lighting," by Mr. Corlett, will be discussed.

NOTES.

Beattie v. Barton-Wright.—Judgment in this case, a report of the opening stages of which appears in our "Legal" columns to-day, was given on Wednesday, the plaintiff being awarded £48 1s. damages.

Dockyard Overtime. — DISCHARGE OF ELECTRICAL WORKERS.—The discharge of six electrical workers from Portsmouth Dockyard formed the subject of a question which was asked in the House of Commons by Mr. Chas. Duncan, M.P. He inquired of the First Lord of the Admiralty whether he was aware that the only offence brought against the men was their refusal to work overtime until 10 p.m. because sufficient notice had not been given; and that the men had been working from 7 a.m. until 9 p.m., and it was not until they were leaving work that they were informed that they had to remain until 10 p.m. Mr. Duncan also wished to know whether the First Lord was aware that one man named Henderson had not been paid a bonus to which he was entitled, the reason given being that Henderson's offence was aggravated by other offences, which had not been indicated, and of which the man himself had no knowledge; and whether the First Lord would have further inquiry made into the case, and reconsider whether the discharge of these men at a time like the present was justified by the offence committed. "My hon. friend may rest assured," replied Dr. Macnamara (Parliamentary Secretary to the Admiralty), "that it is our desire that as long notice as possible should be given to the men concerned when overtime is required, but he will realise that the exigencies of the Service make it inevitable that the notice should sometimes be short. In the present case, the 200 men concerned, who were already on overtime, were warned from 7 p.m. onwards that an extension of overtime from 9 p.m. to 10 p.m. would be required of them, the amount of notice given being all that was possible in the circumstances. No doubt some time elapsed before all the men concerned received notice. The six men referred to by my hon. friend were the only ones who failed to respond. Their cases have been very carefully considered, and I see no grounds for revising the decision arrived at."

S.A. Power Station Fire.—A fire which might have had very serious results to the Transvaal mining industry, broke out on September 9th at the Robinson Compressor Station, near Fordsburg The prompt work of the brigade prevented any very great damage being done. The firemen were at first requested by the engineer-in-charge to stand back, as some of the oil had fired in the tanks, and a switch had ignited, rendering the situation dangerous to firemen. After consultation, however, the firemen went inside with wheelbarrows loaded with sand. They descended into the basement, and shovelled the sand on the burning tanks behind the switchboard, in the hope of putting out the fire. As this did not succeed, they next set to work with water, and after an hour the trouble was over.—*Cape Times.*

Metropolitan Association of Electric Tramways Managers.—A meeting of the members of this Association was held on Friday, 15th inst., at the Municipal and County Club, Whitehall Court, S.W., when the following were present:—Messrs. Ullmann (East Ham), chairman; Schofield (Leyton), vice-chairman; Moffet (West Ham); Mackinnon (London United); Hammond (Metropolitan Electric); Mason (South Metropolitan); and Goodyer (Croydon), hon. secretary. Letters of inability to attend were received from Messrs. Fell (L.C.C.); Bruce (L.C.C.); Murray (Walthamstow); and Stokes (Bexley). Messrs. Ullmann and Schofield were re-elected chairman and vice-chairman respectively, and Mr. Goodyer was re-elected hon, secretary. Various matters of interest were discussed.

British Association Committee on Fuel Economy.—As an outcome of the recent Manchester meeting, the British Association has invited the following gentlemen to serve on a Committee to consider and report upon the question of fuel economy (utilisation of coal and smoke prevention), from a national point of view:—Prof. William A. Bone, F.R.S., of the Imperial College of Science and Technology, London (chairman); Mr. E. D. Simon, chairman of the Manchester Air Pollution Committee (secretary); Profs. P. P. Bedson (Armstrong College, Newcastle-on-Tyne); J. W. Cobb and J. B. Cohen, F.R.S. (Leeds University); H. B. Dixon, F.R.S. (Manchester University); Thomas Gray (Royal Technical College, Glasgow); H. S. Hele-Shaw, F.R.S. (London); L. T. O'Shea and W. P. Wynne, F.R.S. (Sheffield University); and Richard Threlfall, F.R.S. (Birmingham); together with Dr. G. T. Beilby, F.R.S. (Glasgow); Mr. Ernest Bury; and Dr. J. E. Stead, F.R.S. (Middlesbrough and the Cleveland District). The Committee, which is empowered to add, if necessary, to its members, has been selected so as to include representative chemists, engineers, and technologists from all the principal industrial areas.

Plant Inauguration at Stepney.—On Thursday last week, the extensive additions recently made to the Stepney Borough Council's generating station at Limehouse were inaugurated by the Mayor, Mr. H. T. A. Chidgey. Before calling on the Mayor to start up one of the new turbine sets, Ald. Kiley, chairman of the Electricity Supply Committee, commented on the extensive progress made by the undertaking during the last few years, and the low average prices charged in the borough. Councillor Prevost, on behalf of those present, thanked the Mayor for the assistance he had rendered, while Councillor Gordon, in seconding the vote of thanks, paid a tribute to the work carried out by Mr. W. C. P. Tapper, the borough electrical engineer, and his staff. The new plant, which we hope to describe in detail at a later date, consists of two 5,000-KW. Escher-Wyss impulse type turbines coupled to Brown-Boveri three-phase alternators generating at 6,600 volts and 50 periods. The sets are capable of supplying 25 per cent. overload for two hours, and 50 per cent. for half an hour; the speed is 1,500 R.P.M., and the full-load steam consumption about 13·3 lb. per KW.-hour. The surface condensers, also by Messrs. Escher-Wyss, have steam-turbine-driven auxiliaries, and a Heenan & Froude rotary cooler is installed for cooling the circulating air to each alternator. Between the alternators a 1,000-KW. Peebles motor converter is installed. The switchgear for the new plant is of the Reyrolle ironclad type, and, in addition, Brown-Boveri automatic field regulators and electrical governor control are provided. In the boiler house four new Howden 33,000-lb. boilers have been installed, fitted with underfeed stokers of the moving grate type, worked in conjunction with hot-air economisers, forced draught and Prat induced-draught chimneys. The coal-handling plant has also been extended by the addition of a new telpher of Messrs. Strachan & Henshaw's make, and an electric jib crane, while other extensions include new feeders and sub-station plant. Considerable building extensions were necessary to accommodate the new machinery, which, in view of the bulk supplies to be given to the Shoreditch and Bethnal Green areas, the rapid growth of the demand in Stepney, and the reciprocal supply arrangement with the Poplar Council, will probably only meet expected requirements. The cost of the extension scheme is understood to have been about £140,000.

Charge of Stealing Electricity.—Before the Guisborough Bench on 18th inst., T. W. Barker, carrying on business as Hallimond & Co., ironmongers, Saltburn, was fined ten guineas, including costs, on a charge of stealing electricity. Mr. P. H. Monks prosecuted on behalf of the Cleveland Trust, Ltd. According to the report in the *North-Eastern Daily Gazette*, it was stated that for three months prior to July 1st defendant had had a contract with the company to supply at a fixed charge, plus 1d. per unit. For some reason or other the defendant was not satisfied with the contract, and terminated it in favour of one to pay 6d. per unit. When the company's collector visited defendant's premises it was found that only 30 units had been consumed during the last quarter, whereas, in the corresponding quarter of last year, 195 units had been used. On asking how this had come about the collector received the reply that he was very sorry, and offered to pay for the electricity. The amount of electricity consumed, and not accounted for, was valued at £8 2s. 6d. The method adopted had been to remove a bolt and insert a piece of wire, described as a "sprag," which had the effect of retarding the disk which measured the current. Mr. Charles Thompson, manager, stated he paid a surprise visit, with Sergeant Brough, on October 9th, and found the meter covered with cardboard. It was found that it had been spragged. Defendant expressed sorrow, and offered to pay for the electricity consumed. When the meter was being removed Barker offered the manager £100, but the latter replied he would not take ten times that amount. Mr. A. E. Forbes, for the defendant, stated that his client had been an "inglorious fool." Defendant had had some differences with the company, and foolishly thought to "get his own back."

The "Ward Special" Electric Vehicle.—We are informed by the Kriéger Electric Carriage Syndicate, Ltd., of 48A, Gillingham Street, S.W., that a "Ward Special" electric can now be inspected on their premises. The "Ward Special" was illustrated and described, and performance data were given, in an article on "A Low-priced Electric Vehicle," which appeared in our issue of July 16th last.

Institution and Lecture Notes.—Rontgen Society.—This Society is not making any changes in its meeting arrangements for the coming Session. The gatherings are held on the first Tuesday in each month until June next, at the Institution of Electrical Engineers. Probably about 20 per cent. of the members are with the Forces or doing service in military hospitals. The Session will open with a Presidential address, on Tuesday, November 2nd. During the recess the Council has been occupied in formulating a set of rules or recommendations for the protection of X-ray operators from the dangers attending the use of X-rays, and these will be issued shortly. They will be in the form of a card for hanging upon the wall of the laboratory, &c. The October number of the *Journal* of the Society contains a photograph of the retiring President, Sir A. P. Gould, the report for last Session, a list of the officers, and a list of members. Mr. J. H. Gardiner, F.C.S., is President for 1915-16.

Institution of Electrical Engineers (Western Local Section.—This Section holds its first meeting of the Session next Monday evening, in the Merchant Venturers' Technical College, Bristol. The chairman, Mr. D. E. Roberts, will deliver an address.

(Yorkshire Local Section).—The following arrangements are included in the programme for the first half of the Session:—

November 10th.—Chairman's address and Smoking Concert.
December 8th.—Paper on "Difficulties of Design of High-Speed Generators," by Prof. A. B. Field.
January 12th, 1916.—Paper on "The Design of High-Pressure Distribution Systems," by Mr. J. R. Beard.

Mr. J. D. Bailie is the hon. secretary.

(Glasgow Local Section.)—The provisional programme for this Section is as follows:—

November 9th, Glasgow.—Chairman's Inaugural Address.
December 14th, Edinburgh.—Paper by Mr. G. Wilkinson on "Electric Heating; its Present Position and Future Development."
January 11th, 1916, Glasgow.—Paper by Prof. Magnus Maclean and Mr. D. J. M'Kellar on "Distribution and Rise of Temperature in Field Coils." (Part II)
February 8th.—Edinburgh.
March 14th.—Glasgow.
April 11th, Glasgow.—Annual general meeting.

Mr. Joseph Taylor is the hon. local secretary.

(Birmingham Local Section).—It has been decided that whilst it is impossible to hold the usual number of meetings during the coming session, the work of the Section shall be continued, and monthly meetings are to be held during the first half of the session, as follows:—

Wednesday, October 27th.—Chairman's Address, by Col. J. F. Lister.
Wednesday, November 24th.—Prof. A. B. Field, on "Difficulties of Design of High-Speed Generators."
Wednesday, December 15th.—Mr. J. D. Morgan (the Hon. Sec.), on "Notes on the Ignition of Explosive Gas Mixtures by Electric Sparks."

The meetings will commence at 7 o'clock, instead of 7.30 o'clock.

University College, London.—A series of six advanced lectures on "Electric Heating and Electric Furnaces" will be given by Prof. J. A. Fleming on Fridays, at 5 p.m., commencing to-day. The course is open to non-members of the University. Applications for tickets should be made to the Secretary, University College.

Fatality.—At Brixton, on 13th inst., an inquest was held into the death of Thomas Edward Green, aged 24, an electrical engineer, lately employed by the South London Electric Supply Corporation, Ltd., at Coldharbour Lane, Camberwell. According to the report of the matter in the *Morning Advertiser*, evidence was given by Mr. E. H. Ulman, the resident engineer, who said that on the previous Thursday morning the deceased, who was a fully competent man, went into one of the cells to dust the insulators. Shortly afterwards witness heard a peculiar noise, and, upon going to ascertain the cause, found the deceased leaning over the live conductors with his clothes on fire. Witness made everything "dead," and extricated the unfortunate man, who was at once taken to King's College Hospital, where he died the following day. Witness was of opinion that the deceased, who was standing on some steps, slipped and fell forward whilst looking to see if any dusting was required. He did not think Green had started dusting, as his feather duster and rubber gloves, found on the steps, were not burned. Before he had started the work the deceased would have pulled out the isolation switch and made the cell "dead." Deceased said, "I slipped, and do not know what I've done." If Green had pulled out the isolation switch the accident could not have happened. He fully understood the work, and was next in charge during witness's absence from the works. He was a careful man, and not at all likely to take any unnecessary risk. The isolation switch and the switch cell, where the deceased was found, were quite apart, and the deceased should have gone to the isolating switch first and pulled it out. That would have rendered the switch cell "dead," and, as he had not done this, witness did not think he intended to start dusting, but that he was simply looking into the cell. Dr. C. Baines, of King's College Hospital, stated that the deceased was severely burned about the face and upper part of the body. Death resulted from shock and syncope due to the burns. Deceased stated that he got mixed up in some electric wires. The jury returned a verdict of "Death by misadventure."

Lantern Slides for Lectures.—Messrs. Ed. Bennis and Co., Ltd., have a large number of lantern slides dealing with the development and present practice in connection with automatic stokers, coal elevators and conveyors, &c., which they will be pleased to loan to any responsible engineer for lecture purposes. Application for particulars of or the loan of the slides should be made well in advance of the lecture date to the firm at 28, Victoria Street, London, S.W.

Inquiries.—A portable self-contained electric lamp equipment for a kinematograph (2,000 c.p.) is wanted. Rotary switches with five points, for series-parallel connection, are inquired for.

Appointments Vacant.—Switchboard attendant (27s.), for Wakefield Corporation Electricity Works; electrical and mechanical engineer, for the Imperial Bacteriological Laboratory, Muktesar, India (350 to 400 rupees per month), age 25 to 35, by Director-General of Stores, India Office; junior charge engineer (£91), for York Electricity Works; superintendents are required for a works in a leading British Dominion, for a number of electrical manufacturing departments; men who are employed on Government work are not required. See our advertisement pages to-day.

Business Announcement.—Mr. S. G. Leach informs us that he has acquired from the Official Receiver the business of the Adnil Electric Co., Ltd., including premises, goodwill, fixtures, furniture, and stock-in-trade. He has formed a new company under the title of S. G. Leach & Co., Ltd., to carry on the business at the same address, Artillery Lane, E.C. He informs us that the company has no foreign interests, enemy or otherwise—direct or indirect—and that the shareholders, directors, and staff are entirely British.

Volunteer Notes.—Engineering Institutions' Volunteer Training Corps.—

Company Orders.—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week commencing October 25th, 1915:—

Drills, 6.15 to 7.15; 7.15 to 8.15 p.m.

Monday, October 25th.—Section 1, Technical; Section 3, Squad or Working Party.

Tuesday, October 26th.—Section 2, Technical; Section 4, Shooting.

Thursday, October 28th.—Section 3, Technical; Section 1, Shooting.

Friday, October 29th.—Section 4, Technical; Section 2, Squad or Working Party.

Sections for Technical Drill will fall in at the Headquarters of London Electrical Engineers (T.F.), at 46, Regency Street, S.W.

Sections for Squad, Signalling and Working Parties will fall in at the new Headquarters, Chester House, Eccleston Place, S.W.

All Members who have not yet been measured for Uniforms will attend at Headquarters, on Friday, the 29th inst., for this purpose.

E. G. Fleming,
Company Commander and Acting Adjutant.

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, October 21st, 1915:—

Week-end Parades.—Saturday.—The Battalion will parade, as strong as possible, for Battalion Manœuvres, at Hanover Gate, Regent's Park, at 2.30 p.m. Dress:—Uniform, with rifles and sidearms.

Sunday.—7 a.m., Reveille. 10 a.m., Church Parade. 10.20 a.m., Parade under Company Officers. 2.15 p.m., Battalion Parade.

Map Reading and Sketching Class.—Men detailed for this work should report themselves to Mr. Page at the Bridge over the Lake, adjoining Hanover Gate, Regent's Park, at 4.15 p.m. on Friday, the 22nd inst.

Musketry.—Saturday next, the 23rd inst. There will be shooting at both Acton and Bisley Ranges, as usual. Members proceeding to Bisley must report themselves to Sergeant Cotter, at the barrier of No. 9 Platform, Waterloo Station, at 12.45 p.m.

Tuesday next, the 26th inst. Shooting at Acton, as usual.

A. G. Joiner, *Major and Adjutant*, O.B.C.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. E. A. Gleaves, who is on the staff at Stockport Corporation electricity works, was married on October 2nd to Miss Winifred Bourne, daughter of Mr. H. Bourne, formerly manager of the Cheadle (Staffs.) Railway.

The Basingstoke T.C. has increased the salary of Mr. G. Broadhurst, electrical engineer, from £180 to £200 per annum.

Mr. A. H. Jones has been appointed charge engineer at the Dover Corporation electricity works; and Mr. F. W. Davis a pupil at the works.

The Colchester T.C. has granted permission for the following officials to join the Forces:—Switchboard attendants Chignell and Blyth (Royal Engineers), and Inspector Wright, of the tramway staff.

At the Regent's Park Generating Station of the St. Pancras Borough Council on October 20th, Mr. S. P. Cook was presented with a case of pipes and a pouch, subscribed for by his colleagues at the King's Road and Regent's Park Station and many of the men, as a token of goodwill on his departure to take up the position of a senior shift engineer at the Nechells Power Station, Birmingham. Mr. Farrell, assistant shift engineer at Regent's Park Station, has been appointed shift engineer, and Mr. Brookman, senior switchboard attendant at King's Road Station, has been appointed assistant shift engineer at Regent's Park Station.

The Barnsley T.C. has increased the salaries of the following assistants at the electricity works:—Mr. T. W. Hibbert, Mr. C. Matthews, and Mr. C. Pickering, each from £150 to £160 per annum.

General.—On 7th inst., the Liverpool staff of Simplex Conduits, Ltd., gave a farewell dinner to their manager, Mr. E. Pelham Bennett, to celebrate his new appointment and promotion to the position of manager of the London and South of England district of the above company. The opportunity was taken to express their sincere regret at his departure, and in wishing him every success in his new sphere, Mr. Smith, of the Liverpool Branch, presented Mr. Bennett with a silver cigarette case, suitably inscribed, on behalf of the staff.

The many friends of Mr. A. V. Gifkins, the well-known electrical engineer, of 68, Victoria Street, Westminster, and Bankipore, India, and late of Elstown Works, Bedford, will, we are sure, regret to hear that he was very severely injured on Wednesday night last week. He is now in hospital in London, and is making slow but satisfactory progress. Needless to say, he will welcome any letters from old friends. They can be addressed to him at the office.

Mr. H. R. Mills has resigned his position as resident electrical engineer with the Cali Hydro-Electric Light and Power Co. to take up a new appointment as constructional engineer to the Popayan Hydro-Electric Light & Power Co., Colombia, South America.

Mr. G. Wilson, assistant to the Swinton and Pendlebury Council's electrical engineer, has joined the Royal Flying Corps.

Mr. Ralph J. Jefferson, of Aughton, who has just been gazetted a second-lieutenant in the 3rd South Lancashire Regiment, has been serving in the electric light department of the Lancashire Royal Fortress Engineers since 1913.

Lieutenant J. A. Baker, formerly an assistant electrical engineer in the traction department of the British Westinghouse Co., till recently in the A.S.C. in France, is now officer commanding a heavy armoured battery at the front.

Roll of Honour.—Second-Lieut. Leonard Elmslie Schultz, 2nd Battalion Wiltshire Regiment, who was killed in action on 27th ult. near Hulluch, France, was secretary of Messrs. George Schultz & Co., Ltd., London, E.C.

Sapper F. D. Rowland, of the Royal Engineers, formerly in the telegraph department of the Bury Post Office, has been wounded in France, where he was engaged on telegraph work.

Rifleman Cephas Frail, of the 12th Rifle Brigade, formerly on the clerical staff of Messrs. Hans Renolds, Manchester, has been killed in action in France.

Captain George Crellin Cartwright, Royal Warwickshire Regiment, who was killed whilst gallantly rallying a company which had suffered the loss of nearly all its officers in "the great advance," was born in March, 1882, and graduated from the Central Technical College of the City and Guilds of London Institute. He served in the 2nd Scottish Horse in the Boer War, receiving the Queen's Medal with four clasps. Captain Cartwright went to New York after the Boer War and joined the student course at the Schenectady works of the General Electric Co. (U.S.A.). After completing the course in the shops, he took a position in the foreign department of the company. He was sent to Japan by the General Electric Co., where he remained three years, returning to New York in 1910. He then went to Rio de Janeiro to represent the General Electric Co. in Brazil for about a year. While in Rio he met the late Dr. F. S. Pearson, of the F. S. Pearson Engineering Corporation, and president of the Sao Paulo and Rio de Janeiro Electric Light and Tramway Companies. Dr. Pearson offered Captain Cartwright a position in the F. S. Pearson Engineering Corporation London office in charge of engineering and purchasing work, which was accepted. He returned to London in 1911, and from that time until the outbreak of the war was associated with the F. S. Pearson Engineering Corporation, in particular in connection with the Barcelona (Spain) Power Transmission, and the Ebro Irrigation & Power Co. At the outbreak of the war, Captain Cartwright applied for a commission, and was gazetted to a second-lieutenancy early in November, 1914. He was promoted to lieutenant in April, 1915, and to captain in July last. Shortly before his death he was attached to the staff of the 22nd Infantry Brigade as a machine-gun officer. On the morning of the attack, on September 25th, Captain Cartwright, as Brigade Machine-gun Officer, was in the front line trenches with his guns, observing the English advance. A certain regiment in front had suffered the loss of nearly all its officers, and Captain Cartwright, seeing that the men needed assistance, immediately left the security of his trenches and rallied the men, and started to lead them forward again to the attack. He was shot through the right breast and lingered only two hours. Captain Cartwright was a capable and exceedingly well-informed engineer, and his excellent qualities made him many staunch friends.

Corporal Alfred O'Brien, of the 7th Battalion Manchester Regiment, who has been killed at the Dardanelles, was formerly in the employ of Messrs. L. E. Wilson & Co., of Manchester.

Sergeant Henry James Sydenham, of the 1/4th Somerset Light Infantry, who was on the staff at the Bath Corporation electricity works, has died at Peshawur, North India, where he was on service with his regiment. He was a son of the late Councillor Sydenham, of Bath.

Private J. W. JOHNSON, of the 11th Manchester Regiment, and Private C. W. CROOK, of the 1st Lancashire Fusiliers, formerly employés at the British Westinghouse works, Trafford Park, have been killed at the Dardanelles.

MR. JOHN CARSON, Warrant Officer, Royal Naval Reserve, a Belfast man, has just had the gold medal of the Order of St. Anne of Russia conferred upon him by the Czar in recognition of services in Russia last year. Mr. Carson, who before the war was employed as a fitter in the electrical department of Messrs. Harland & Wolff, Belfast, served in the South African War with the Imperial Yeomanry, and a brother was killed in the same campaign. Another brother is serving with the fleet in the North Sea.

Private GEORGE MORGAN, of the 8th Battalion Lancashire Fusiliers, has died from wounds received at the Dardanelles. He was 20 years of age, and, prior to his enlistment in February last, was employed at the General Electric Works, Salford.

Private H. G. PRIDDLE, of the 7th Lancashire Fusiliers, is reported missing after an engagement at the Dardanelles. He was formerly employed at the British Westinghouse Co., Trafford Park.

Private ERNEST TUSON, of the 4th Battalion South Wales Borderers, was killed at the Dardanelles at the end of September. He was 31 years of age, and had for some years been a foreman in the electrical department of the L. & N.-W. Rly. Co.

Private A. ABBOTT, who has been wounded, was employed for some years at the works of the St. Helens Cable & Rubber Co., Ltd., Warrington.

Private GEORGE ROLLASON, of the 7th South Staffordshire Regiment, an electrician at Baggeridge Colliery, Penn, prior to his enlistment a year ago, has been killed in action at the Dardanelles.

Corporal WM. WARREN DAVIES, of the Royal Engineers, who has been killed in action in France, was, prior to the war, an inspector on the Ashton-under-Lyne Corporation Tramways.

Lance-Sergeant DANIEL, of the Oxon. and Bucks. Light Infantry, who has fallen in action in France, was on the staff of the British Thomson-Houston Co., Ltd., Rugby.

Corporal PERCY STENT, of the Maxim Gun Section of the Rugby Infantry Company, reported killed in action in France, was formerly with Messrs. Willans & Robinson, Ltd., Rugby. He was some time ago awarded the Distinguished Conduct Medal for bravery in capturing a German trench.

Sergeant J. GLOVER, of the Royal West Kent Regiment, who has been killed in action in France, was until the outbreak of war engaged with the British Thomson-Houston Co., Ltd., Rugby.

Lance-Corporal GEO. LATHAM, of the 9th Devonshire Regiment, who was employed at Fenton by the Potteries Electric Tramways Co., has been wounded in action, and is in hospital at Blackburn.

Lieutenant HUMPHREY SHARP, 11th Royal Fusiliers, who was on the staff of Messrs. Fraser & Chalmers, electrical engineers, of Erith, has been killed in action in France.

Corporal CYRIL ROYSTON GUYTON BASSETT, of the New Zealand Divisional Signal Company, has won the V.C. for most conspicuous bravery and devotion to duty on the Chunuk Bair ridge in the Gallipoli Peninsula on August 7th, 1915. "After the New Zealand Infantry Brigade had attacked and established itself on the ridge, Corporal Bassett, in full daylight and under a continuous and heavy fire, succeeded in laying a telephone line from the old position to the new one on Chunuk Bair. He has subsequently been brought to notice for further excellent and most gallant work connected with the repair of telephone lines by day and night under heavy fire."

Second-Lieutenant NORMAN B. ANTROBUS, of the 4th Battalion South Lancashire Regiment, who has been killed in action in Flanders, was a student in electro-metallurgy at the Manchester University.

Lance-Corporal JOHN DILLON, of the 1st Battalion King's Own Royal Lancaster Regiment, formerly employed at the Broughton Copper Works, Salford, has been wounded. Rifleman WM. JENNINGS, of the 12th Battalion Rifle Brigade, who has been killed in action in France, was also an employé at the Broughton Copper Works.

Corporal TOM BARRETT, of the Rifle Brigade, whose death in France is announced, was likewise an employé at the Broughton Copper Works.

MR. F. H. GOOCH, one of the leading members of the wholesale department of Drake & Gorham, Ltd., 1, Felix Street, Westminster Bridge Road, London, S.E., has been killed in a German trench in France. Mr. Gooch joined the Cameron Highlanders at the commencement of the war, and had been in France for several months. He came home on five days' leave in July last.

Obituary.—Col. T. E. VICKERS, C.B., who was so great a power in the development of the world-famous business of Messrs. Vickers, Ltd., and who was chairman of the company for 36 years, passed away on 19th inst. at the age of 82 years.

Will.—The "Times" states that Second-Lieut. HARRY GUSTAV BYNG, 2nd Border Regiment, formerly of the Artists' Rifles, of the General Electric Co., Ltd., who was killed at Bethune on May 18th, aged 25, third son of the late Gustav Byng, left estate of the value of £73,716, with net personalty £73,617.

NEW COMPANIES REGISTERED.

S. G. Leach and Co., Ltd. (141,855).—This company was registered on October 13th, with a capital of £20,000 in 19,500 cum. pref. shares of £1 each and 10,000 ordinary shares of 1s. each, to carry on the business of electricians, electrical, consulting, mechanical and sanitary, gas, and water engineers, ironmongers, makers of and dealers in electric tramcars, motor-cars, flying machines, aeroplanes, carriages, cycles and other vehicles, manufacturers of and dealers in dynamos, motors, telephones, bells, electroliers, arc and other lamps, electric light fittings, heating and cooking apparatus, metals, india-rubber, asbestos, and other insulating materials, and chemical and medical apparatus, etc. The subscribers (with one share each) are: G. Rowson, 44, Richmond Road, Barnsbury, N., clerk; H. M. Cordrey, 128, Drakefield Road, New Cross, S.E., clerk. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. Qualification (except directors appointed during first year, who require none), 100 shares. Remuneration (except directors in receipt of salaries), £50 each per annum. Registered office: 15-17, Artillery Lane, E.C.

Mica Lubricant Co., Ltd. (141,895).—This company was registered on October 16th, with a capital of £5,000 in £1 shares, to take over the business carried on at Candlish Street, Westoe Lane, and 63, King Street, South Shields, as the Mica Lubricant Co. Registered, to carry on the business of lubricant and packing manufacturers, manufacturers of and dealers in grease, packing and syrup, asbestos, and india-rubber goods, etc. The subscribers (with one share each) are: W. W. Wilkin, 57, Vespasian Avenue, South Shields, manager; A. P. Purvis, 4, Grange Avenue, Harton, South Shields, clerk. Private company. The number of directors is not to be less than two or more than five; the first are A. Purvis, A. P. Purvis, W. W. Wilkin (manager), L. Bird, and N. Sturrock. Qualification, 100 shares. Remuneration as fixed by the company. Registered office: 63, King Street, South Shields.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Arc Welding Co., Ltd. (108,759).—Capital, £15,000 in £10 shares. Return dated July 15th, 1915. 657 shares taken up. £10 per share called up on 457; £4,570 paid; £2,000 considered as paid on 200 shares. Mortgages and charges: Nil.

Christy Bros. and Co., Ltd. (90,039).—Capital, £12,000 in £1 shares (3,000 def.). Return dated July 20th, 1915. 7,926 ord. and 3,000 def. shares taken up. £1,826 paid; £9,100 considered as paid. Mortgages and charges: £4,600.

Exchange Telegraph Co., Ltd.—Capital, £96,430 in 8,023 "A" shares of £10 each, and 16,200 "B" shares of £1 each. Return dated August 11th, 1915. All shares taken up. £10 per share called up on 6,000 "A" and £2 per share on 2,023 "A."; £64,046 paid; £32,384 considered as paid, being £1 per share on 16,200 "B" and £8 per share on 2,023 "A." Mortgages and charges: Nil.

Electro Flex Steel Co., Ltd.—Issue, on September 28th, 1915, of £4,900 debentures, part of a series of which particulars have already been filed.

Enfield Electric Cable Manufacturing Co., Ltd.—Deed of further charge on certain hereditaments and premises dated September 30th, 1915 (supplemental to mortgage dated November 5th, 1914), to secure £11,250. Holders: Viscount Grimston, The Camp, St. Albans; C. J. Andrews, 40, West Campbell Street, Glasgow; and F. Plutte, Fontainbleau, Dacres Road, Forest Hill, S.E.

Electrical Oil Refining Co., Ltd. (43,126).—Capital, £5,000 in £1 shares. Return dated September 10th, 1915. 4,375 shares taken up. £882 paid; £3,493 considered as paid. Mortgages and charges: Nil.

Blackburn, Starling and Co., Ltd. (61,302).—Capital, £12,000 in £1 shares. Return dated August 5th, 1915. All shares taken up. £8,100 paid; £3,900 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Montevideo Telephone Co., Ltd.

THE directors, in presenting their accounts for the year ending July 31st last, state that after providing for all charges in Montevideo and London, the net profit for that period is £25,776, as against £28,525 for the previous year. This falling off in the profit is due to the diminution in the number of subscribers, owing to the depressed business conditions which prevailed during the year. The interim dividends paid on May 1st last absorbed £4,343, leaving a balance of £21,434, plus £5,303 brought forward, making an available balance of £26,737. After applying £8,000 to depreciation of the company's property and plant, and transferring £9,000 to reserve for renewals, the directors recommend the payment of final dividends of 2½ per cent. upon the preference shares and 3 per cent. upon the ordinary shares, making for the year 5 per cent. on the preference and 6 per cent. on the ordinary shares, leaving £5,394 to be carried forward.

The meeting is called for October 27th.

Barbados Electric Supply Corporation, Ltd.

THE directors report that for the year ended June 30th, 1915, the trading profit amounted to £2,231, as compared with £1,381 for the previous year, in spite of a decrease in the profit from installation work and sales of electrical apparatus and stores. The war has naturally reduced the number and size of new installations, and results have been affected by the increase in the cost of materials. £504 has been charged against trading for repairs and renewals, as compared with £483 in the previous year. This item again represents principally the cost of replacing poles, which expense is expected to continue for some time. The members of the advisory committee in Barbados have agreed to accept, as from the last date of payment, viz., December 31st, 1912, half the fees previously paid. A moiety of the fees already charged in the accounts for the 18 months from January 1st, 1913, to June 30th, 1914, has been credited, therefore, to profit and loss account as at June 30th, 1914. No fees have been paid to the directors, or to the members of the local advisory committee, since the issue of the last annual report, although, as previously, the fees for the year have been debited in the profit and loss account. The growth of the company's service is shown by the following figures:—

	Consumers connected at June 30th.	25 c.p. equiv. connected at June 30th.
1912	247	5,201
1913	456	9,430
1914	737	12,715
1915	997	15,036

In view of all the circumstances, the directors consider that excellent progress has been maintained during the past year. Capital expenditure during the year amounted to £1,103, being principally the cost of new house connections and small necessary additions to the mains. The negotiations for the supply of power to the Tramway Co. have been practically in suspense as a result of the war, but it is hoped that discussion may be resumed later.

Annual meeting: October 28th, in London.

Ferranti, Ltd.

The directors report that for the year to June 30th, 1915, the profit on trading for the year was £37,231, and, after crediting discounts, interest, and transfer fees, and deducting general establishment charges, repairs and renewals, legal expenses, income tax, bad debts, directors' and trustees' fees, there remains £16,739. The amount at credit at June 30th, 1914, was £2,050, making £18,789. From this there has been deducted interest on first mortgage debenture stock £4,438, interest on five-year notes £2,052, interest on bank loans £1,271, depreciation reserve account £10,000, leaving to be carried forward £1,028. The results for the year show a falling off as compared with the previous year, but this is due in a considerable measure to the dislocation created by the war, and the heavy falling off in export business due to the same reason, and also to adverse monetary conditions. The company have entered into a contract with the Government for a supply of shells and fuses, and as considerable outlay will be necessary in buildings and plant, arrangements have been made with the Government, under which certain advances are made by them for this purpose, and the consent of the debenture-holders and shareholders has been duly obtained. The construction work is proceeding satisfactorily, and the directors hope that deliveries will commence shortly. The works of the company were declared a controlled establishment under the Munitions of War Act, 1915, on September 6th, 1915. During the year £3,046 first mortgage debentures have been redeemed, and the loans against five-year notes and second mortgage debentures have been further reduced.

Annual meeting: October 29th, in London.

Italian Electrical Companies.

The Italian General Electricity Co. (Compagnia Generale Italiana di Elettricita), of Milan, closed the year 1914-15 with a loss of £1,400. The share capital is £60,000, and a loss is reported to have been incurred in every year since the formation of the company, four years ago.

The Mining and Electrical Co. of Valderno (Società Mineraria ed Elettrica), of Florence, which has a share capital of £320,000, realised net profits of £21,000 in 1914-15. A dividend of 4s. per £4 share has been declared.

The Brescia Electrical Co. (Società Elettrica Bresciana), of Brescia, reports net profits of £61,000 for 1914-15, as compared with £54,000 in the previous year. After placing 5 per cent. to the reserve fund the balance has permitted of the payment of a dividend of 6 per cent. for the year.

The "Dinamo" Electrical Undertakings Co. (Società Imprese Elettriche "Dinamo"), of Milan, which is associated with the Brown-Boveri group, earned net profits of £9,600 in 1914-15, as compared with £6,900 in the previous year, on a share capital of £200,000. The increase is attributed to the fact that the company's plant has now passed from the preparatory period to that of full working. It is intended to distribute 4 per cent., as contrasted with 3 per cent. in 1913-14.

The Italian Westinghouse Co., which has a paid-up capital of £160,000, reports that the year 1914-15 opened under favourable auspices, and had a fairly normal course, despite the international political situation. Orders of the value of £400,000 were brought over from 1913-14, and further contracts for £220,000 were booked during 1914-15. The deliveries amounted to £382,000, and the year closed with orders on hand for the sum of £244,000. The gross profits reached £29,000, of which £15,000 has been devoted to the extinction of losses, and the balance applied to the purpose of depreciation.

The Italian Aluminium Co. (Società per la Fabbrizione dell' Allumino ed Altri Produtti del' Elettrometallurgia), of Rome, reports that the more satisfactory results achieved in 1914 were due, in addition to the advance in the price of aluminium in the second half of the year owing to the war, to the improvements effected in manufacturing, which had increased the efficiency of the furnaces and the production; the furnaces were still in course of completion. The gross profits amounted to £16,700, of which £12,000 has been placed to the depreciation account and £4,000 to the reserve fund, leaving £7,000 to be carried forward to 1915.

The Piedmont Carbide of Calcium Co. (Società per la Fabbrizione del Carburo di Calcio e Produtti Affini), of Rome, whose works are situated in the valley of the Aosta, states that, notwithstanding the developments caused by the political situation and the floods, the balance sheet which closed on December 31st, 1914, did not present material variations from that of the preceding year. The output comprised 1,528 tons of carbide, 2,041 tons of raw calcium cyanamide, 1,753 tons of refined cyanamide, and 110 tons of silicon for aeronautical purposes, the last-mentioned being produced at the request of the Ministry for War. After making provision for depreciation, the net profits are returned at £4,900, rising to £5,000 with the balance brought forward, and a dividend of 4s. per share has been declared on share capital of £80,000.

The Galileo Ferraris Electrotechnical Construction and Installation Co. (Società Elettrotechnica Galileo Ferraris per Construzione ed Impianti) is the new title of the A.E.G.-Thomson-Houston Co., of Milan, which has an ordinary share capital of £360,000. At an extraordinary meeting of the company held at Milan, on October 12th, when the change in the title was sanctioned, the report presented by the directors stated that the company had always followed a programme of purely national activity, which was proved by the large works erected in the country. The company intended henceforth, also, to express its purely national character by assuming the name of Galileo Ferraris, through whose ingenious discovery of the rotary magnetic field the principal part of the industry had originated. At the same time, the meeting elected three Italians resident in Paris and two in Milan in substitution for five foreign directors, and the chairman undertook to convey to the family of the distinguished Italian the thanks of the shareholders for their consent to the use of his name in the title of the company.

Anglo-American Telegraph Co., Ltd.—Interim dividend for the quarter ended September 30th, 1915, of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, less income-tax at 3s. 2d. in the £, payable November 1st.

Calcutta Tramways Co., Ltd.—Interim dividend of 3 per cent., less income-tax, on the ordinary shares.

Brazilian Traction, Light and Power Co., Ltd.—A dividend of ½ per cent. on the issued ordinary capital stock is announced.

Callender's Cable and Construction Co., Ltd.—The directors announce an interim dividend at the rate of 10 per cent. per annum, less income-tax, on the ordinary shares for the half-year.

Reduction of Capital.—Holophane, Ltd.—A petition for the confirmation of the reduction of the capital from £200,000 to £105,000 is to be heard in the Chancery Court on November 2nd.

Cuban Telephone Co.—A financial daily states that a committee has been formed for the protection of the interests of the holders of preferred stock in this company.

Montreal Light, Heat and Power Co., Ltd.—The directors have declared a dividend of 2½ per cent. on the paid-up capital stock, being at the rate of 10 per cent. per annum, for the quarter to October 31st.

STOCKS AND SHARES.

Tuesday Evening.

The principal feature in the Stock Exchange markets this week is a substantial recovery in all the securities connected with Mexico. Notwithstanding the reported failure of the Peace Conference at Washington last week, it is obvious that practical negotiations are going forward for the settlement of the country, on the basis of Carranza being recognised by the United States Government. Would-be sellers of Mexican securities have cancelled their orders, and have turned round, inquiring eagerly for cheap stock. There is little or none in the market: what there was has been swept up. Prices show rises ranging from 5 to 6 points on the week, and in all departments connected with Mexico the story is the same.

Maybe the movement is going a little too rapidly in some cases. Severe financial sacrifices will be called for from holders of stocks in existing companies that will require more money to put them once more upon a sound footing. It is doubtful whether the Treasury will consent to capital being raised on this side for the purpose of sending to Mexico; but, of course, there is plenty of money in the United States, and the interests of America in Mexico have wide ramifications. At the same time, the American drives a hard bargain; and the cost of his financial support is likely to be onerous.

Nevertheless, it would be a great pity to sell Mexican securities just now, because the latest developments look more like a step in the direction of peace than any negotiations have done up to the present. And from all indications it is obvious enough that the country is exhausted and wearied with the long-continued internecine warfare. The recovery in Mexicans as a whole was started by lively bidding for railroad shares on behalf of New York, and this, it was contended, would not have been indulged in had not there been sound grounds for assuming that internal peace lay near to hand.

So far as the other markets are concerned, the firmness in the War Loan stock is a pleasant feature: pleasanter, inasmuch as politics—domestic and foreign—seem to get into a more muddled condition every day. To catalogue the various minor difficulties may be a grateful task to that section of the Press which gloats over any happening that can be distorted into a sensation or a weapon for driving wedges of disunion between parties and classes. The Stock Exchange keeps on its way with a good deal more coolness and resolution than are displayed in certain other quarters. Prices are well maintained; and the volume of business, although small, is sufficient to pay electric lighting bills in these days of compulsory darkness. Sometimes there is a little money over wherewith to buy bread, but this is not always the case.

The Home Railway market has got into such a stagnant condition that it took with complete philosophy and indifference the news that substantial additions are to be made to the war bonus awarded to various grades of the service. Some, indeed, profess relief at the finality which the arrangement strives to impose; though sceptics are not wanting who wonder how long the new arrangements will be permitted to last. Prices generally are heavy, in the absence of support; but the Undergrounds have maintained their prices with a good deal of steadiness. The London & South-Western Railway's electrified portion is understood to be nearly ready for public use, and the first section will be opened on Monday next. The "jumpy" Special Constable who sees unusual flashes in the south-western sky is quieted by the assurance that these lights are caused by the trials being run nightly with the new plant and rolling stock.

Amongst the home electricity shares, the only changes are falls of ¼ in Charing Cross ordinary and of ⅛ in London Electric preference, the last-named following a decline of similar amount a week ago. There is not much doing in this market, as may well be supposed; but a little demand still exists for some of the best kind of debenture stocks.

In the telegraph section, Anglo-American preferred has risen to 101½. The company has declared the usual quarterly dividends. The deferred put on ⅝ to 22¾, but is still standing relatively lower than the preferred stock, although between the security of the two issues there is not a great deal of difference. The preferred would appear to be fully, if not over, valued at 101½, since the dividends are paid less tax and the return on the money is scarcely 6 per cent. The deferred has still scope for improvement, and the price may be expected to go to the neighbourhood of 25. But the preferred might be sold and the proceeds invested in something with better prospect of improvement.

Eastern Extension shares and Eastern Telegraph ordinary stock have both regained their dividends. Great Northerns rose ½ to 33½. Oriental Telephone preference fell back to 17s. 6d., but the ordinary remains steady at 38s. 9d. on the declaration of an interim dividend of 4 per cent., tax free. The United River Plate Telephone Co. has declared an interim dividend of 3 per cent., also free of tax. Both kinds of Globe shares are ⅛ better. New York Telephone bonds further improved, and are now demonstrably too high, in view of the yield from the 4½ per cent. War Loan—to take only one security. In Marconis there is not much doing. Americans have been dull at 17s., but have recovered a few pence; and Canadians are neglected.

Telegraph Constructions are 10s. higher at 31½, but British Insulated ordinary have come on offer again, relapsing to 10⅜. Save for these changes, the list of manufacturing shares is steady and practically unaltered. There has been a little buying from Holland of Henleys, in consequence of the big return now offered by the shares.

Brazilian issues in general are distinctly better. Brazil Tractions have regained their little fall, hardening again to 50; while the preferred are an active market in the neighbourhood of 88. Canadian General Electrics have risen 6 points within the last two days, standing now at 116½. Most of the securities generally associated with the name of Latin-Canadian are decidedly strong.

The report of the International Lighting Association contains a reference to the decreased profits of the Para Gas Co., owing chiefly to the severe competition of the Para Electric Co. As a result of negotiations, the Electric Co. entered into an agreement to take over the gas undertaking on terms, the acceptance of which the Gas Co. directors strongly recommended to their share and debenture holders; and the transaction was duly completed four months ago. Victoria Falls Electric shares are quietly firm, with some inquiry on Cape account for the ordinary shares. Consolidated Gas, Electric Light & Power, of Baltimore, holds its recent rise.

The market for rubber shares is fortunate in getting rather more than its proportion of business, as compared with other sections of the industrial department. Raw rubber has gone back a shade, but this has made no difference to the strength of the share market. The armament group is quiet and firm. Copper issues are on the rise, a full-dress boom in Wall Street forcing up the price of copper shares, together with those of railroads and industrials, the latter including quite a number of shares in various American electrical undertakings. The robust strength of the New York market is due this time not so much to the gyrations of the exchange, but to the prosperity of the Continent at large.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Oct. 19, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	7½	—	£6 13 4
do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	3½	— ¼	7 2 10
do. do. do. 4½ Pref.	4½	3¾	—	6 0 0
do. do. City Pref.	4½	3½	—	6 8 7
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4¼	—	5 17 8
do. 4½ Deb.	4½	87	—	5 3 6
City of London	9	12¼	—	7 7 0
do. do. 6 per cent. Pref.	6	10¾	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10¼	—	6 16 7
do. do. 6 per cent. Pref.	6	10¼	—	5 17 8
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6¼	—	7 4 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4½	— ⅛	6 13 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	3½	2¼	—	7 15 7
do. 4½ per cent. Pref.	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6¾	—	7 8 2
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1$\frac{1}{16}$	—	6 14 0
Westminster Ordinary	9	6¾	—	6 13 4
do. 4½ Pref.	4½	4¼	—	5 9 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	101½	+1	5 18 6
do. Def.	1½	22¾	+ ⅝	6 11 10
Chile Telephone	8	6½	—	6 8 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11⅞xd.	+ ⅛	*6 14 9
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord.	7	119xd.	+1	*6 14 7
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	81	+1	4 19 0
Globe Tel. and T. Ord.	6	9⅞	+ ⅛	*6 19 0
do. Pref.	6	9⅞	+ ⅛	6 1 6
Gt. Northern Tel.	22	33½	+ ½	6 11 4
Indo-European	13	47	—	6 18 4
Marconi	10	1⅞	—	6 8 0
New York Tel. 4½	4½	101½	+ ½	4 8 6
Oriental Telephone Ord.	10	1$\frac{15}{16}$	—	5 8 1
do. Pref.	6	⅞	— ⅛	6 17 2
Tel. Egypt Deb.	4½	90	—	5 0 0
United R. Plate Tel.	8	5¾	—	*8 2 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1	—	10 0 0
Western Telegraph	7	12½	—	*6 18 4
do. 4 Deb.	4	80	—	5 0 0
Home Rails.				
Central London, Ord. Assented	4	69	—	5 16 0
Metropolitan	1¼	23	—	5 8 8
do. District	Nil	13	—	Nil
Underground Electric Ordinary	Nil	1⅜	—	Nil
do. do. "A"	Nil	5/6	—	Nil
do. do. Income	6	71	—	*9 11 8
Foreign Trams, &c.				
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	97	—	5 3 0
Anglo-Arg. Trams, First Pref.	5½	8½	—	7 17 2
do. 2nd Pref.	5½	8	—	9 8 4
do. 4 Deb.	4	74	—	5 8 1
do. 4½ Deb.	4½	74	+2	6 1 7
do. 5 Deb.	5	75	—	6 13 4
Brazil Tractions	3½	50	+ ½	7 0 0
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb.	4½	87	—	5 8 0
Mexico Trams	Nil	84	+1	Nil
do. 5 per cent. Bonds	—	47	+10	Nil
do. 6 per cent. Bonds	—	44	+9	Nil
Mexican Light Common	Nil	28	+5	Nil
do. Pref.	Nil	87½	+7½	Nil
do. 1st Bonds	—	46	+9	—
Manufacturing Companies.				
Babcock & Wilcox	14	2$\frac{3}{16}$	—	6 8 5
British Aluminium Ord.	5	1$\frac{1}{16}$	—	4 14 1
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	10⅜	— ¼	7 4 7
do. Pref.	6	5⅞	—	5 2 2
British Westinghouse Pref.	7½	84/-	—	8 10 8
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref.	5	4½	—	5 11 8
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	61/-	—	4 18 6
Edison & Swan, £3 pd.	Nil	10/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	57	—	7 0 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	18/-	—	9 4 8
do. do. Pref.	7	19/9	—	7 1 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	12⅜	—	*9 2 0
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	8	—	6 5 0
Telegraph Con.	20	31½	+ ½	7 12 0

* Allowance made for dividends being paid free of income-tax.

Correction.—In the advertisement of the Mansfield electricity department for a clerk, the printer credited the borough with having "over 100" consumers. That, of course, was ridiculous, the statement intended being "over 1,000." We regret the slip.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING SEPTEMBER, 1915.

The returns of electrical export and import business for the month of September show an all-round improvement on those of the previous month. Thus the electrical exports reached a total value of £374,418, as compared with £346,318 in August; the electrical imports were valued at £211,488, as against £202,490 in the previous month; and the re-exports of electrical goods advanced from £10,676 in value in August to £19,885 in September. Of the various items constituting the exports, it may be noted that cable exports more than doubled in value; machinery exports also reached a higher level, and lamp exports slightly improved, but in other directions, and notably in telegraphic and telephonic exports, the returns show decreased business. Machinery, telegraphic and telephonic, and lamp imports reached higher values during the month, only partly counter-balanced by falling off in other lines.

India, Victoria and New South Wales were our best customers, while it may be noted that Scandinavian and French purchases remain at a high level. Importation from the States fell off slightly, and Dutch lamp imports increased, reaching over £10,000 in value.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	4,062	9,765	840	2,018	2,518	1,050	8,419	214	12	104	503	7,435	36,740
German West Africa	11	...	...	...	...	...	...	...	11	...	...	73	95
Netherlands, Java and Dutch Indies ...	835	4,723	778	141	14	65	331	140	14	16	885	19	7,961
Belgian Congo	20	...	24	...	...	...	...	...	...	...	...	21	65
France	376	1,338	1,632	115	35	47	5,037	4,636	400	100	490	5,281	19,487
Portugal	54	363	357	144	...	...	53	284	120	...	953	598	2,926
Spain, Canary Isles and Spanish N. Africa...	203	231	5	17	...	488	356	192	12	...	256	416	2,176
Switzerland, Italy and Austria-Hungary ...	866	171	244	...	...	168	3,593	68	...	...	127	2,377	7,614
Greece, Roumania, Turkey and Bulgaria ...	...	28	...	...	...	...	71	...	...	...	...	77	176
Channel Isles, Gibraltar, Malta and Cyprus...	195	10	151	50	...	238	38	11	11	...	4	364	1,072
U.S.A., Philippines and Cuba	385	...	726	49	...	...	906	...	296	13	44	961	3,380
Canada and Newfoundland	7	...	577	348	...	1,137	4,196	...	612	...	29	179	7,085
British West Indies and British Guiana ...	13	10	...	106	...	...	...	...	40	...	31	828	1,028
Mexico and Central America	...	20	...	36	...	...	...	...	113	...	95	134	398
Peru and Uruguay	17	277	5	25	...	...	95	72	69	...	3	80	643
Chile	132	92	4	277	...	394	373	...	...	...	28	28	1 328
Brazil	204	590	823	364	382	415	308	619	176	36	10	878	4 805
Argentina	1,068	9,001	362	534	...	930	1,199	2,728	1,187	30	5,059	518	22,616
Colombia, Venezuela, Ecuador and Bolivia...	37	247	...	331	...	...	...	...	...	...	55	...	670
Egypt, Tunis and Morocco	260	1,418	189	77	...	51	639	471	261	425	101	433	4,325
British West Africa	7	445	88	95	...	42	154	1,754	...	42	45	17	2,689
Rhodesia, O.R.C. and Transvaal	453	6,291	1,101	3,334	...	437	586	111	376	212	182	25	13,108
Cape of Good Hope	642	3,563	853	921	...	37	1,454	35	209	29	96	52	7,891
Natal	269	3,679	705	257	...	110	14,766	32	49	9	311	172	20,359
Zanzibar, Brit. E. Africa, Mauritius & Aden	58	79	51	308	...	26	280	14	...	...	220	255	1,291
Azores, Madeira and Portuguese Africa ...	102	...	191	65	...	...	40	...	72	...	...	423	893
French African Colonies and Madagascar...	15	...	45	...	...	...	48	...	...	...	...	...	108
China and Siam	466	236	323	215	57	83	2,142	616	48	11	150	609	4,956
Japan and Korea	6	126	51	14	21	113	631	...	2,830	19	...	220	4,031
India	2,509	22.002	3,824	3,102	51	1,072	8,427	3,442	1,625	111	202	649	47,016
Ceylon	312	727	148	35	42	59	559	...	65	3	26	49	2,025
Straits Settlements, Fed. Malay States and Sarawak	366	909	332	452	...	339	1,785	207	91	7	56	24	4,568
Hong Kong	...	337	23	...	58	57	132	...	91	173	582	...	1,453
West Australia	404	851	132	77	...	428	229	...	74	...	29	43	2,267
South Australia	329	4.326	256	200	...	23	154	...	16	7	8,395	657	14,363
Victoria	438	28 391	2,868	949	...	382	14,730	100	1,108	...	788	...	49 754
New South Wales	510	9,617	1,576	2,708	133	407	11,469	7,673	1,139	33	4,615	1,322	41,202
Queensland	100	...	446	...	...	76	265	247	403	...	2 696	...	4,233
Tasmania	...	...	43	44	...	...	2,173	...	87	46	580	...	2,973
New Zealand and Fiji Islands	240	4,872	1,875	651	...	1,330	3,932	43	180	...	11,231	294	24,648
Total, £	15,971	114,735	21,618	18,059	3,311	10,004	89,570	23,709	11,797	1,420	38,677	25,511	374,418

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	39	2,210	35	146	674	460	10,390	3,630	1,941	984	9,393		29,902
Germany	...	...	...	...	...	...	...	...	...	...	...		...
Holland...	...	1,018	275	10,076	22	...	282	...	435	...	387		12,495
Belgium	...	...	...	...	...	...	...	...	...	...	45		45
France	120	2,637	360	3.349	2,230	603	109	40	4,725	3,398	89		17,650
Switzerland	1,306	10	315	280	86	419	6 859	14	200	1,635	1,181		12,305
Italy	2	4,397	6	...	...	32	2,477	...	...	130	...		7 044
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...		...
United States	8,694	7,860	2,692	1,977	5,085	176	13,841	66,167	7,954	5,274	7,659		27,379
Total, £	10,161	18,132	3,683	15,828	8,097	1,690	33,958	69,851	15,255	11,421	18,754		206,830

Additional imports.—Spain, lamp parts, £274; carbons, £2,167; Victoria, telegraph and telegphone apparatus, £83; Canada, wires and cables, £1,329; electrical goods, £605; machinery, £200.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	1,997	3,316	...	504	125	1,214	2,470	...	166	258	9,935		19,885

Total Exports: £374,418 Total Re-Exports: £19,885 Total Imports: £211,488

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

OUTPUT OF COAL AND THE USE OF ELECTRICITY IN MINES.

From latest reports of H.M. Inspectors of Mines we learn the total output of coal for the different districts of the British Isles, during 1913 and 1914, was as follows :—

District.		Year 1914. Tons.	Year 1913. Tons.
No. 1 district,	Scotland	38,847,362	42,456,516
No. 2 ,,	Northern	52,384,478	58,675,687
No. 3 ,,	York and North Midland	66,807 623	72,951.841
No. 4 ,,	Lancashire	26,200,447	28,130,845
No. 5 ,,	South Wales	53,879,728	56,830,072
No. 6 ,,	Midland and Southern	27,430,992	28 284,387
	Totals	265,550,630	287,329,348

which shows a decrease of 21,778,718 tons.

The value of the coal worked in 1913 is given as £145,210,493, and for the year 1914, £132,536,184 ; so that the loss in money due to the lessened output was £12,674,309 sterling. The loss is, of course, due to the dislocation of trade following the outbreak of war, and especially of shipping, upon which so many collieries depend. This is most noticeable in Nos. 2 and 3 districts, embracing the whole of the North of England and Yorkshire. Scotland, too, was affected in the same way, and in about the same proportion. The loss in value is equivalent to rather more than 10 per cent., and, under the circumstances, matters might have been much worse.

It is interesting to note, however, that in Ireland, which is in No. 4 division, the output increased by nearly 10,000 tons, viz., from 82,521 tons in 1913, with a value of £50,654, to 92,400 tons, the value of which is given as £54,993 ; also that 130,440 tons of coal with a value of £73,566 was produced from the Kent coalfield.

It is also interesting to note, in view of all that has been said recently in regard to the price of coal to the consumer, that the value at the pit, according to the figures given above, works out at about 10s. per ton. It must, however, not be forgotten that this is the average price, as much of the coal would be sold for less than this figure, and the better qualities would, of course, command a much higher price, and as it is the better class of coal which mostly is used in households and around the price of which most of the discussion has centred, it is rather misleading to assert, as we believe has been done by those who ought to know better, that coal costing 25s. to 30s. per ton to the customer is worth only 10s. at the pit. Then there are to be added the cost of wagon hire, carriage, wharf, and siding dues, which amount in very many cases to nearly as much as the coal is worth, and to-day good house coal at the pit costs from 20s. to 25s. per ton. The reason for the advance in the price of coal is due first to the great increase in the wages of miners, and secondly, to the increased cost of timber and general stores consumed by the collieries ; and it is most likely that the price of coal will remain high—possibly at a higher level than at present—for a long time to come, the chief reason for this being the scarcity of labour and the inordinate demand of the miners for higher wages as the price of coal increases.

The remedy for this, of course, is the introduction of coal-cutting and labour-saving machinery generally, and as wages increase the tendency will undoubtedly be to displace manual labour by machinery, as the saving effected is much more apparent when wages are high than when low, as they have been in this country when compared to wages in the United States of America, for instance, where coal-cutting machinery is used to a very much greater extent. The advantages of coal-cutting machinery in this country are rapidly becoming more and more recognised by colliery owners, and it is satisfactory to note that 169 more machines were installed during the year 1914. The total number of machines at work was 3,111, of which 1,415 were driven by electricity and 1,696 by compressed air. The following table shows the number and type of machine, together with the quantity of mineral mined by their use. It also gives the number of conveyors in use at the coal-face.

This table emphasises the superiority in numbers of the electrical machines to those driven by compressed air, in the case of the long-wall face type of machine, viz, the disk, bar and chain types. The proportion is nearly two to one, there being 1,407 of the former to 734 of the latter. As regards the percussive type of machine, this unfortunately cannot—so far—be driven satisfactorily by electrical means, but we have no doubt that even many of these machines were operated by compressed air generated by an electrically-driven air-compressors. The output of these machines is small compared to the long-wall type of machine. Of the total output of coal obtained by machines, viz.,23,976,371 tons, only 2,163,851 tons, or less than 10 per cent., was obtained by percussive machines. The coal cutter of the future is undoubtedly the electrically-driven long-wall type of machine. The percussive machine is limited in its operation, as it must be fixed in one position while at work, but the great disadvantage is the extremely high cost in consumption of air for its limited output. An electrical machine—could one be satisfactorily devised—would no doubt be operated at one-third the cost for energy.

There were 408 conveyors at work at the coal-face, and this method of dealing with the coal after being mined is slowly but surely gaining ground. The reports do not say how these were operated, whether electrically or by compressed air, but as they are in use, on long-wall faces, it may may be quite safely assumed, as most of the coal-cutters are

Coal-Cutting Machines and Conveyors.

District.	Electrically-driven machines.								Conveyors.
	Type.					Statute tons of mineral cut.			
	Disk.	Bar.	Chain.	Percussive.	Rotary heading.	Coal. Tons.	Ironstone. Tons.	Fireclay. Tons.	
1	515	216	12	2	2	7,808,984	53,532	2,964	128
2	58	33	63	2	—	1,256,433	—	—	68
3	157	87	104	—	2	3,556,410	—	—	116
4	7	19	8	—	—	355,650	—	—	27
5	3	38	3	—	—	242,747	—	—	63
6	35	20	29	—	—	770,654	161,192	—	6
Total	775	413	219	4	4	13,990,878	214,724	2,964	—
	Compressed-Air Driven Machines.								
1	119	7	—	40	—	1,313,593	16,572	—	—
2	61	15	8	451	11	2,317,879	—	—	—
3	175	60	35	99	6	3,549,722	—	27,007	—
4	117	34	5	209	—	1,733 922	—	—	—
5	1	50	7	29	—	392,079	—	—	—
6	14	6	20	94	5	678 298	36,883	—	—
Total	487	172	75	922	22	9,985,493	53,455	27,007	—
Grand total ...	1,262	585	294	926	26	23,976,371	268,179	29,971	408

electrically operated, the majority of the conveyors would also be worked by electricity.

What strikes one most from an examination of the foregoing table, is the enormous development of machine mining in Scotland. More than half of the electrically-driven longwall machines in use in the collieries of Great Britain are in Scotland, and these machines obtained practically one-third of the whole of the coal output obtained by machine mining. Surely if coal-cutting pays in one district to such an extent, it would seem to be worth very much more consideration in the other districts than it is evidently receiving. Of the 38 million tons of coal produced in Scotland, one-fifth was obtained by machine mining.

In regard to the use of electricity in mines for other purposes, the following tables show the aggregate horse-power in use for different purposes, both below and above ground, in coal mines and metalliferous mines respectively :—

The next use of importance is haulage, and there is still room for a considerable extension in this direction. Electric winding does not seem to make much progress, especially in the North of England, where the collieries have such excellent facilities for obtaining power from the supply companies. South Wales still leads in this application of electric power.

In regard to lighting, there is a distinct improvement in the numbers of electric miners' safety lamps now being used, though, of course, the proportion is still very small, compared to the number of oil lamps in use. Of the latter there were a total of 679,572, and of electric lamps 75,507, or a little over 10 per cent. The only objection now to the electric lamp is the cost of installation and maintenance, which, no doubt, will be overcome as manufacturers gain experience, and the managers and miners begin to recognise their great advantages in efficiency and safety.

Electricity in Coal Mines.—Summary of Aggregate Horse-Power.

District.	Number of mines.	Above ground.						Underground.					Gross total.
		Winding.	Ventilation.	Haulage.	Coal washing or screening.	Miscellaneous.	Total.	Haulage.	Pumping.	Portable machinery	Miscellaneous.	Total.	
1	340	2,991	5,651½	3,478½	7,281	10,781½	30,183½	30,134⅘	50,932¼	22,149¼	3,755$\frac{9}{10}$	106,972⅕	137,155$\frac{7}{10}$
2	279	11,118	18,644½	10,063½	13,485¾	25,624½	78,936¼	40,681	42,657¼	4,245¾	3,291½	90,875½	169,811¾
3	240	1,462½	10,292$\frac{3}{10}$	3,054½	21,537$\frac{19}{20}$	29,510$\frac{7}{10}$	65,857$\frac{19}{20}$	28,699	16,366¾	9,124	3,600⅞	57,790⅝	123,648$\frac{23}{40}$
4	137	268	3,292½	1,031½	3,180½	5,345¼	13,117¾	10 545½	9.889¾	832	1,235	22,502¼	35,620
5	291	16,372	17,924	14,693½	9,528½	35,314	93,832½	42,783	55,095½	799½	1,765½	100,443½	194,276
6	131	291½	2,216½	1,534½	3,357½	4,764½	12,164½	18,333½	19,012	2,428	1,332$\frac{1}{10}$	41,105⅗	53,270$\frac{1}{10}$
Total...	1,418	32,503½	58,021$\frac{3}{10}$	33,856	58,371⅕	111,340$\frac{9}{20}$	294,092$\frac{9}{20}$	71,176⅘	193,953½	39,578½	14,980⅞	119,689$\frac{27}{40}$	713,782⅛

Electricity in Metalliferous Mines.—Summary Showing Aggregate Horse-Power.

District.	Number of mines.	Above ground.					Underground.					Gross total.
		Winding.	Ventilation.	Haulage.	Miscellaneous.	Total.	Haulage.	Pumping.	Portable machinery.	Miscellaneous.	Total.	
1	8	106	⅓	30	185½	321⅚	20	178¾	—	51½	250¼	572$\frac{1}{12}$
2	15	71	—	—	395	466	159	915	—	408	1,482	1,948
3	5	27	—	52	64	143	—	77½	—	—	77½	220½
4	8	790	150	385	801¼	2,126¼	781	1,243½	—	292	2,316½	4,442¾
5	6	130	—	10	580	720	10	110	—	15	135	855
6	12	843	3	28	3,548½	4,422½	10	1,370	—	33	1,413	5,835½
Total ...	54	1,967	153⅓	505	5,574¼	8,119$\frac{7}{12}$	980	3,894¾	—	799½	5,674¼	13,873$\frac{10}{12}$

It will be noticed from these tables that the greatest amount of power is used for pumping—nearly one half of the total horse-power installed underground in the coal mines, and more than one half in the metalliferous mines being applied to this purpose. Taken altogether more than one fourth of the total electrical horse-power installed in mines is used for pumping, and from this one may obtain some idea of the cost of keeping the mines clear of water.

Birmingham.—Tramway Stoppage.—On Tuesday last week the operation of the whole of the city tramways was suspended for half an hour, due, it appears, to the exceedingly heavy demands on the electricity department at the time (about dusk), to meet which it was decided to suspend the traction supply in order to maintain the manufacturing supply. It will be remembered that the Corporation has a temporary 10,000-KW. generating station practically completed at Nechells, and it was anticipated that this would be available for supply in August, but, owing to delay in plant delivery, this station is only now being completed.

PARTICULARS OF ELECTRIC TRAMWAYS IN THE COMMONWEALTH OF AUSTRALIA.

The following Table of Statistics relating to Australian Electric Tramways has been compiled by the *Commonwealth Engineer* :—

State.	Mileage (route) open for traffic.	Capital cost.	Energy generated. Kilowatt-hours.	Car-miles run.	Gross revenue.	Working expenses.	Percentage of working expenses on gross revenue.	No. of passengers carried.	No. of Cars.	No. of employés.
	Miles.	£	Thousands.	Thousands.	£	£	Per cent.	Thousands.		
New South Wales... ...	145·74	7,060,424	93,554	27,008	1,783,620	1,522,489	85 36	290,512	1,399	9,195
Victoria	61·95	841,071	6,617	4,166	193,306	144,308	74·65	28 268	183	719
Queensland...	34·55	—	7,014	3,979	300,195	—	—	44,691	149	803
South Australia	51·46	1,396,638	12,000	5 326	328,809	202,503	61·59	43,797	170	1,073
Western Australia... ...	46·83	1,065,312	4,902	2,703	186,757	127,049	68·03	17,473	119	449
Tasmania	16·73	180,790	1,562	849	56,605	33,972	60 02	6,526	47	259
Commonwealth	357·26	10,544,235	32,095	44,031	2,849,292	—	—	431,267	2,067	12,498

In addition to the above services, the following other-motive-power lines are in operation :—Steam (miles) : N.S.W., 70 ; Victoria, 1 ; Queensland, 7½. Cable (miles) : Victoria, 46. Horse (miles) : Victoria, 12½ ; South Australia, 19½ ; Western Australia, 29.

The controlling authorities of the various tramway services are :—Government (miles) : N.S.W., 211 ; Victoria, 5¼ ; S. Australia, 17¼ ; Western Australia, 52. Municipal (miles) : Victoria, 23½ ; Queensland, 7½ ; S. Australia, 51½ ; W. Australia, 11 ; Tasmania, 16¾. Private (miles) : N.S.W., 4¾ ; Victoria, 92½ ; Queensland, 34½ ; S. Australia, 2¼ ; W. Australia, 14¾.

NOTES ON FAULTS IN CABLES.

By E. P. AUSTIN, A.M.I.E.E.

The construction of paper-insulated lead-covered cables is such that under certain apparently simple fault conditions localisation tests are often inaccurate. In the following lines the writer proposes to investigate some of the causes of this inaccuracy.

Paper lead cables are commonly made up in the following classes:—Single core, two and three core, and two or three concentric conductors. The triple-concentric conductors are usually installed on three-wire networks, and have the outer conductor earthed at the generating station and of half the sectional area of the other two conductors.

Insulation breakdowns can usually be attributed to damp, cracked paper, or overheating of the dielectric, the primary causes of these conditions being mechanical or electrolytic damage to the lead, faulty box glands, creeping of damp along the strands due to careless handling, abuse of the cable when laying, or overheating due to excess voltage or overload.

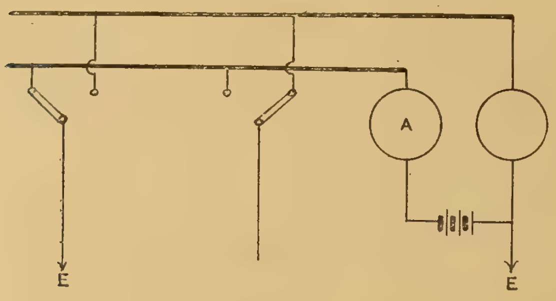


FIG. 1.

Protection against electrolysis is obtained by frequent bonding between adjacent cables, across boxes, and between traction return circuits and the lead sheath.

Faults that occur through mechanical damage subsequent to laying operations generally declare themselves at once if the cable is alive, but damage from other causes frequently results in faults that develop over a period of time depending on the environment of the cable at that point.

Dealing first with the triple-concentric cable, we will consider the indications of a fault, its development, and the type of test likely to give most accurate results.

With this class of cable, faulty lead allows the influx of damp and lowering of the insulation between the outer conductor and earth. In course of time the damp creeps along the cable until the general insulation between conductors becomes low enough to form a low-resistance fault or dead short.

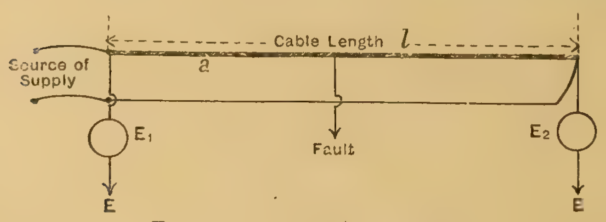


FIG. 2.—$a = l \times E_1/(E_1 + E_2)$.

It is much better to localise and remove a fault before this last stage is reached and while it is possible to locate a faulty cable on a network during working.

A suitable arrangement is shown diagrammatically in fig. 1. A second neutral bus-bar is made use of, and its potential to earth varied at will by means of a battery, accumulators being the most suitable. The two-way switches form continuous contact during the change from the neutral working bus to the auxiliary bus. The method of procedure is as follows.

Choosing a period of light load, the network is divided into sections at the street pillars and boxes on all three conductors. The neutral of No. 1 section is switched on to the auxiliary bar, the accumulator switched into circuit and the reading on ammeter A noted. If no current is indicated, then each section is taken in turn until the one containing the faulty cable is found.

The precise cable is discovered by transferring portions of the faulty network to the sound network until the ammeter indicates no leakage.

The faulty cable will probably be sound between the inner conductors, and possibly between each of these and the neutral, therefore the localisation test will be simple. The Murray loop test is applicable if the fault resistance is low, or a fall of potential test may be used, employing a high-resistance galvanometer or suitable voltmeter.

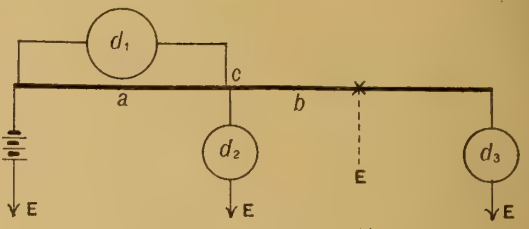


FIG. 3.—$b = a\,(d_2 - d_3)/d_1$.

In many instances a cable fails before its condition is suspected, and the resistance between all conductors becomes low. If the paper has not been too badly damaged in the region of the fault, the oil will run in between the conductors and cause the conditions to become unstable. Localising under these conditions presents considerable difficulty and takes up considerable time, as it is generally necessary to develop the fault again by applying a fairly high potential through a resistance, and maintaining a sufficiently heavy current through the fault to reduce the paper to stable condition at this point.

Before applying a test it is essential for success to determine accurately the relative condition of the conductors to each other and earth, and from that to decide how far the requirements of a given method or methods are met.

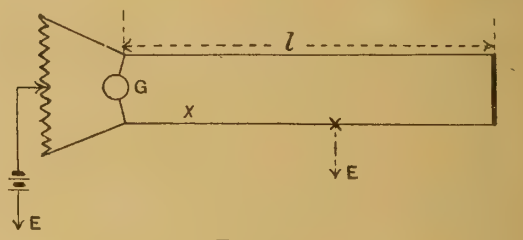


FIG. 4.

In all methods there are certain essential requirements, which may be briefly summarised as follows for a few of the common ones.

Fall of potential, figure 2. One conductor must be sound or another sound conductor available, possibly a neighbouring distributor or pilot, otherwise a temporary wire must be used, which is often inconvenient. Failing these, the method in figure 3 may be used provided the point c is available. This method and its adaptations are not very accurate, as the fault resistance from either end may not be equal. When all conductors are shorted, as we have assumed, one may be used as the wire under test and its neighbour as the earth lead.

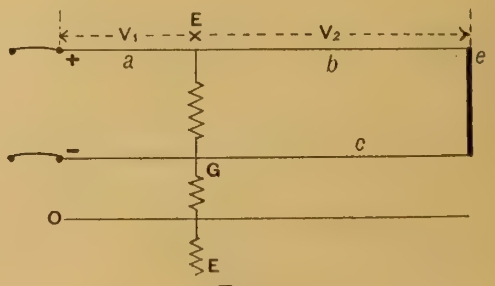


FIG. 5.

Bridge and loop methods are simple and effective. They call for one sound conductor, preferably of equal section to the faulty one, the shortest possible instrument leads, and they are most accurate when the fault resistance is low. Fig. 4 illustrates the well-known Murray loop method.

Assuming that the cable has low resistance faults between all conductors and earth, it is probable that the insulation between any two conductors will hold up under a test pressure of, say, 6 volts, and apparently fulfil the conditions necessary for the method shown in diagrams 2 or 4, but misleading results are often obtained for the following reasons :—

Fig. 5 represents the state of affairs described, and its effect on a fall of potential test.

V_1 accurately measures the drop on the length *a*, but V_2 is the difference of potential between *e* and G. The loop E *e* G is shunted by the fault resistance, and therefore V_2 will measure the drop across the fault less the drop from *e* to G.

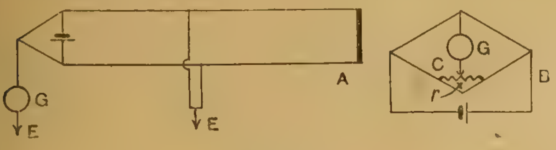


FIG. 6.

The loop test is also inapplicable in these circumstances, as shown in fig. 6, where A represents the cable connections, and B the equivalent lozenge diagram, in which the resistance *r* represents the fault between cables having an uncertain position of the point of contact C.

The alternative methods to use are those applicable to short-circuit, namely, the fall of potential without a return wire, as illustrated in diagram 3.

The other test for short-circuit is the overlap method shown in diagram 7. The principle is self-evident from the formula given. Since the fault resistance is measured in this case, and not used merely as an instrument or battery connection, it is essential for success that the fault should be perfectly stable during the tests, and have the same value from either end of the cable.

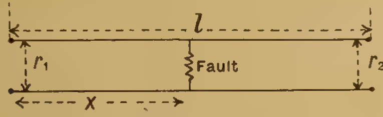


FIG. 7.

$x = (r_1 - r_2 + 2\,l\,a)\,/4a$ where a = resistance per yard of cable.

Induction methods are strictly limited in their scope of usefulness on concentric cables, and are quite inoperative on armoured cables, for obvious reasons. The screening effects on concentric cables are sufficient to damp inductive phenomena, in addition to which the impulses impressed on the cable flow along the lead to any remote point of contact with earth, and there is, therefore, no definite indication of the position of the fault.

IGNITION MAGNETOS.

(Concluded from page 511.)

As the ignition magneto always has to work intermittently, one must endeavour to produce the maximum effect at the moment when it is doing useful work—that is, when the spark is to be produced by opening the circuit—and with this in view, it is not a matter of indifference when the circuit is closed. At very low speed the influence of closing the circuit is next to nothing ; the maximum current is always produced at the moment when $d\,\mathbf{B}/d\,a$ is a maximum, and it is sufficient if the circuit is closed long enough before the rupture ; it can even be closed for several cycles without affecting the value of *i*. At high speeds this does not hold good, and if one wishes to obtain the greatest possible current strength at the moment of break, one must take care to close the circuit at the moment of maximum flux. This is well shown in fig. 7, where Curves I and III start from zero flux, whilst Curve II corresponds to starting from the maximum flux. These curves are calculated by the method given on p. 510, for the same coil as fig. 6, and for a speed of 20 revs. per second. Between the limits shown the strength of current varies, but it is clear that the best result is always attained when closing is effected in the sector 0°—90° for the spark to take place in the neighbourhood of 180°, and that it is necessary to approach 90° as closely as possible.

It might appear that, this point having been established, there would be no difficulty in fixing once for all on the point 90° ; in reality, however, practical conditions sometimes require complete closing during more than one revolution, and then it is found that the *useful* current strength diminishes when the speed increases ! In other cases, on the contrary, the duration of closed circuit has to be reduced, and the consequence is a weakening of the useful effect. Finally, it happens with magnetos that have a double winding that the secondary current has sufficient influence to disturb the *régime* described above, and sparks are sometimes produced at times other than the break ; each case, therefore, requires special consideration, with the help of the foregoing information.

As the variation of the maximum current with the moment of closing occurs only at high speeds, when the current strength is almost always more than sufficient, apparently it might be neglected without inconvenience ; as a matter of fact, however, it must not be forgotten that, in spite of the considerable volume of the magneto relatively to its useful output, it is a machine of which the heating is always to be feared, and although a premature closing of the circuit may diminish the maximum current strength at the point of rupture, it has also the grave drawback of materially increasing the R.M.S. value of the current, and, consequently, the heating effect.

The coefficient Z mentioned on page 511 depends entirely on the magnetic circuit, and, as already indicated, it is proportional to the limit of the ratio of the current strengths at very low and at very high speeds.

If the flux had a sinusoidal wave-form, the value of Z would be unity ; this is one of the few cases in which it is possible to make the calculation. In the case of magnetos, for want of being able to determine to a sufficient degree of accuracy the maximum value $d\mathbf{B}/d\alpha$, we must be content with the approximation obtained by the direct measurement of the variations of flux Δ **B** for angles $\Delta\,\alpha$, whence $Z = \text{max.}\ \Delta\mathbf{B}/\Delta\alpha \div \text{max.}\ \mathbf{B}$; or the elongations θ, which are proportional to the variations Δ **B** (page 510) are utilised, replacing $\Delta\,a$ by $2\pi/p$ for p measurements per revolution,

$$Z = \frac{p}{2\pi}\ \frac{\text{max.}\ \theta}{\frac{1}{2}\,\Sigma_{-\phi}^{+\phi}\,\theta}.$$

Very numerous measurements made on good magnetos of different makes show that Z varies between 4·5 and 7, although the machines are almost identical in appearance.

Considerable changes in the form of the curves of flux result from very small differences in the shape of the elements of the magnetic circuit. Generally speaking, the pole-pieces P_1 and P_2 and the shoes A A of the **H** armature subtend equal angles of 90° (B in fig. 8), and as the air-gap $\rho_2 - \rho_1$ is very small, the width *d* of the shoes is practically equal to the opening D between the tips of the pole-pieces. It is preferable to allow a small overlap, making $d > D$ rather than $d < D$. When the overlap is small, of the order of 1 mm. in ordinary cases, the ratio Z remains almost constant.

On the other hand, if $d < D$, even for a difference of 1 or 2 mm , the flux curve shows a kind of step corresponding to the passage of the shoes between the pole horns, and the curve $d\mathbf{B}/\ \alpha$ presents a double peak (fig. 9), so that with equal maximum flux the coefficient Z may have a value of 3 ; the magneto, whilst quite suitable for normal speeds, makes bad startings. The failure of several models was due to this cause.

The air-gap $\rho_2 - \rho_1$ ought to be made as small as the mechanical conditions will permit ; it is often less than 0·2 mm. If it is further reduced there is a risk of the shoes touching the pole-pieces through wear of the bearings.

If the air-gap is increased, another defect is introduced ; the flux is reduced, but what is more serious, the maximum variation falls more rapidly still, and the value of the coefficient Z becomes very low. Fig. 10, which relates to two air-gaps of 0·2 and 0·45 mm., with a radius ρ_1 of 28 mm., illustrates this point ; to facilitate comparison, the curves for the two air-gaps have been displaced with regard to one another by an angle of 90°. They show that the flux is equal to 63,500 maxwells for an air-gap of 0·2 mm., and 56,400 for 0·45 mm. ; but at the same time Z falls from 5 to 3·8. This clearly demonstrates the importance of small air-gaps.

The power of the magneto being a function of the maximum flux S $\mathbf{B}_{\text{max.}}$, and $\mathbf{B}_{\text{max.}}$ being dependent on the quality of the iron used, the only independent variable is really S, the cross-sectional area of the core (= N E in fig. 8). It is advisable not to press the induction too far, to avoid trouble from hysteresis, and from the saturation of the iron. With sheet-iron laminations of good quality, the induction may be from 12,000 to 13,000 ; with cast-iron it is difficult to exceed 9,000 or 10,000.

The shoes A A have a surface $s = \rho_1$ B F (fig. 8) ; it is not advisable to make F too great, as there would be a tendency to leakage of flux outside the winding, and therefore the ratio s/S should not exceed 6, which gives a field of about 2,000 gauss in the air-gap. It only remains to determine the dimensions of the magnets. The best magnets never exceed, at the neutral section and on magnetic short-circuit, an induction of 7,000 gauss, and it is better to reckon only on 5,000, which, allowing for the inevitable leakages, gives a useful induction of about 3,000 ; hence the magnets must have a section of almost four times that of the armature core. The length of the magnets may vary widely, according to considerations of construction, available space and weight ; as the magnetic circuit is almost closed, there is nothing to gain by making the magnets long so as to avoid demagnetisation. Generally the length is five or six times the diameter of the armature.

Ignition magnetos being intended to generate a current which is broken at the most favourable moment—that is, when the axis of the armature is perpendicular to the lines of force of the magnet—the magnetic field due to the armature current cannot at that moment have any effect upon the magnet. But this is not always the case in practice, and it happens sometimes that the rupture takes place after the position of zero flux is passed, and in that event the current tends to demagnetise the magnets. Moreover, the current does not always stop suddenly at the moment of break, but often sets up an arc, which prolongs its duration, and this delayed current may have a detrimental effect. As the magnetomotive forces of the magnets and armature may be of the same order of magnitude, this point is worthy of attention; the best course seems to be to take care that rupture does not occur with too much delay after passing the line of zero flux.

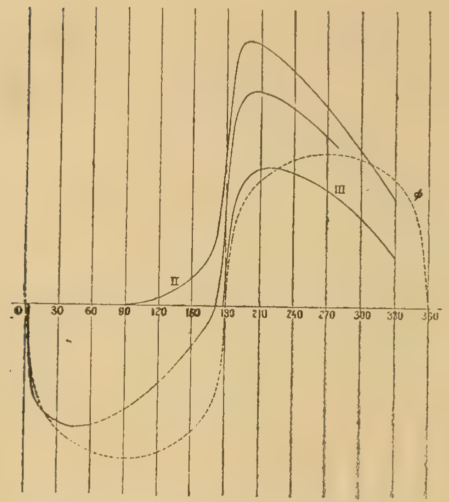


Fig. 7.—Curves showing the Effect of Closing the Circuit at different Instants.

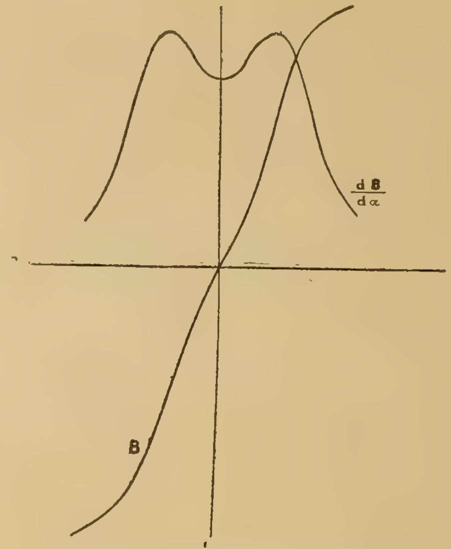


Fig. 9.—Curves of Flux and $d\mathbf{B}/da$ with Armature Shoes narrower than Gap between Pole Tips.

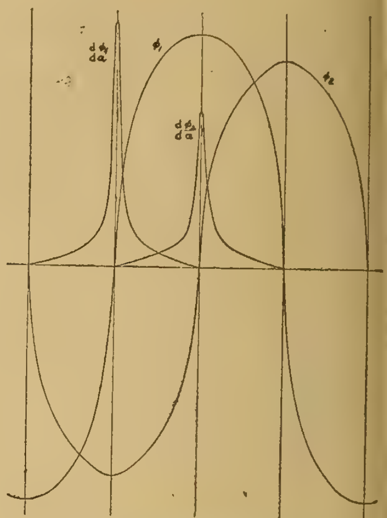


Fig. 10.—Effect of width of Air-gap on Curves $d\phi/da$.

As the ignition magneto is intended for intermittent operation, the energy available at each rupture is the important quantity, apart from the true power, which is another function of the speed. Neglecting the current, often negligible, which follows the spark, at each rupture we have at our disposal the energy $W = \frac{1}{2} L i_r^2$. We can determine W for the two limiting cases—zero and infinite speed—but first it is necessary to express the inductance L and the resistance R of the circuit in terms of the dimensions of the winding. As a first approximation let us assume that the inductance is proportional to a constant term B, to the section S, and to the square of the number of turns, or $L = B S n^2$. For similar armatures we can write $R = an^2$.

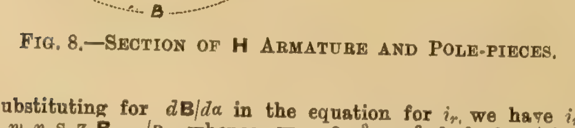


Fig. 8.—Section of H Armature and Pole-pieces.

Substituting for $d\mathbf{B}/da$ in the equation for i_r, we have $i_r = 2 \pi m n S Z \mathbf{B}_{max}/B$, whence $W = 2 \pi^2 B m^2 Z^2 S^3 \mathbf{B}^2_{max.}/a^2$, or, replacing the induction by the total useful flux, $\phi_{max.} = S \mathbf{B}_{max.}$, we get $W = 2 \pi^2 B m^2 Z^2 S \phi^2_{max.}/a^2$. It might seem advantageous, for a given flux, to lower the induction by increasing S; but the factor a is also a function of S, since the mean length of a turn increases with the section, and it is preferable to keep to an induction near 12,000.

Let us take now the higher limit of current strength; we have $W = S/2B \times (\mathbf{B}_r - \mathbf{B}_c)^2$, or at the maximum, when $\mathbf{B}_r = -\mathbf{B}_c$, $W = 2S/B \times \mathbf{B}^2_{max.}$

The two limiting expressions have this feature in common—that the number of turns does not enter into them; the energy is derived almost entirely from the magnetic circuit, and it is only by increasing S that one can increase the available energy, since other considerations fix the maximum induction. We speak here only of the section S, but the interesting factor is really the volume of iron, which is implicitly given by the value of S, since we know that there is a practical relation between S and s, the polar surface, which is itself a function of the diameter of the armature.

As to the energy necessary for igniting the gaseous mixture, opinions are divided, but the expressions given above, applied to magnetos in good running order, give limiting values of practical interest. As a preliminary step we can include the values utilised in practice between the two following examples: For motor-cycles small magnetos are made, which weigh less than 2·5 kg., and give at starting a sufficiently powerful spark when the speed reaches about one revolution per second. The energy per spark, obtained from the above formula, is then of the order W = 0·007 joule. On the other hand, the type of magneto most generally used on cars with four-cylinder engines, running at the maximum speed, gives W = 1·2 joules. The first value would clearly be insufficient to ensure the regular running of the engine; there would be numerous misfires; but the second is certainly too high. One can safely say that with an expenditure of energy of one joule per spark the ignition is always perfectly ensured, and if misfires occur, the cause must be sought outside the magneto.

The foregoing calculation applies only to the energy available at the moment of rupture, and can be regarded as giving the maximum energy in magnetos with separate transformers; but in magnetos with direct sparks, as well as in low-pressure magnetos, in which the electrodes of the plug or of the ignition lever remain in connection with the magneto, it may happen that after the break-spark the current may be maintained by the electromotive force (much weaker, but not negligible) generated simply by rotation of the armature, and this would partly explain the fact, often observed, but without actual proofs, that magnetos with direct sparks are more effective, for equal power, than those with separate transformers.

The power necessary to drive the magneto includes the useful power given by the product of W with the number of sparks per second, together with all the electrical and mechanical losses. Few tests have been made on this question, but it is probable that the useful energy represents only a small fraction of the total energy expended, and that the efficiency is small.

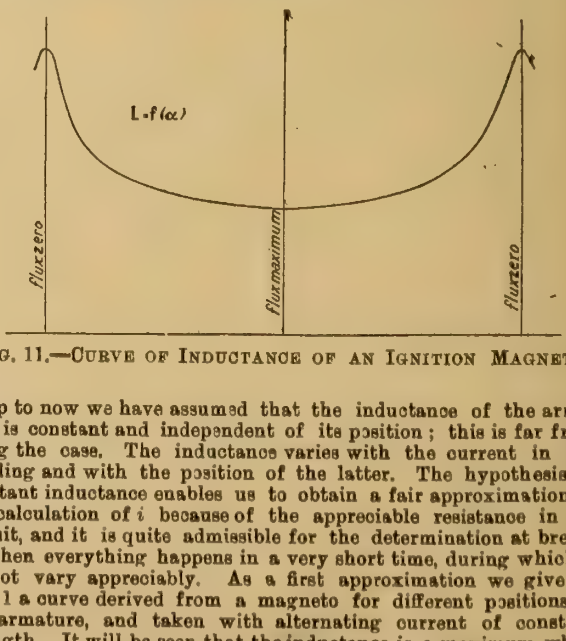


Fig. 11.—Curve of Inductance of an Ignition Magneto.

Up to now we have assumed that the inductance of the armature is constant and independent of its position; this is far from being the case. The inductance varies with the current in the winding and with the position of the latter. The hypothesis of constant inductance enables us to obtain a fair approximation in the calculation of i because of the appreciable resistance in the circuit, and it is quite admissible for the determination at break, for then everything happens in a very short time, during which L cannot vary appreciably. As a first approximation we give in fig. 11 a curve derived from a magneto for different positions of the armature, and taken with alternating current of constant strength. It will be seen that the inductance is a maximum wh the core of the armature is perpendicular to the axis of the p l pieces, that is, when the magnetic flux sent through the cor by the magnet is zero. As the result of numerous tests, we may say that the inductance rises by 100 per cent. as the flux from the magnet passes from the maximum to zero, and one may take, for actual magnetos, the coefficient B as being equal to 150×10^{-9} for $\mathbf{B} = 0$ and 75×10^{-9} for **B** maximum, the value of L being calculated in henries.

When the core of the armature is vertical, with the edges of the shoes facing the edges of the pole-pieces, as in fig. 8, a strong attraction is set up, and it is often difficult to pass this point.

The force thus exerted is proportional to the square of the flux and in inverse ratio to the section through which it passes, and the tangential component of this force, with which only we are concerned, is considerable; if the phenomenon were not in reality due to the *difference* between the opposed forces on the two edges of the shoes, it would be practically impossible to drive the magneto. For actual machines, calculation shows that the tangential pull is of the order of 40 kg. on each edge! Nevertheless, if the magneto were perfectly symmetrical, without hysteresis, and if the ratio of flux to section of path were constant, the two attractions would balance one another, and one would not feel the passage of the shoes between the poles. In practice, the effort of passage is fairly considerable, and often very annoying, for it induces mechanical reactions which are very detrimental to the magneto.

One of the principal causes of this defect is certainly the bad shape of the shoes and poles; if the flux curve is like that shown in fig. 9, it will be seen that the maximum tangential force occurs before the passage through $\phi = 0$, that is, at a point where one of the edges of each shoe is more engaged with the pole-piece than the other; the opposed forces are then very different, and the total couple is considerable. These remarks are intended merely to indicate the direction for research to take; improvements can only be made by successive alterations of the outlines.

Starting from this point, the magneto acts as an inductance traversed by a current in the low-pressure type, and as the primary of an induction coil in that with direct sparks, and we enter a well-known field.

TRADE CONDITIONS AFTER THE WAR.

By C. F. MOTTRAM.

It is difficult to estimate the effect of the present war on trade during the years immediately following its conclusion. The prevailing opinion seems to be that the huge expenditure of the nations involved will leave them, more or less, in a state of financial, as well as physical, exhaustion, and that there will be a serious shortage of capital. Assuming, of course, that the Entente Powers are finally victorious, what will be the effect of the war on the industries of this country? Will trade become stagnant for a time, or will the period of recovery here be more than counter-balanced by the capture of a large portion of the German foreign trade? Here lies a great opportunity for the British manufacturer. The crippling of our most serious European competitor should open up new markets for British goods giving the manufacturing centres opportunities for more oversea trade, which should compensate them for losses sustained during the present crisis. Immediate preparations must, however, as far as war conditions will allow, be made to capture this trade. We must be first in the field, and not leave everything until peace is proclaimed, when the Germans, aided by their Government, will endeavour to dump their goods anywhere abroad.

Of the large industries, the electrical can, perhaps, look forward with the greatest amount of optimism. In the past it has suffered much in this country from the keen competition of the German manufacturers, whose capacity for organisation has enabled them to spread their influence throughout all parts, greatly to the detriment of the home industry. They should not be allowed to resume this position after the war. A determined effort should be made by our manufacturers to take advantage of the wave of national feeling to obtain possession of and retain the home market, and to prevent the German resuming trade in this country on the terms he has hitherto enjoyed. There is no reason why every kind of electrical apparatus, from the largest generating set to the smallest lamp or switch, should not be easily procurable of British manufacture. Customers who in the past have purchased German plant on account of its so-called cheapness, and since the commencement of hostilities have found a difficulty in getting repairs and replacements, will no doubt appreciate the false economy of dealing with Continental firms. A strong effort should also be made to increase the present export figures of the electrical industry by taking advantage of the feeling now existing in many neutral nations against the German nation.

Electricity possesses so many advantages that it should rapidly forge ahead in the future. No other form of power is so readily adaptable to the various processes of manufacture. It takes up less floor space, which in some premises is a very important factor; it reduces transmission losses to a minimum, increases output, and also reduces labour, attendance and maintenance charges. Again, and this is a point which will no doubt be emphasised, when the energy is taken from the public supply mains, electrical plant is installed with less capital expenditure than any other form of power. There is a wide field, also, now for the use of electric vehicles which British enterprise should not leave our American cousins to exploit; we should claim our fair share of the business. If more attention is paid to the needs and requirements of the various customers, there will also be a more rapid development in the use of electrical cooking and heating apparatus; whilst for lighting, whether in the factory, shop, or residence, the many superiorities of electricity are now too well known to need recapitulation here. So far from being considered a luxury, it is now realised to be the most economical and scientific form of illumination.

A great deal of the success of industrial development naturally depends upon the organisation of the sales department, and, although economies may be effected here by manufacturers, one result of the war will probably be to increase the efficiency and importance of this section. Advertising should also receive greater consideration than in the past. Many British manufacturers have suffered much from the lack of attention to this very important subject. Literature, which only too soon finds its way into the waste-paper basket, is worse than useless. Apart from the choice of matter, which must meet the needs and suit the requirements of the various classes of customers, and also the national characteristics of different nations, greater attention must be given to the choice of colour, illustrations, diagrams, balance, selection of type, and general lay-out of all kinds of pamphlets, leaflets, etc., if the success which is so desired is to be attained.

In conclusion, if British manufacturers prepare for a determined effort to take advantage of public feeling, not only here, but also in neutral countries, to oust the German competitor, there is no reason why British trade, and more particularly the electrical, should suffer any temporary depression. It should even go ahead with a greater impetus, and thus help the nation to recover from the present disastrous but unavoidable conflict.

TRADE STATISTICS OF JAPAN, 1914.

The following statement, showing the imports into and the exports from Japan of electrical and similar goods during the year 1914, is taken from the recently-issued official trade statistics; the figures for 1913 are given for purposes of comparison, and notes of any increases or decreases are added:—

	1913. Yen.	1914. Yen.	Inc. or dec.	Yen.
Galvanised iron wire.—				
From Great Britain ...	233,000	262,000	+	29,000
,, Germany	2,043,000	1,486,000	–	557,000
,, Belgium	122,000	66,000	–	56,000
,, Austria	—	8,000	+	8,000
,, United States ...	41,000	304,000	+	263,000
,, Other countries ...	8,000	2,000	–	6,000
Total	2,447,000	2,128,000	–	319,000
Rails.—				
From Great Britain ...	555,000	72,000	–	483,000
,, Germany	1,197,000	643,000	–	554,000
,, Belgium	211,000	46,000	–	165,000
,, United States ...	1,922,000	1,115,000	–	807,000
,, Other countries ...	201,000	3,000	–	198,000
Total	4,086,000	1,879,000	–	2,207,000
Posts and materials for electric lines.—				
From Great Britain ...	6,000	2,000	–	4,000
,, Germany	15,000	24,000	+	9,000
,, United States ...	284,000	580,000	+	296,000
,, Other countries ...	1,000	6,000	+	5,000
Total	306,000	612,000	+	306,000
Copper (pipes and tubes).—				
From Great Britain ...	251,000	105,000	–	146,000
,, Germany	22,000	31,000	+	9,000
,, Other countries ...	14,000	16,000	+	2,000
Total	287,000	152,000	–	135,000
Insulated electric wire.—				
From Great Britain ...	491,000	160,000	–	331,000
,, France	2,000	—	–	2,000
,, Germany	1,419,000	235,000	–	1,184,000
,, United States ...	96,000	48,000	–	48,000
,, Other countries ...	3,000	1,000	–	2,000
Total	2,011,000	444,000	–	1,567,000
Steam turbines.—				
From Great Britain ...	20,000	22,000	+	2,000
,, Germany	27,000	139,000	+	112,000
,, United States ...	16,000	2,000	–	14,000
Total	63,000	163,000	+	100,000

	1913. Yen.	1914. Yen.	Inc. or dec. Yen.
Submarine cable.—			
From Great Britain ...	51,000	926,000	+ 875,000
Cranes.—			
From Great Britain ...	426,000	150,000	− 276,000
,, Germany	473,000	124,000	− 349,000
,, United States ...	173,000	35,000	− 138,000
,, Sweden	7,000	24,000	+ 17,000
Total	1,079,000	333,000	− 746,000
Pumps.—			
From Great Britain ...	612,000	209,000	− 403,000
,, Germany	164,000	240,000	+ 76,000
,, United States ...	272,000	182,000	− 90,000
,, Other countries ...	33,000	34,000	+ 1,000
Total	1,081,000	665,000	− 416,000
Gas engines, petroleum engines and hot air engines.—			
From Great Britain ...	577,000	114,000	− 463,000
,, Germany	359,000	118,000	− 241,000
,, Belgium	7,000	—	− 7,000
,, Sweden	97,000	31,000	− 66,000
,, United States ...	80,000	88,000	+ 8,000
,, France	23,000	2,000	− 21,000
,, Italy	14,000	2,000	− 12,000
,, Switzerland ...	59,000	—	− 59,000
,, Other countries ...	—	11,000	+ 11,000
Total	1,216,000	366,000	− 850,000
Steam engines.—			
From Great Britain ...	219,000	244,000	+ 25,000
,, Germany	223,000	181,000	− 42,000
,, United States ...	27,000	17,000	− 10,000
,, Belgium	94,000	10,000	− 84,000
,, Other countries ...	6,000	1,000	− 5,000
Total	569,000	453,000	− 116,000
Steam boilers.—			
From Great Britain ...	660,000	654,000	− 6,000
,, Germany	150,000	192,000	+ 42,000
,, United States ...	77,000	13,000	− 64,000
,, Belgium	89,000	2,000	− 87,000
Total	976,000	861,000	− 115,000
Dynamos, electric motors, etc.—			
From Great Britain ...	1,035,000	667,000	− 368,000
,, Germany	1,460,000	808,000	− 652,000
,, Switzerland	49,000	56,000	+ 7,000
,, United States ...	1,706,000	1,211,000	− 495,000
,, Sweden	18,000	91,000	+ 73,000
,, Other countries ...	22,000	10,000	− 12,000
Total	4,290,000	2,843,000	− 1,447,000
Water turbines and Pelton wheels.—			
From Great Britain ...	37,000	9,000	− 28,000
,, Germany	613,000	206,000	− 407,000
,, France	4,000	—	− 4,000
,, Switzerland	—	14,000	+ 14,000
,, Sweden	21,000	81,000	+ 60,000
,, Belgium	14,000	7,000	− 7,000
,, Denmark	26,000	—	− 26,000
,, Italy	13,000	5,000	− 8,000
,, Other countries ...	1,000	—	− 1,000
Total	729,000	322,000	− 407,000
Incandescent electric lamps.—			
From Great Britain ...	6,000	4,000	− 2,000
,, Germany	238,000	379,000	+ 141,000
,, United States ...	2,000	8,000	+ 6,000
,, Other countries ...	38,000	—	− 38,000
Total	284,000	391,000	+ 107,000
Wattmeters.—			
From Great Britain ...	30,000	29,000	− 1,000
,, Germany	149,000	117,000	− 32,000
,, United States ...	80,000	36,000	− 44,000
,, Other countries ...	2,000	11,000	+ 9,000
Total	261,000	193,000	− 68,000
India-rubber and gutta-percha, crude.—			
From British India ...	479,000	447,000	− 32,000
,, Straits Settlements ..	1,771,000	1,357,000	− 414,000
,, Dutch India	18,000	3,000	− 15,000
,, Great Britain ...	818,000	319,000	− 499,000
,, Germany	21,000	2,000	− 19,000
,, United States ...	200,000	16,000	− 184,000
,, Other countries ...	145,000	3,000	− 142,000
Total	3,452,000	2,147,000	− 1,305,000

The exports of electric machines and parts thereof from Japan in the years 1913 and 1914 were as follows:—

	1913. Yen.	1914. Yen.	Inc. or dec. Yen.
To China	249,000	268,000	+ 19,000
,, Kwantung Province ...	155,000	130,000	− 25,000
,, Philippine Islands ...	2,000	2,000	—
,, Siam	1,000	1,000	—
,, Australia	10,000	15,000	+ 5,000
,, Hong-Kong	13,000	13,000	—
,, British India	19,000	9,000	− 10,000
,, Straits Settlements ...	2,000	4,000	+ 2,000
,, Germany	1,000	6,000	+ 5,000
,, Other countries ...	18,000	4,000	− 14,000
Total	470,000	452,000	− 18,000

Yen = 2s. 0½d.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

14,026. "Electro-magnetically-operated clutches, particularly applicable to reversing-gear for reciprocating machines." LANCASHIRE DYNAMO & MOTOR CO., LTD., and W. HARGREAVES. October 4th.

14,043. "Vibratory electric bath blanket." H. D. PARKER. October 4th. (Complete.)

14,120. "Dynamo-electric machines." H. LUCAS & C. L. BREEDEN. October 5th.

14,121. "Means for connecting electrical conduits." F. W. UREN. October 5th.

14,145. "Electric indicating and lighting systems." A. BLACKMORE. October 6th.

14,160. "Dynamo-electric machines." A. H. NEULAND. October 6th. (Complete.)

14,164. "Electrical resistances." J. COLLINSON. October 6th.

14,214. "Electrical measuring instruments." C. E. FOSTER. October 7th.

14,216. "Dynamo-electric machines of the commutator type." M. WALKER. October 7th.

14,232. "Portable telephone and telegraph instruments." INTERNATIONAL ELECTRIC CO., LTD., & R. G. LE NOIR. October 7th.

14,233. "Telephones." INTERNATIONAL ELECTRIC CO., LTD., & R. G. LE NOIR. October 7th.

14,273. "Process for the electrolysis and treatment of sulphate liquors." E. J. HUNT & W. T. GIDDEN. October 8th. (Addition to 11,634/13.) (Complete.)

14,302. "Electric instrument for determining and indicating the altitude of an aeroplane or the like when descending to earth." A. JOHNSON & A. KINGMAN. October 9th.

14,310. "Process for the production of cuprous oxide electrolytically." B HUNT. October 9th.

14,311. "System for the generation of electric currents." C. F. BENITEZ. October 9th. (Addition to 17,811/14.)

14,328. "Electric signalling systems." H. R. RIVERS-MOORE. October 9th. (Addition to 1,649/10.)

PUBLISHED SPECIFICATIONS.

1914.

16,935. COMBINED DYNAMO AND ACCUMULATOR ELECTRIC SYSTEMS. Soc. Anon des Etablissements L. Bleriot. July 16th. (September 24th, 1913.)

16,936. CONTROL SYSTEMS FOR ELECTRIC INSTALLATIONS. Soc. Anon. des Etablissements L. Bleriot. July 16th. (September 24th, 1913.)

20,130. RHEOSTATS. Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co., U.S.A.). September 24th.

20,728. ELECTRICAL HEATING ELEMENTS. G. H. Collins & H. F. Collins. October 8th.

21,680. TELEGRAPH, SUBMARINE SOUND SIGNALLING, OR SIMILAR SYSTEMS. W. H. Shephard & A. E. McKechnie. October 28th.

21,881. MACHINE FOR WINDING ELECTRO-MAGNETIC COILS. C. H. Thordarson. November 2nd.

22,647. METHODS OF USING ELECTRIC CONDENSERS FOR TRANSFORMATION OF ENERGY. J. E. Taylor. November 18th.

23,189. APPARATUS FOR CHARGING ELECTRIC ACCUMULATORS. H. F. Joel, sen. November 27th.

23,211. ELECTRIC BELLS OR GONGS. H. F. Macdonald. November 28th. (Addition to 7,638/13.)

24,049. MEANS FOR THE ELECTRICAL HEATING OF STEERING WHEELS. R. S. Smith. December 14th.

24,475. ELECTRICAL VIBRATORY CONTACT MAKERS AND BREAKERS. J. Gardner. December 22nd.

24,637. CONTROL DEVICES FOR ELECTRIC CLOCK SYSTEMS. G. C. Hatton. December 24th.

1915.

367. ELECTRICAL SWITCHES. A. P. Lundberg, G. C. Lundberg, P. A. Lundberg, & G. Pegg. January 9th.

1,119. ELECTRICAL ALARM APPARATUS FOR MINES AND LIKE PLACES. J. P. O'Donnell (G. D. Hodges & D. Smith). January 23rd.

2,934. POCKET ELECTRIC FLASHLIGHTS. W. J. Mellersh-Jackson (S. I. Posen) February 23rd. (Addition to 18,809/14)

7,270. ELECTRICAL MEASURING INSTRUMENTS OPERATING ON THE FERRARIS OR INDUCTION PRINCIPLE. E. Fawssett. May 14th.

9,336. DEVICES FOR ESTABLISHING ELECTRIC CONNECTION BETWEEN CONDUCTORS. H. G. Wood. June 25th.

11,480. BAND RESISTANCE FOR USE WITH ELECTRIC PEDAL SWITCHES. Robert Bosch (firm of). August 9th. (July 29th, 1914. Divided application on 2,236/15, February 11th.)

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Vol. LXXVII.] CONTENTS: October 29, 1915. [No. 1,979.

Page
Electricity and the Munitions Output 545
Rubber 546
The Electrical Position in China 546
German Stocktaking of Electrical Machinery 547
A Russian Tax on Electricity 547
Wireless Telephony 547
London and South-Western Railway Electrification (*illus.*) (*concluded*) 548
Electricity Extensions at Stepney (*illus.*) 552
The Electrical Trade Position in China 556
Diesel Engine Users' Association 557
Correspondence—
  British Manufacturers Criticised 557
  The A E G Meeting 558
  An Improved Lifting Magnet 558
  The Institution and Alien Enemy Members 558
  Electric Heating 559
Legal... 559
Business Notes 559
Notes 564
City Notes 566
Stocks and Shares 567
Share List of Electrical Companies 568
Market Quotations 568
The Ideal Transmitter 569
Increasing the Cost to the Consumer 569
Decimal Coinage and the Metric System (*continued*) 570
Trade Statistics of Siam 572
Apprenticeship in the Electrical Contracting Industry ... 573
The Textile Institute 574
War Items 575
New Patents Applied for, 1915 576
Abstracts of Published Specifications 576
Contractors' Column ... ... Advertisement page xx

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ELECTRICITY AND THE MUNITIONS OUTPUT.

THE war has exercised innumerable influences on the electrical industry—some favourable, some injurious, and many whose effect has yet to be decided, partly by the general trend of events, and partly by the action, or inaction, of those whose interests are concerned. One fact, however, stands out clear-cut and unmistakable—our electricity works have deserved well of their country. The most cursory inspection of central station returns shows, in almost every instance, a remarkable development in power load connections during the last 12 or 15 months. At first sight this may seem to be merely a matter for selfish congratulation on the part of the central-station engineer—in other words, an instance of flourishing upon the national calamity. In fact, it is not outside the bounds of possibility that parties more zealous than discerning may seek to represent the increased power load revenue of such centres as Sheffield as "war profits" liable to taxation! Though the truth must be obvious to every electrical engineer, it is very doubtful whether the layman—even the layman in position of authority—realises that our 500 odd generating stations have been an enormous military asset during the past year. *Our present output of munitions would have been unattainable but for our electricity works.*

Though central-station generating costs were so low and the margin of profit on power sales was so small that perspicacious factory owners preferred purchasing to generating electrical energy, and electrification of new works was rapidly becoming the rule before the war, still there were a number of established workshops in which mechanical driving was retained for one or more of many reasons. Lack of capital, conservatism, and incomplete redemption on old plant were among the factors determining the retention of mechanical drive. In some cases the reliability and elasticity of steam engines were considered apart from the losses and defects in other parts of the mechanical installation; and in other cases the high thermal efficiency of gas engines was given undue importance.

With the outbreak of war a new era commenced. There was a temporary industrial paralysis or period of uncertainty, less acute and less enduring than in conscription countries, but still marked enough to permit many skilled men to enlist. Gradually the magnitude of munition demands became apparent, and with it the total inadequacy of mechanical driving and private power generation to meet the crisis. No doubt this inadequacy was realised by actual experience in many existing works, and it became immediately manifest wherever extensions or new works were planned. Every skilled man was needed in the workshops, and the depletion of private boiler room and engine house staffs by this cause and by enlistment became chronic directly night shifts doubled the minimum number of men with which operation could be continued. At a time when every effort was required to secure manufacturing materials and machinery the question of coal supplies and delivery became acute. Space, time, and labour required to secure and store a working margin of fuel could be better employed in other directions. Under continuous operation with depleted staffs, the satisfactory maintenance of private plant became impossible, and great delay was occasioned in obtaining replacement parts. To extend existing mechanical driving equipment involved similar delays, and wastage of valuable space, besides merely multiplying most of the operating difficulties already enumerated.

These conditions were experienced in many works, and would have been experienced in all had electric driving not been already in use or promptly adopted. The electric motor with its efficiency, flexibility, and simplicity undoubtedly saved the day. The whole problem of power production was relegated to undertakings devoting their entire energy and resources to the subject. The technical efficiency and reliability of our central stations stood us in good stead. Increased demands were met instantly which could have been supplied by no other means, and the costs of production could have been approached by few private concerns under the conditions existing. Replacements and additions to the driving equipment were effected with no interruption of work, an absolute minimum of useful space was occupied by the driving motors, and, perhaps best of all, the total staff engaged in power production was reduced to a minimum, and practically no skilled labour was requisitioned in workshops to attend to the driving equipment. All these advantages, which have been existent for years past, though hitherto imperfectly appreciated, are still operative. They will be of military value till the end of the war, and after that use will surely continue to be made of them, and central stations will reap the full benefit of the national service which they are now rendering.

The exigencies of war have broken down those barriers of conservatism and hesitancy to incur capital outlay, which have so often in the past kept electric driving from what is technically and economically its own. Once broken, those barriers can never be rebuilt. In quieter days to come, the present experience with electric driving will withstand the most critical analysis, and now that every industry has been compelled to adopt electric driving from central-station supply, its advantages can never again be overlooked. In the meantime the electric motor and the whole of our central-station generating and distributing equipment are proving themselves equal to the most severe conditions ever known in industry, and, let us repeat, without them our present output of munitions would be literally impossible.

Rubber.

There have been a number of fluctuations in the prices ruling for plantation rubber since last writing, but, on the whole, the tendency of the market has been pretty satisfactory from the point of view of holders. Some very good buying has been experienced, mainly, of course, in connection with the supply of tires, and there has been no weight of raw material offering upon the market. The quantities coming to hand have been pretty good, but, as usual, extraordinary delay occurs in discharging, &c., and it is due to this that some difficulty was experienced from time to time in satisfying the demands coming forward from consumers. Under ordinary circumstances it would have been quite easy to satisfy inquiries, but the times are quite abnormal. As the demand tapered off, so the tone slackened, but there is no disposition even now to push sales, especially as rubber, in common with all other commodities which have to be imported, is suffering from the extreme degree of stringency affecting freights. There will probably be some interruption in the supplies reaching the United States owing to the traffic through the Panama Canal being entirely dislocated, and this may, perhaps, cause a diversion of demands from America to this side of the Atlantic, though it may be possible, of course, for vessels held up in the Canal to discharge their cargo and have it forwarded by rail. It is only relatively costly material, however, which could stand such an additional expense. American consumption is naturally proceeding on a very liberal basis, if only because of the huge war orders which have been placed there for motor-cars and tires by the Governments of the Entente Powers, and it is stated that the American automobile makers generally are running at record pressure in all parts of the country, and that the output of cars will mark a fresh high-water mark for this year. Below are given the usual details showing the exports of plantation rubber from the Straits Settlements for this year, with comparisons :—

	1913.	1914.	1915.
	Tons.	Tons.	Tons.
January	784	1,181	2.576
February	743	1,703	2,741
March	898	1,285	2,477
April	762	1,548	1,978
May	814	1,309	3,588
June	812	1,480	2 249
July	1,120	1,584	2,324
August...	1,315	1,325	2 295
September	1,057	1,602	4,725
Total	8,305	13,017	24,953

These figures include transhipments of rubber from various places in the neighbourhood of the Straits Settlements such as Borneo, Java, Sumatra, and the non-Federated Malay States, as well as rubber actually exported from the Colony, but do not include rubber exports from the Federated Malay States.

The position in Germany and Austria appears to be rapidly verging upon the critical. In Germany raw material is very scarce, and superhuman efforts are being made to turn out satisfactory grades of artificial rubber, but without much practical result, while the Government seems to have confiscated practically all the rubber in the country upon which it can lay its hands. In Austria the policy of confiscation has also been developed on a wholesale scale, as regards both raw material and all kinds of finished goods. It is generally believed that both Austria and Germany have placed large orders for crude rubber in neutral countries for importation directly the war is over.

The Electrical Position in China.

For some years past, in the pages of the Electrical Review, many writers have urged the needs of the Chinese electrical and engineering market upon the attention of British manufacturers.

It may be thought that the moment is unpropitious for repeating such advice. Those firms who enterprisingly placed their manufactures permanently on exhibition before the eyes of a continuous stream of Chinese students at Hong-Kong University will undoubtedly have their reward, if they have not actually received some of it already, but it were the height of folly to rest content with that. We commend to the notice of all our readers, and particularly those interested in the development of our foreign trade, the extracts which we publish to-day from an extremely valuable address delivered before the Birmingham and District Electric Club on Saturday last by Mr. W. G. L. Riddle. It would almost seem that notwithstanding all that has been written by expert observers of the situation, the dangers presented by the German activity of the last decade have been practically ignored by many of our own people, who really ought to have been in a position unitedly to put up a strong fight. Authority after authority has told practically the same tale—surely we can, even in war-time, be proceeding to adopt some well-thought-out policy which shall safeguard and extend British electrical interests in this vast territory in the future. Mr. Riddle is an electrical engineer, who looks at the matter through electrical eyes, and he recently returned from China; his advice and warning should therefore be the more readily listened to and acted upon. But what he says as an electrical authority is also said by the Government Special Commissioner, Mr. T. M. Ainscough, whom the Board of Trade sent out to China nearly a couple of years ago. He, too, has returned, and is in London at the disposal, within limits, of British traders, as already announced in our pages. He wants us all to be impressed with the seriousness of German competition in China, but while our wonder-working Fleet cripples German trade there is open to us such an opportunity as cannot recur. Mr. Ainscough's advice, therefore, is to act upon the opportunity that presents itself *now*. After the war China, like many other foreign and Colonial countries, will have immense requirements in engineering manufactures—are not development operations in arrears or in suspense practically everywhere?—and British factories will want to turn present munition workers on to peaceful occupations. Surely the facts of the position make their own imperative appeal to us!

German Stocktaking of Electrical Machinery.

Events now appear to be moving rapidly in Germany in connection with the problem of the supply of copper for munitions of war. A few weeks ago we referred to the protest raised by the leading electrical journal in that country against the expropriation, which then seemed to be in prospect in the near future, of electrical machinery and apparatus used in electricity supply works and power stations, it being contended that the copper used in the roofs of public buildings, church bells, and locomotive tubes should first be appropriated in the place of the former. It is quite possible that the work of stripping in the latter direction has already been carried out, or is in course of execution. If this were not the case it is improbable that we should hear, as was reported from Zurich on October 18th, that the military authorities in Berlin are proceeding to make an inventory of all electrical machinery, transformers and apparatus. All the machinery and apparatus of this kind which are to be found in warehouses or showrooms, and which have not had a dispensation from requisitions for the war, can be sequestrated. Affairs, therefore, are proceeding quickly, and stocks are to be seized before attempting to lay official hands on the plant in generating stations. On the face of it, the report appears to suggest that everything possible in the copper line which could be utilised, or which it would be advisable to utilise, has been removed from Belgium and the North of France; among the inadvisable removals would seem to be the copper used in connection with the tramways employed for military purposes, which, according to reports from Paris, are still running in some places, and, in fact, they are said to have run German officers and soldiers into the Bruges canal, whence the bodies of 114 were recovered a week or two ago. Already the iron and steel, particularly scrap iron, has been to a large extent taken from the occupied districts to Germany, where supplies of scrap from those localities are now expected to arrive in less abundance in the future than hitherto, for use in connection with the production of open-hearth steel. If, then, the iron and steel resources in the occupied territories are becoming depleted—we leave out of consideration the valuable iron ore mines in the basin of Briey, in the east of France, which are being worked by the Germans—how much more probable is it that all the available copper from those districts, which is more urgently needed by the army authorities than iron or steel, has been transferred to Germany, excepting in those cases where generating stations or tramways, as already mentioned, are being worked preferentially for army purposes! Under all the circumstances, affairs are tending in the direction of a gradual exhaustion of the copper resources of Germany, and the lapse of time will merely serve to accentuate this situation, and begin adversely to affect certain branches of industry. Since the foregoing was written, German newspapers have arrived in this country, confirming the Swiss report already mentioned. The official announcement shows that the obligation has been placed upon all owners of electrical machinery, transformers, and apparatus, which are now in stock, or which can be dispensed with during the war, to notify the stocks to the Electrical Machinery Distribution Bureau of the Ministry for War in Berlin by means of the prescribed notification forms. The information had to be furnished by October 25th for machinery and apparatus up to 100 in number, whilst five days longer are being allowed for notifications where the number exceeds 100, so that the whole of the details should be in possession of the army authorities by to-morrow.

A Russian Tax on Electricity.

The question of taxing electrical energy in Russia, which is now seriously occupying the attention of the Government, was agitated as long ago as the eighties of last century, says a Petrograd journal. On the last occasion the proposal was not brought formally under the notice of the legislative bodies, chiefly because industry revived, and there was an abundant harvest, which reduced the necessity for seeking new sources of revenue for the Government. The present altered state of affairs requiring the expenditure of immense sums of money finds the Government obliged, it is stated, to extend taxation to electrical energy. In 1913 the Ministry of Finance collected data throughout the Empire on all electrical concerns then existing, including central and private electric stations. A comparison of these data with those of 1905 shows that during the eight years the electrical industry made excellent progress, and our contemporary says that at the present time it is quite strong enough to bear taxation. We have ourselves already questioned the wisdom of the proposal, but must accept our contemporary's statement at present. In 1913, the total consumption of electrical energy in the Russian Empire could be stated as 2,000 million KW.-hours, of which about 20·5 per cent. was used for illumination and 79·5 per cent. for power and other industrial purposes. The total consumption had increased four times. The tax, according to the new project, affects all electrical energy used for lighting, heating, power, and other industrial requirements, but excluding current used for the Treasury and Government buildings, constructions, and establishments, current obtained from installations the output of which does not exceed 1 KW., current used for illuminating the rolling stock of private railways, or communal railways, and so on. The tax on the energy delivered from central stations is fixed at, per KW.-hour, (*a*) 4 copecks for lighting private rooms, isolated houses and farms, the rooms of factory employés, commercial establishments, theatres, &c.; (*b*) 2 copecks for lighting factory establishments, and workmen's dwellings connected therewith; (*c*) 1 copeck for lighting streets, public places and gardens maintained at the cost of towns or other public bodies, railway station platforms and lines on private railways used for public purposes, &c.; (*d*) ½ copeck for heating, locomotive, and other industrial purposes, not included specifically under *b* and *c*. Electrical energy applied in the household for heating, driving, and other industrial purposes obtained from the system of lighting wires without being measured by special meters is subject to a tax of 4 copecks per KW.-hour. The tax on electrical energy is payable to the Treasury by the owners of stations who on delivering the current to outsiders—that is, subscribers—may transfer the tax to the latter.

A special consultation on the subject of the tax with the participation of representatives of the industry was to be held at the Ministry of Finance a fortnight ago, but we have not yet received any information respecting what transpired.

Wireless Telephony.

As we remarked not long ago, amid the clash of arms, Science placidly pursues her way, hampered undoubtedly by the world-war, but undeterred in her high aims. It is but a few months since we recorded the successful accomplishment of trans-Continental telephony over loaded lines; we now have to congratulate our American friends once more on what may well be regarded as a still more striking achievement—the transmission of speech over a distance of 4,900 miles, without the aid of a connecting wire. But for the war, this country might have shared in the work; certainly we may claim credit for some of the foundation stones upon which the superstructure has been raised, in the work of Sir Oliver Lodge, Prof. Fleming, and Mr. O. W. Richardson. Apparently the factor which has played the leading part in rendering possible this new triumph of science is the principle of thermionic currents, as exemplified in the pliotron, which we described in our issue of May 28th. That was developed by Dr. Langmuir, of the General Electric Co., U.S.A.; but before that time Dr. Lee de Forest had developed his audion, which resembles the Fleming vacuum valve that is so widely used as a receiver in wireless telegraphy. We do not yet know to whom the credit of providing the corner-stone of this great work is justly to be ascribed; but we do heartily congratulate all these gentlemen, and Mr. J. J. Carty, under whom the experiments have been conducted, upon the splendid achievement to which their labours have contributed.

LONDON AND SOUTH-WESTERN RAILWAY ELECTRIFICATION.

(*Concluded from page* 464.)

There are seven frequency changing sets in all, the generator in each case being an open type single-phase alternator, with direct-coupled exciter. They were all supplied by Messrs. Bruce Peebles & Co., Ltd. In three of the sets, the single-phase generator is driven by a D.C. motor, while in four of the sets the single-phase generator is driven by a slip-ring induction motor fitted with the makers' patent short-circuiting and brush-lifting gear. Two of the former class were illustrated on p. 464, these being installed at the power house.

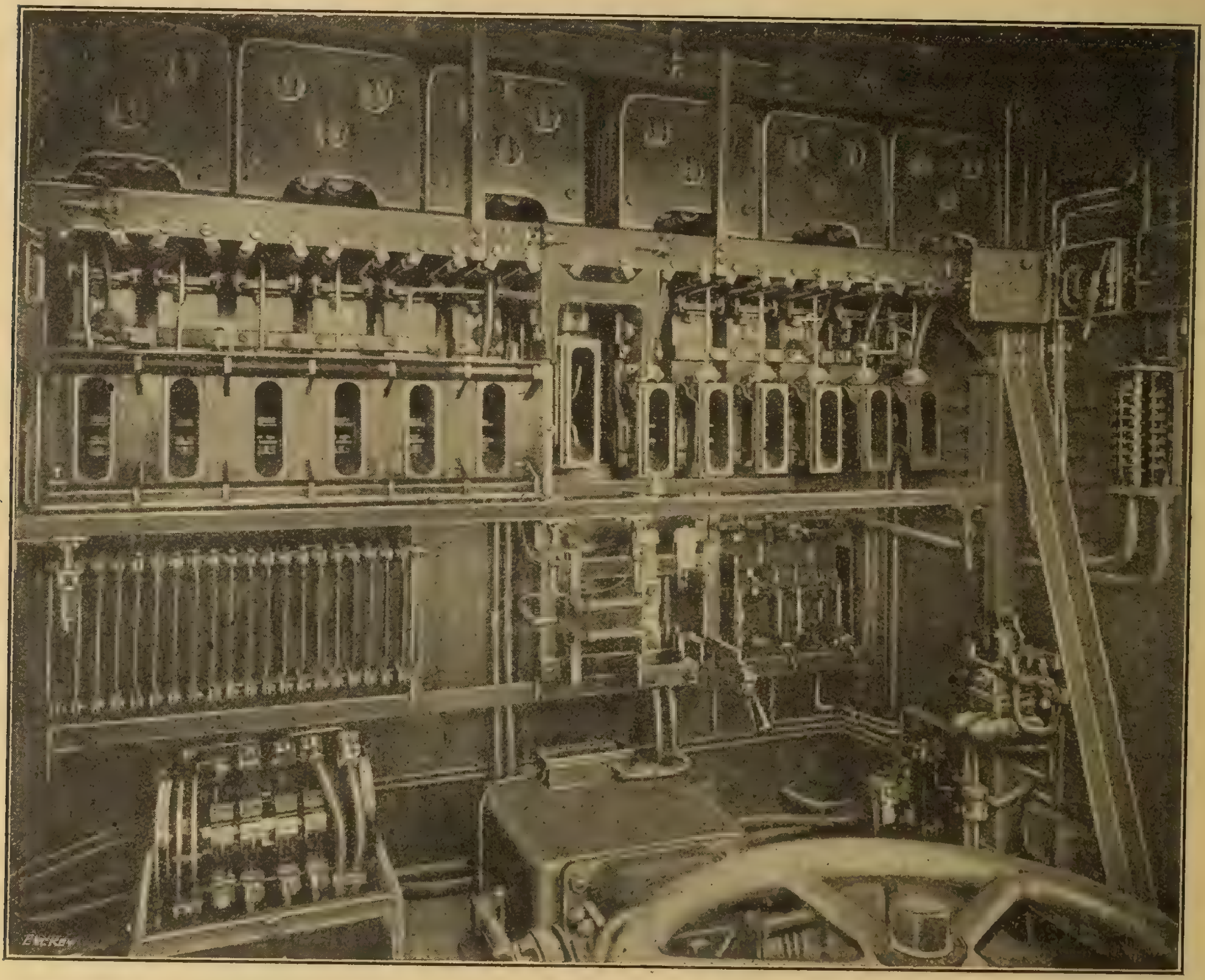
The four sets which are driven by induction motors will be installed respectively at the Raynes Park, Twickenham, Clapham Junction, and Waterloo sub-stations.

The speed of the D.C. motor sets is 900 R.P.M., while that of the induction motor driven sets is 722 R.P.M.

The 3,300-volt feeder cables are 0·05 sq. in., twin-core, paper-insulated, copper-taped, lead-sheathed, wire armoured, and served, and are divided into sections at the transformer chambers, where they are connected to oil switches. These oil switches are fitted with trip coils operated by relays, having operating coils connected to the copper tapes on the cables. In the event of a fault developing on a length of cable, the relays at each end of the defective length come into operation, and trip the oil switches, thus cutting out the length.

A large proportion of the 11,000-volt feeder system is in the form of a ring main, and where duplicate cables are provided in this ring, they are fitted with protective gear consisting of balanced relays, which, in the event of a fault, isolate the length of defective cable at both ends. Duplicate cables which do not form part of the ring main are provided with balanced relays at the feeding end and balanced reversed power relays at the receiving end. Two lengths of single feeder are fitted with Merz-Price protective gear, in connection with which three-core pilot cables have been provided.

The 11,000-volt supply is distributed to nine sub stations, where it is transformed down and converted to continuous current at 600 volts, at which pressure it is delivered to the conductor rails on the track. The sub-stations are situated at Waterloo, Clapham Junction, Raynes Park, Hampton Court Junction, Kingston, Sunbury, Twickenham, Isleworth and Barnes. They contain transformers, rotary converters and the necessary high and low-pressure switchgear. The rotary converters, which were made by the British Thomson-Houston Co., Ltd., are of two sizes, viz.: 1,875 and 1,250 KW., and each of them is supplied by three single-phase oil-cooled transformers.

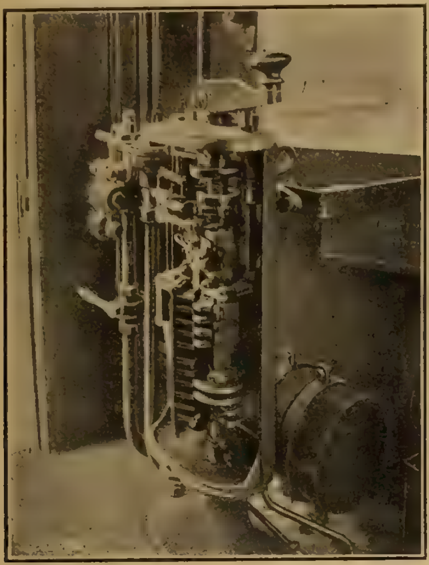


Front View of Contactors in Driver's Compartment, some with Arcing Boxes removed (on the right); Circuit-breaker in centre.

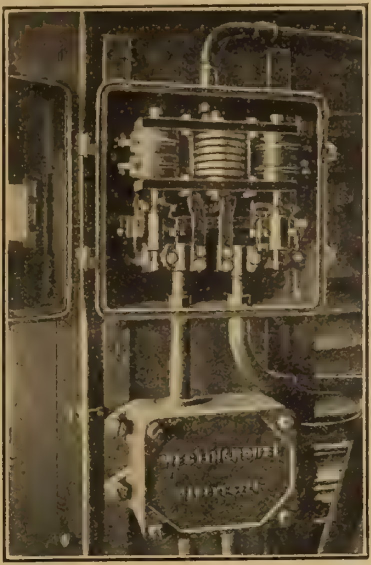
The high-pressure switchgear is completely enclosed in moulded stone cells, and, with the exception that the oil switches are hand-operated, is similar in construction to that installed at the power house. Each of the D.C. feeder panels controls two circuits, each of which has a maximum capacity of 5,000 amperes. The feeder circuit-breakers are equipped with indicating lamps which, when the breakers are open, show the position of the breaker through which the different sections of conductor rail are fed from the next sub-station.

The track work involved in the electrification comprises the laying of a third rail and the bonding of the running rails of about 150 single-line miles of railway.

The conductor rail is laid at one side of the track 16 in. from gauge, and 3 in. above rail level; it is of special high-conductivity steel, and weighs 100 lb. per lineal yard. The resistance is approximately $6\frac{3}{4}$ times that of copper of equal cross section. The rail is bent down at the ends to form the ramps, and is bonded at the joints with four copper bonds having a total cross-sectional area of 1·4 sq. in.



Master Controller, open.



Automatic Relay.

The jumper cables connecting adjacent lengths of conductor rail at crossings and other points where it is necessary to have a gap in the rail, are of 1 sq. in. sectional area, and are made up of 127 0·101-in. diameter copper wires insulated with rubber, bitumen sheathed and braided.

Contactors seen from the rear, showing the Interlocking Switches.

All the low-pressure rubber and bitumen feeder cables from the sub-station to the track, together with all the jumper and cross-bonding cable for track work, were made and laid by Messrs. Chas. Macintosh & Co., Ltd., who also manufactured and supplied all the lighting and control cables used in connection with the rolling stock.

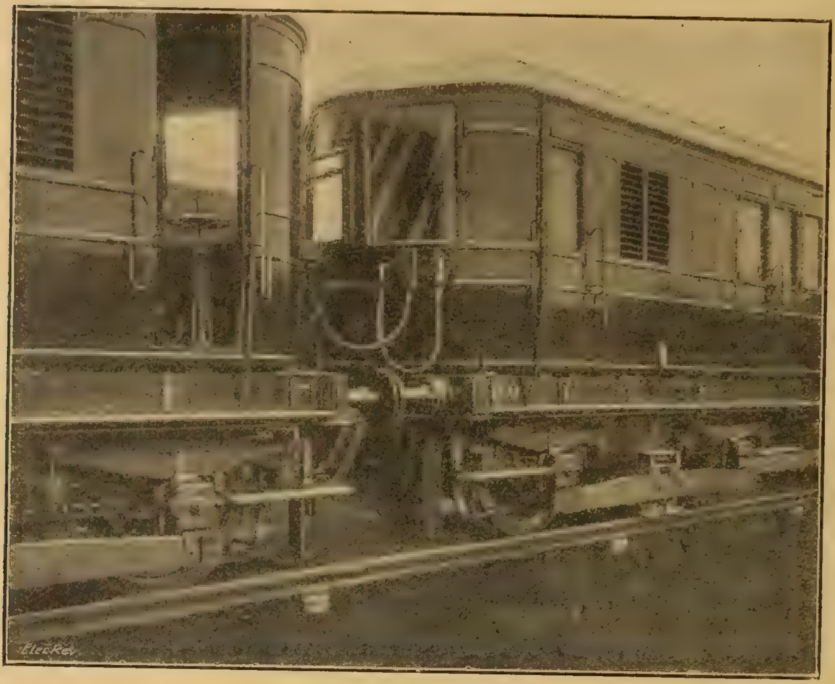
The return circuit is formed by the running rails, the joints of which are bonded with two copper bonds of the protected type placed under the fish-plates. These bonds are made up of copper strips, and have a total cross-sectional area of ·33 sq. in.

The rolling stock consists of 252 51-ft. compartment-type coaches which were until recently used in steam service and have been converted for electrical working. The stock is made up into permanent sets of three coaches, and is equipped with multiple-unit control, so that trains may be formed of one or two three-coach units in accordance with the requirements of the traffic.

Each three-coach unit has a motor bogie carrying two motors under each end, weighs 94 tons unloaded and seats 190 passengers. The motors have been specially designed to meet the requirements of the service, and are each rated at 275 H.P. on the usual traction motor basis.

The control equipment is of the relay automatic type in which the rate of acceleration is governed by a relay. The relay is controlled partly by the motor current, and partly by a dashpot time lag. Marks will be fixed on the line to indicate to the motormen when to shut off current, and this, in conjunction with the automatic control of the rate of acceleration, will enable the most economical method of running to be adopted.

The motors run at 590 R.P.M., and are geared 21/59 on standard $42\frac{1}{2}$ in. driving wheels. All the electric control gear is placed in the driving compartments at opposite ends of the unit, each pair of motors being controlled by its own set of control gear. The arrangement of the control gear in the driver's cab was decided upon by the railway company's engineers in preference to having it underneath the coach, on account of the greater ease of access for inspection, cleaning and adjustment. The positions of the individual pieces of apparatus have been carefully arranged with this end in view. Access to the control apparatus is obtained on the one side from the driver's compartment and on the other through large hinged doors in the partition between the driver's and luggage compartments. There is an advantage in placing the control apparatus in the driver's cab, in that the weight of this apparatus comes over the driving bogie, and so increases the adhesive weight on the driving wheels.



Coupling between two Three-coach Train Units.

We give herewith views of the control apparatus from front and rear, of the master controller, and of the automatic accelerator. Another view shows one of the motor trucks, together with the interior of the car depôt, which adjoins the power house.

The motors are of the totally-enclosed type, with commutating poles; the field poles are laminated, while the interpoles are made solid and have a special shape of tip. Spring washers are used in both cases to keep the coils firm in their places and to prevent chafing due to vibration.

A fan is provided on the armature for air circulation on the axial system; air drawn through openings in the commutator spider and armature core passes through the fan and back between the field coils, and over the armature and commutator. Openings to the atmosphere are not provided, the whole of the cooling being done by radiation from the case, but the circulation of air ensures even temperature throughout the motor.

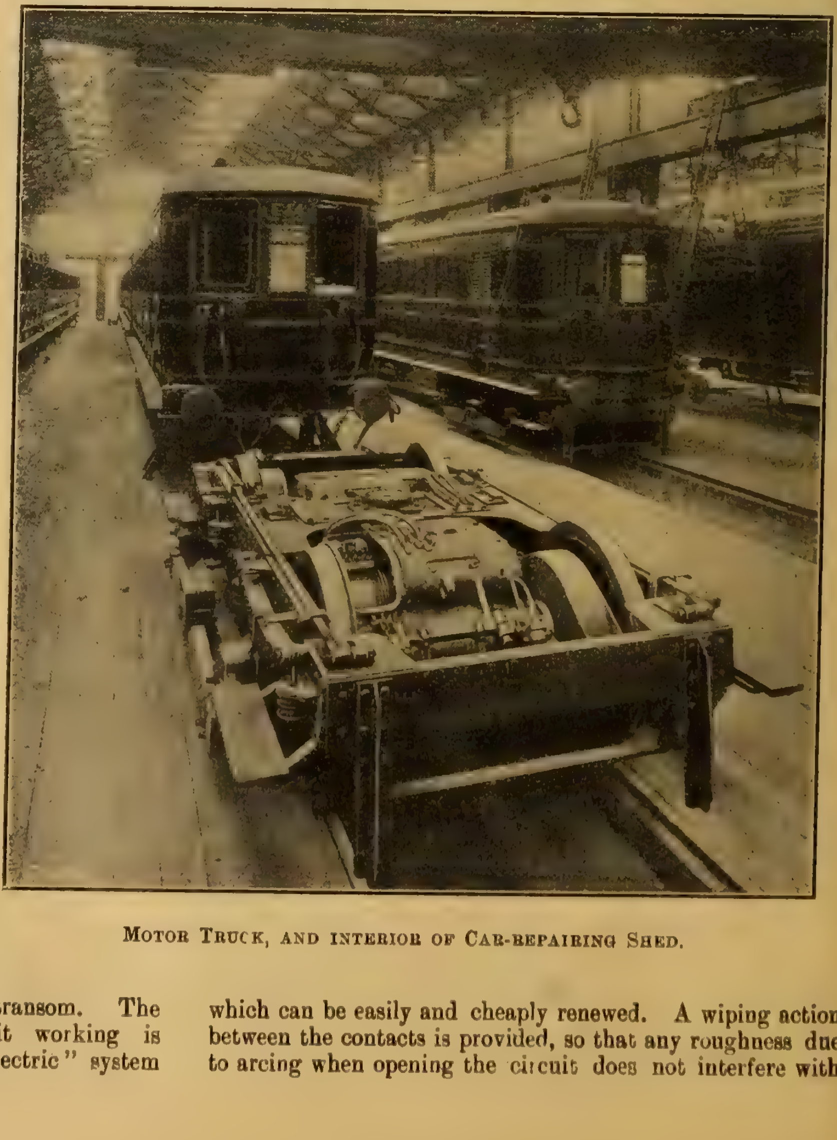
The lubrication of all bearings is effected by means of long fibre wool waste, which siphons the oil up to the bearings and provides a continuous and automatic supply. A separate oil reservoir permits the fresh oil to be fed and filtered up through the waste to the bearings, and suitable oil wiper rings and guards prevent the oil from the bearings getting into the motor casing. The oil thrown from the wiper rings passes to a waste pocket of ample capacity in the bearing housing from which it may be drawn off periodically.

The motor casing is carried by a suspension bracket, which is supported through rubber springs from the truck transom. The control of the trains for multiple unit working is effected by the Westinghouse Co.'s "All Electric" system of automatic relay control. In this system the motor current is handled by a suitable number of electrically-operated contactor switches, the operating coils of which are connected to control wires running throughout the length of the train, and actuated by six small motor controllers. The contactors are provided with interlocking switches connected in their operating circuits, to ensure the correct sequence of changes in the connections.

The motor equipment on each coach is controlled during the accelerating periods by its own relay, which is independent of the other relays on the train; hence the motors on the different coaches are notched up in accordance with their individual requirements, which are, in a measure, dependent upon the diameter to which the wheels may be worn and the slight inherent differences in the characteristics of the motors. This system, therefore, helps to equalise the load on the different motor coaches and gives a low energy consumption.

With this system the master controller becomes a very simple piece of apparatus, and this is important, because it is the only piece of apparatus handled by the drivers, who are generally non-technical men. The operation of the controller is extremely simple, the driver having merely to move the controller right round to the full "on" position, and the relays automatically do the rest.

Powerful magnetic blow-outs are fitted to all pieces of apparatus where there is a possibility of arcing when breaking current. The arcing tips are of hard-drawn copper, which can be easily and cheaply renewed. A wiping action between the contacts is provided, so that any roughness due to arcing when opening the circuit does not interfere with



Motor Truck, and interior of Car-repairing Shed.

the contact surface when the switch is in the closed position. Each contactor and circuit-breaker is carried by a pressed steel plate clamped to mica-insulated steel tubes, which are fixed to two channel irons running the full length of the switch group. This method of construction is light and strong, and has the necessary flexibility to withstand vibration. It also renders the withdrawal and replacement of a contactor switch an extremely easy matter.

The interlocking switches mentioned above are fixed at the back of the contactor switches, and are operated by a lever from the movable core of the contactor solenoid, thus ensuring a definite position of the interlocking switch, corresponding with a definite position of the contactor. These interlocking switches have been most carefully designed with a view to ready inspection, renewal and withdrawal when necessary. The smallest possible number of different parts is used in the construction.

The frame carrying the contactor switches forming the motor-car group lies across the width of the coach in the driving compartment. It also carries the necessary motor-starting resistances, and the main fuse above the contactors. The motor resistances are of the usual three-point suspension grid type, mounted on mica-insulated tie-bars fixed to pressed steel end frames, giving a strong and rigid construction.

Views of the back and front of the switch group are shown herewith, from which may clearly be seen the interlocks at the backs of the switches, and the arcing tips and arcing boxes at the front of the group. The circuit-breaker is similar in construction to the contactor switches, and may be seen in the middle of the group. It is provided with heavy laminated brushes in addition to the contact jaws, and adjustable overload and trip coils.

The reverser is of the drum type. The drum castings are clamped to mica-insulated shafts provided with heavy copper contact segments. The fingers are made with renewable tips, and provided with swan-neck finger springs and heavy copper shunts. The finger bases are clamped to mica-insulated bars. The interlocking of the control circuits for operating the reverser is effected by an additional contact drum attached to the main spindle, so that a fixed relationship between the making and breaking of the main control circuits is obtained. A powerful magnetic blow-out is provided for the interlock fingers, which are identical with the swan-neck fingers used in the master controller.

The master controller is of the drum type, and is provided with both main and reversing handles, so interlocked that the reversing handle must be in either the forward or the reverse position before the driver can operate his controller. The main handle embodies the "dead man" feature, the arrangement being such that in the event of the driver releasing the handle the supply of control current is interrupted, thus opening all the main contactors, and the brakes are automatically applied. Should the driver allow the handle to move upwards at any time, he must bring the operating handle to the "off" position again before he can release the brakes. When coasting and when making ordinary service stops the driver moves the main handle to the "off" position and keeps his hand on the handle, thereby preventing the interruption of current and the automatic application of the brakes.

The main handle of the master controller has four operating positions:—The first position, usually called the "switching" position, gives series connections to the motors with all resistance in circuit; the second position brings the automatic relay into operation, and the resistances are cut out of circuit step by step until full series is obtained; the third position connects the motors in parallel, the well-known bridge connection being used in passing from series to parallel; the fourth position brings the automatic relay into operation again, cutting out the resistance step by step until full parallel is obtained. It is unnecessary to pause on each notch of the controller until the corresponding motor connections are completed; the handle may be moved directly to either the series or parallel position, when the control apparatus automatically notches up step by step until the position is reached corresponding to the particular notch on which the handle is placed.

The starting current, and therefore the rate of acceleration, may be adjusted by means of the setting of the automatic relay; this relay consists of three coils, two of which have movable plungers fitted with copper disks for bridging contacts in the control circuit, the three coils having a common magnetic circuit. The two coils which have movable plungers are connected in the control circuit, and the third coil is a heavy-current coil connected in the motor circuit. The function of the two coils in the control circuit is to lift the short-circuiting copper disks and thereby open one of the control circuits, the disks being held up until the motor current in the series coil has fallen to the pre-determined value for which the relay is adjusted. The contacts in the relay are never used for breaking circuit, and are, therefore, not liable to cause trouble by burning.

The construction of the control apparatus throughout is of non-inflammable material, and the whole of the insulation is of mica.

Practically all the wiring is in the driver's cab, and the connecting train wires and through shoe cable are fixed on the roof of the coach so as to be quite out of reach of unauthorised persons.

The lighting of the compartments has been the subject of very careful study by the railway company's engineers, and a suitable and tasteful fitting has been adopted. The coaches are heated by electric radiators suitably grouped in the various compartments.

The Westinghouse brake used on the electric trains employs cylinders 12 in. and 14 in. in diameter, and the triple valves are of the newest design, which passes on the operation of the driver's brake valve to the rear of the train by a quick serial movement, resulting in the almost simultaneous application of the brakes on a train 600 ft. long, which ensures a smooth and efficient brake service.

The air is supplied to the brake system by small compressors direct-driven by low-speed motors, one of which is placed in each motor-car. The action of all these compressors on a train is controlled by a master governor and switch, which produces uniform compressor labour throughout the train, as all compressors start and stop simultaneously. This arrangement is known as the Westinghouse Governor Synchronising System.

The work on the permanent way has consisted for the most part of the equipment of the existing tracks for electric traction; but a fly-over junction has been constructed at Hampton Court Junction to prevent the crossing of the new electric trains on the level. The new piece of line, which is 1½ miles in length, includes a steel girder bridge of 160-ft. span, which carries the track for the electric services over the existing line at the junction, and which is the longest single span bridge on the London & South-Western Railway. The work also includes two brick arch viaducts 330 and 100 yards long respectively, as well as several road bridges. The whole of this work is now completed.

The week-day train service arranged for between Waterloo and Wimbledon, which began on Monday last, provides trains every 20 minutes from about 6 a.m. to midnight. The new schedule, though all trains serve every station on the route, involves a considerable acceleration upon the times hitherto in force, the journey from end to end being reduced from 31 to 24 minutes.

In view of the fact that steam trains were relatively infrequent on this branch, often an hour or more apart, residents of the East Putney, Southfields and Wimbledon Park districts will benefit considerably.

The schedule time between Waterloo and Teddington will probably be reduced from 50 to 33 minutes.

New Electrical Manufacturing in Sweden.—According to notices in the Swedish Press, the L. M. Ericsson Co., of Stockholm, which has hitherto been more closely associated with the manufacture of telephonic apparatus, has lately commenced the production of electric signalling apparatus for railway block systems. This type of machinery has hitherto been mainly imported into Sweden from Germany, and it is expected that the new departure will render the country independent of foreign manufactures.

ELECTRICITY EXTENSIONS AT STEPNEY.

The modern generating station of the Stepney Borough Council, which is situated on a riverside site at Limehouse, was first brought into use in the autumn of 1909. The various plant additions made since that date, in order to cope with the rapid electrical development of the East London area, soon filled the original buildings, and, as far back as 1912, Mr. W. C. P. Tapper, the borough electrical engineer, in a report advised the doubling of the station buildings, and immediate installation of turbine, boiler and auxiliary plant, at an estimated cost of nearly £138,000.

This scheme of extension has now been carried out, and, as briefly recorded in our last issue, was officially inaugurated on a recent date.

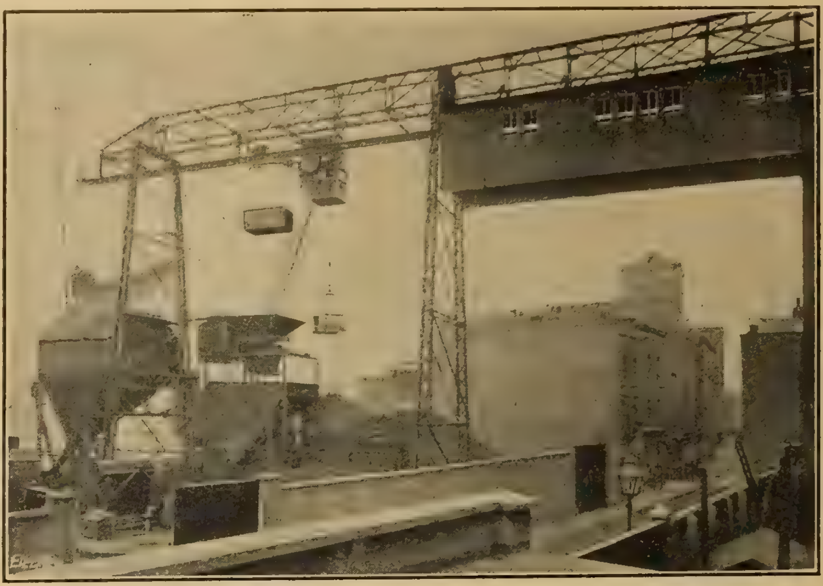


Fig. 1.—Coal Wharf and Electrical Telpher; also Screen for Condensing Water.

The buildings have been extended at their northern end by the addition of three ferro-concrete bays (two of which are occupied by the new plant), and comprise an engine room and switch-gallery section, with basements; a boiler house section, with overhead coal bunkers, and an ash basement. The width of the building remains approximately the same as before, viz., boiler house 63 ft., engine room 46 ft. 10 in., and switch gallery 19 ft. 6 in., but the heights have been somewhat increased, the boiler house by some 15 ft. to 19 ft., to allow room for a double telpher track for coaling the bunkers, and for the hot-air economisers, draught fans and motors, and the engine room by 15 ft., to accommodate larger condensing plant and allow for the handling of a 50-ton electrically-driven overhead travelling crane.

In the boiler house the new equipment consists of four water-tube boilers of Messrs. Howden's make, built for a normal evaporation per boiler of 33,000 lb. of water at 150° F., to steam at 200-lb. pressure, with a heating surface of 6,700 sq. ft. and 190 sq. ft. of grate area. Each boiler is in six elements with upper and lower drums connected

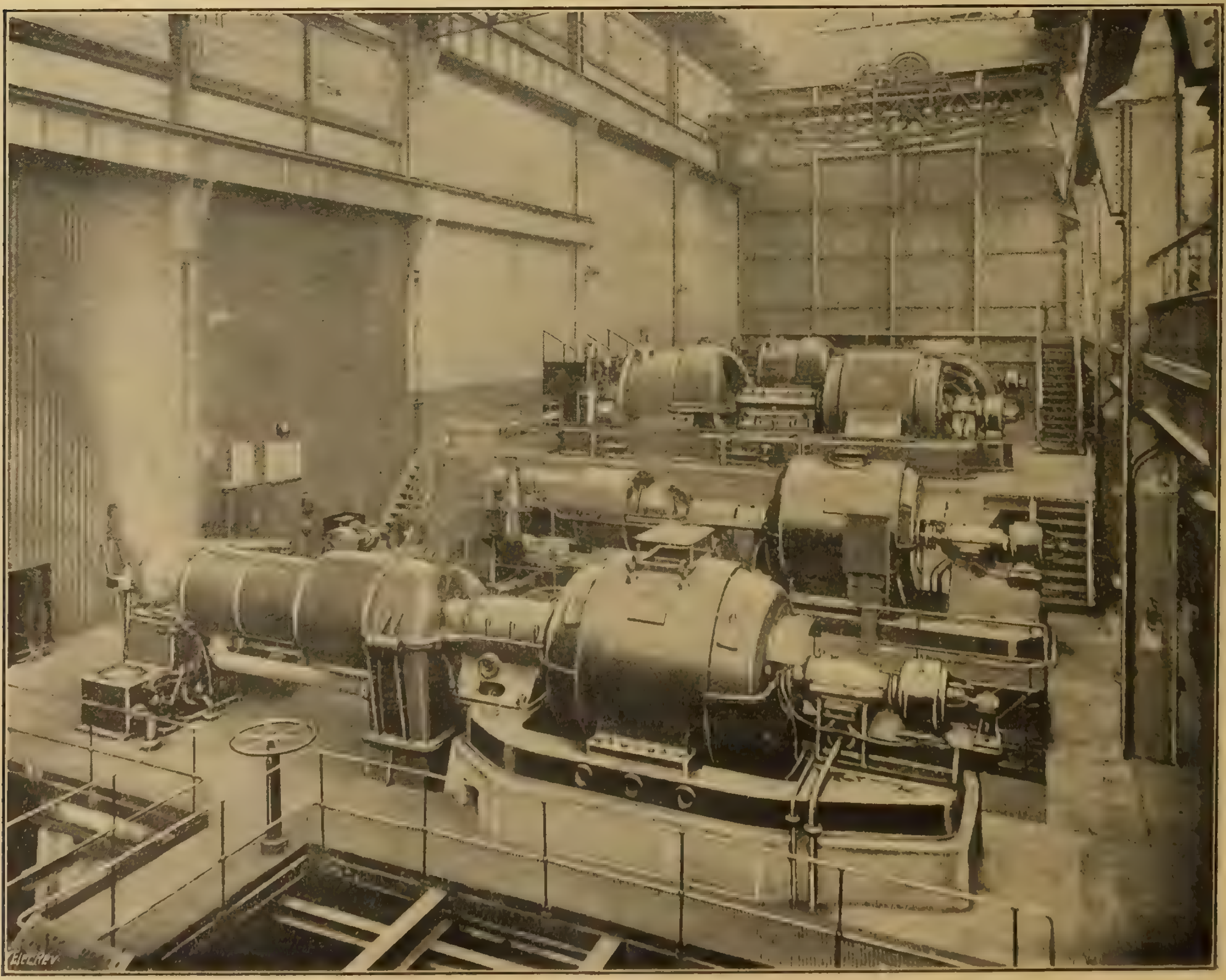


Fig. 2.—Interior, Limehouse Generating Station, showing the New Turbine Plant in the distance.

gether with about 6,700 2-in. vertical tubes, and the ecessary balancing water and steam pipes between the ums; each element is provided with a safety valve, and ere are two feeds to each boiler, while each boiler is fitted th internal superheaters.

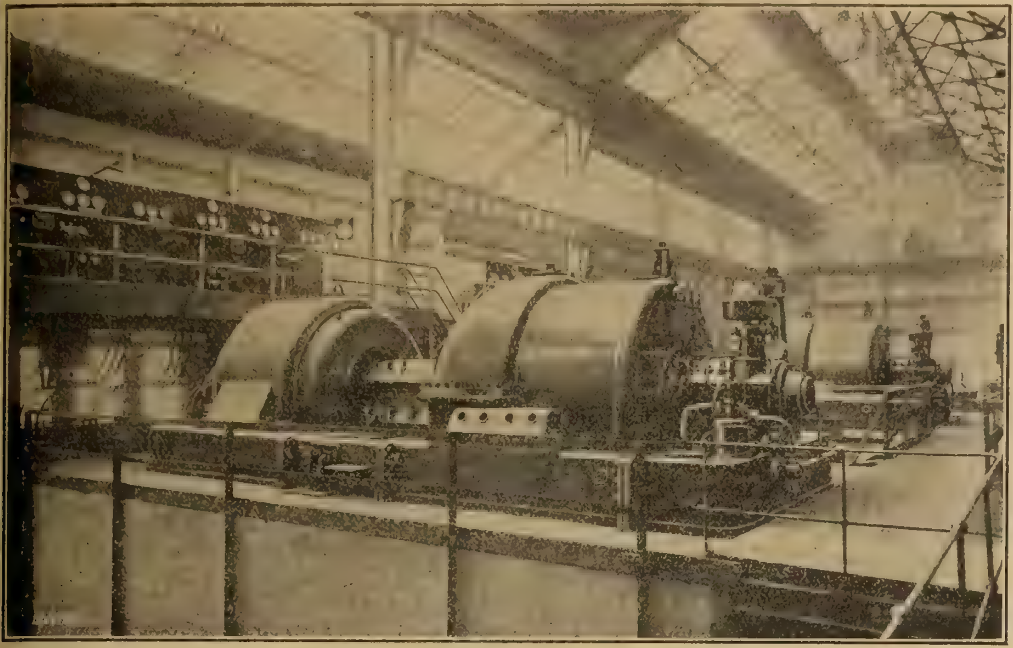


Fig. 3.—5,000-kw. Escher, Wyss—Brown, Boveri Turbines, Limehouse Generating Station.

The stokers (two to each boiler) are of the Underfeed).'s moving-grate type, and are worked in conjunction with eir hot air economisers, forced draught and Prat patent duced-draught chimneys, with the object of obtaining as early as possible a balance draught at the stoker grate vel; the economisers, two to each boiler, are placed in the e immediately above and under the chimney. Each iler is equipped with t induced-draught n and forced-draught n, mounted close to e base of the Prat imney, and is provided with a gauge ord with the following ten instruments:—eam gauge, two perheat gauges, the rced-draught motor nmeter, shunt regulor and draught uge, the induced-aught motor ameter, shunt regulator, d draught gauge d the balanced aught gauge, thus abling the stoker to ep the working contions of the boiler ways under observaon. The stoker drive suspended on the der side of the iler-house floor and erates patent spring utch gear to give otion to the grates.

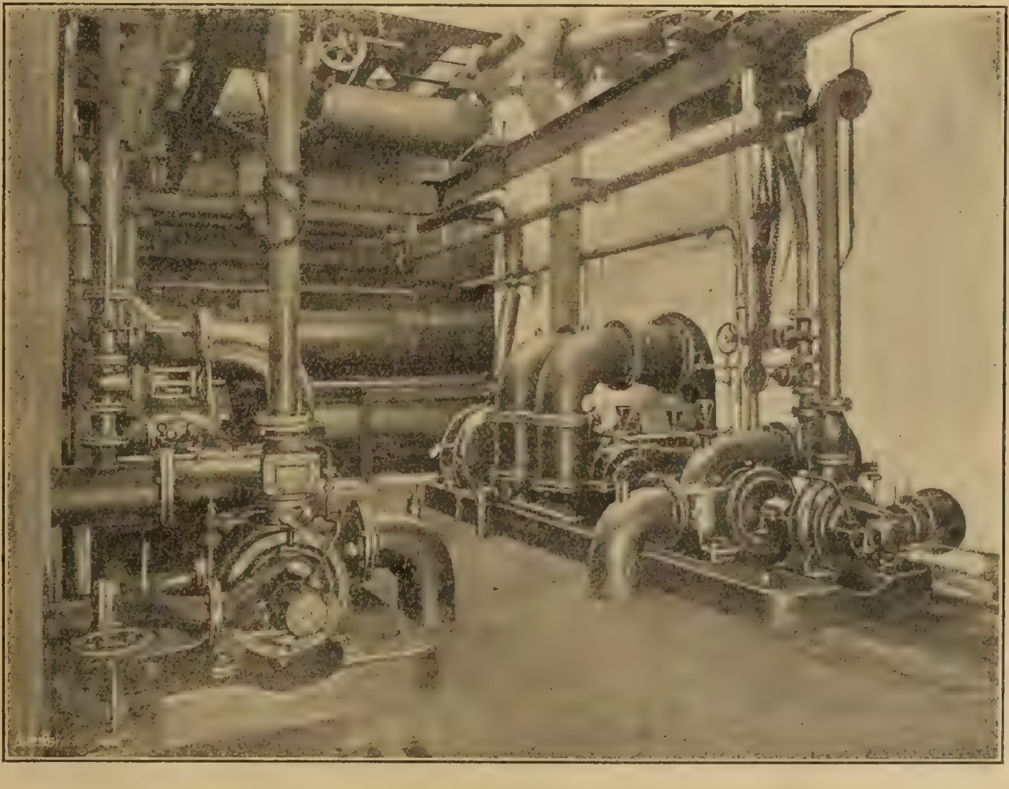


Fig. 4.—View in Basement, showing Steam Turbine-driven Pump Sets for Condensers.

The ash-handling r the four new ilers is carried out on the lines of the original plant by eans of hoppers under each furnace emptying into ovable runabout skips, these latter being conveyed by eans of the telpher to the ash hopper upon the wharf edge.

The coal-handling plant extension consists of a double ono-rail telpher track running over the tops of the coal bunkers, and one track extends for 20 ft. into the yard at the north end of the building; this is coupled up to the original single mono-rail track, and was supplied by Messrs. Strachan & Henshaw in order to cope with the increasing coal supplies, and to ensure continuous working in the event of a breakdown to either of the telpher machines.

For handling the coal stock at the north end of the boiler house a 3 ton electrically-driven jib crane, manufactured by the Chatteris Engineering Works Co., has been erected, with a maximum working radius of 45 ft. A coal-receiving and discharge hopper is provided in the yard at the end of the telpher track. It might be mentioned that this crane is mounted upon a travelling undercarriage, 10 ft. high, with a view to its being used later on the river wharf. When working in conjunction with a Priestman's grab it is capable of dealing with 40 tons of coal per hour.

A Weir steam turbine-driven feed pump of 10,000 gallons per hour capacity has been added to the boiler feeding plant, the exhaust steam being turned direct into the hotwell overhead through a kinetic heater.

The extension of the engine room consists of two 5,000-kw. Escher, Wyss turbines of the Zoelly impulse type, coupled to two Brown, Boveri three-phase alternators, generating at 6,600 volts between phases and 50 periods. These sets are capable of generating 25 per cent. overload for two hours and 50 per cent. overload for half an hour, running at a speed of 1,500 r.p.m. They operate on steam at 180 lb. at the stop valve, temperature 500° F., and the specified full load steam consumption at unity power factor is 13·31 lb. per KW.-hour, subject to a tolerance margin of 2½ per cent.

Cooling air is supplied to each machine through sheet-iron ducts by a Heenan and Froude air filter, of 25,000 cb. ft. per minute capacity. These filters are placed in the basement, and the necessary water supply for them is led from the condensing plant.

The surface condensers, placed immediately below the turbines, each have 10,760 sq. ft. of cooling surface, with a wrought-iron cylindrical shell, and each is provided with a steam-driven pumping set, consisting of a steam turbine driving a circulating water centrifugal pump, rotary air pump, condenser extraction pump and hot well force pump, in tandem, at a speed at 2,000 R.P.M.

The exhaust steam from these auxiliary turbines can be turned either into a stage of the main turbine or into the hot well by means of a Holden and Brooke kinetic heater, thus, in the latter case, regaining the latent heat units of the steam. Either condensing plant can be used with either turbine, or, in case of emergency, both turbines could be run on reduced loads upon one or other of the condensing plants; an alternative atmospheric exhaust is also provided.

A 50-ton Stothert and Pitt electrically-driven overhead crane has been provided for the engine-room extension. This is equipped with three motors, each running at 700 R.P.M., for lifting, travelling, and hoisting respectively.

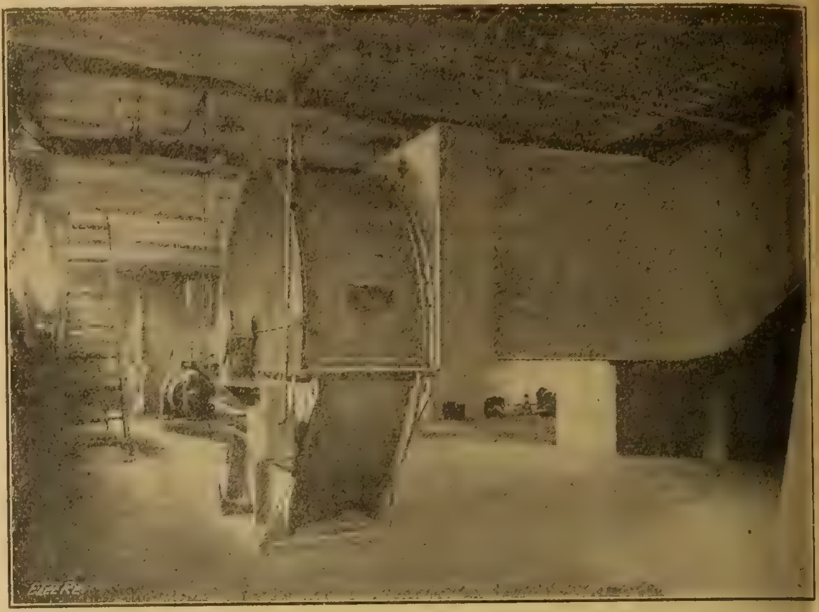


Fig. 5.—Air Filters and Trunks to Turbo-Alternators.

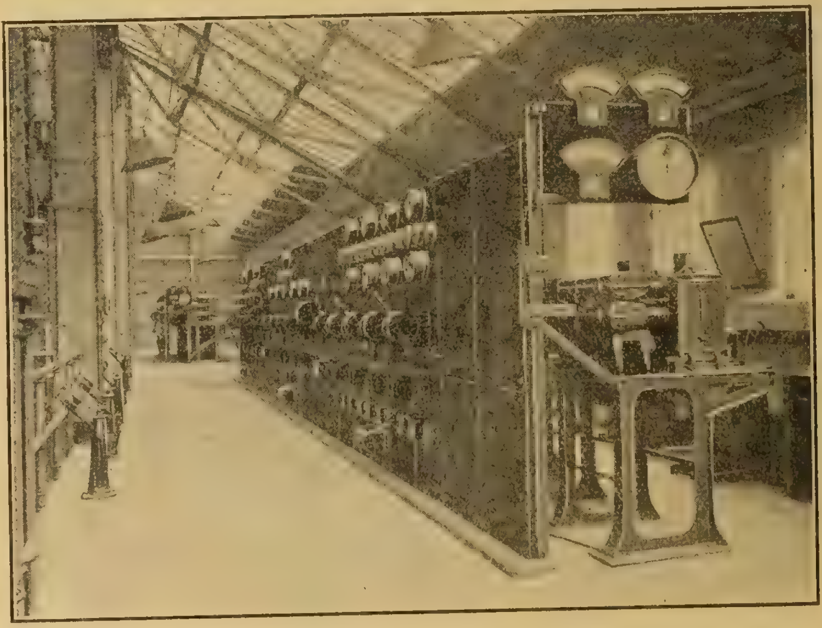


Fig. 6.—General View along Switch Gallery, Limehouse Generating Station.

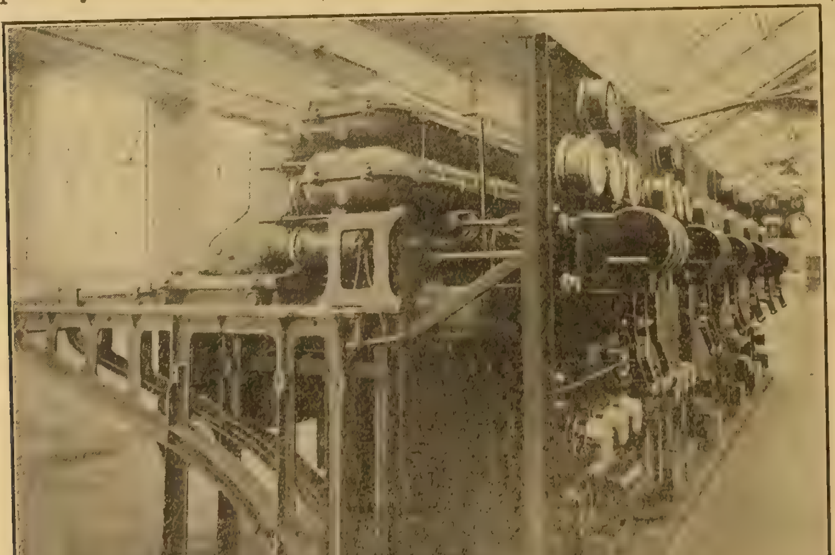


Fig. 7.—Reyrolle E.H.T. Ironclad Switchgear Extension.

Between the tw
5,000-KW. altern
tors, a Bru
Peebles 1,000-K
motor converter h
been intalled, whi
is similar to tho
which have be
in operation f
some years in t
generating stati
and sub-stations.

The whole of t
necessary pipewo
together with
valves, cocks, sep
rators, traps, la
ging, and fixin
have been provid
by Messrs. Babco
and Wilcox, Ltd
practically t
whole of the stea
exhaust and dr
pipes are confi
to the boiler-ho
section, and
river water pipes, cold water pipes,
pump discharge pipes are in the engi
room basement; the steam traps
of Messrs. Alley & MacLellan's make.

In order to secure greater safety in
running of the motor-driven auxili
plant, alternator field excitation
pilot lighting of the station, a
battery of 260 cells has been instal
with a combined battery-booster
feeder-booster of Messrs. Sieme
make, together with the neces
switchgear, for charging purpo
Under normal conditions the battery
be floating across the main D.C. bus-b
but should the main bus-bar su
from any cause fail, or the pressure
abnormally, the rush of current f
the battery brings out a pair of th
way overload breakers, one in the posi
side and one in the negative side of
system, instantaneously cutting
battery off the bus-bars and leavin
on the auxiliary power circuit.
addition, should the motor of the bo
set be cut off from the supply, and a

the boosters to race upon a weak field, change-over switches are operated by a pair of relays coupled across the brushes of the motor, thereby cutting out the boosters.

An additional works power board by the G.E. Co. has been erected in the new engine room to control the additional motor circuits.

The switchboard gallery has been extended, and six panels of Messrs. Reyrolle's new extra-high-tension ironclad gear have been installed there, together with the rheostat regulating gear for the alternator fields. The above gear includes two machine switches, two bulk supply panels and two coupling switches. Following upon the original lines there are duplicate three-phase bus-bars, the section of each bar being 1 sq. in. The switches are contained in boiler plate tanks, with cast steel tops.

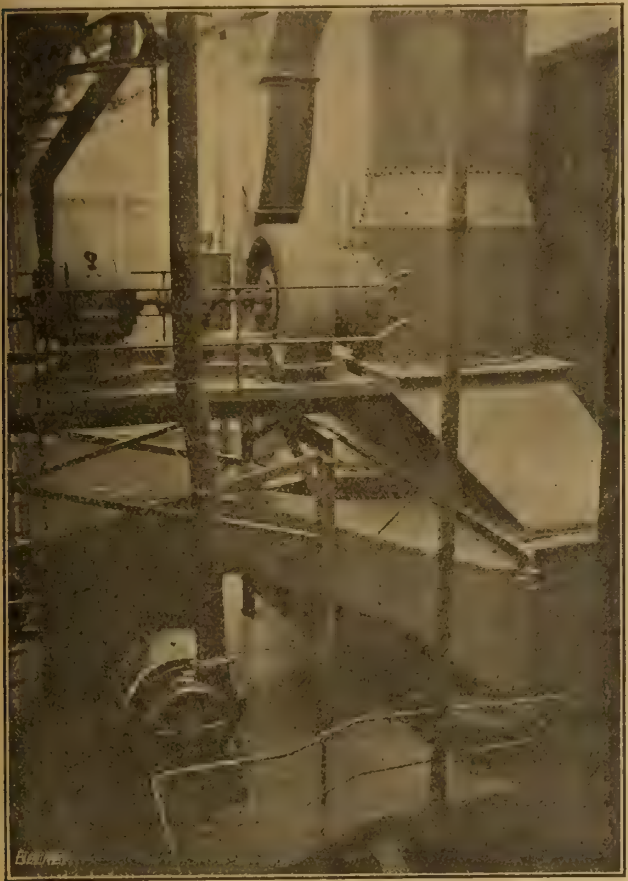


Fig. 8.—Forced and Induced Draught Fans, Boiler House, Limehouse Generating Station.

The whole of the circuits to and from the switchgear are protected with Merz-Price protection. In addition, the generator panels are provided with rotary type field switches with an electrical interlock between them and the main switch, which prevents the field switch from being opened before the main switch, and provides for the automatic tripping of the field switch when the main switch operates, and ensures that the field switch is closed before the main switch. The fields of the exciter are separately excited at 240 volts from the L.T. direct-current supply. The panels are also provided with all the necessary synchronising sockets, signal lamps for "switch on" and "switch off," power factor indicators and open-dial type ammeters and wattmeters for each phase.

A Brown, Boveri automatic field regulator has been furnished for each alternator, and an electrically controlled governor switch for each turbine to regulate the speed direct from the gallery. The coupling switches are for the control of the cables running between the bus-bars of the new board and the bus-bars of the old board. Upon the old board are also inserted two coupling switches, one in each bus-bar. In order to provide space for these latter switches in the old board, various panels and circuits had to be rearranged, including the two Poplar bulk supply feeders. These latter have now been transferred to the new board and provided with the new type extra-high-tension switches, thus securing a switch of larger capacity. All the above necessary alterations have been carried out by Messrs. Reyrolle, who have also supplied the additional D.C. panels.

In order to cope with the increase of load and the bulk supply demands from Shoreditch and Bethnal Green, the following additional feeders, converter and switchgear have been provided:—Two 1,500-KW. E.H.T. feeders from the Limehouse generating station to the Whitechapel sub-station; two 1,500-KW. E.H.T. feeders from the Whitechapel sub-station to Shoreditch; and two 1,500-KW. E.H.T. feeders from the Whitechapel sub-station to Bethnal Green.

All these feeders have been provided with pilot cables for Merz-Price protection gear, and E.H.T. Reyrolle switchgear has been added to the respective sub-station switchboards to control these feeders.

At the Wapping sub-station an additional 1,000-KW. Bruce Peebles motor converter has been installed; the three-phase E.H.T. machine and the two D.C. machine panels complete were erected under Messrs. Reyrolle's contract.

In addition to recently installed plant, the Limehouse station also contains four smaller turbine sets, one being a Parsons tandem direct-current machine, while the others comprise three Peebles three-phase turbo-alternators coupled to Parsons and Willans turbines, the total capacity of this plant being some 6,500 KW. Including the new motor-converter set, to which reference has been made, there are now three 1,000-KW. Peebles machines, and one smaller set of this type in the station.

Practically the whole of the main switchgear is of the Reyrolle ironclad type, as shown in one of our views, in which the new E.H.T. gear is shown in the distance. The boiler house, in addition to the new boilers, contains seven marine type boilers by Babcock & Wilcox, and Danks.

In recent years the supply of electricity in the borough has developed very rapidly, particularly the power demand, in which connection statistics show that at September 30th, 1911, there was 9,987 H.P. of motors connected to the mains, while at September 30th last, this figure had grown to 21,623 H.P.; moreover, the output generated has more than doubled in five years, and during the last official year's working amounted to 21,064,463 units, of which 18,757,000 units were sold.

In addition to supplying the area of the borough, the Council is giving a bulk supply to the Shoreditch Borough Council, and will, in the near future, be similarly supplying the Bethnal Green Borough Council; at the same time, the reciprocal supply arrangements between the Stepney and Poplar Councils is in operation, and thus a large section of East London will be supplied with electricity from the Limehouse generating station.

In conclusion, we are indebted to Mr. W. C. P. Tapper, the engineer and manager, for assistance in the preparation of this article.

The Russian (1886) Co.—On October 3rd, says a message from Moscow, the Governor of the town, M. V. Chelnokoff, returned from a visit to Petrograd, where he had been to see the President of the Council of Ministers, the Ministers of Trade and Industry, and Finance, and others, on the subject of the liquidation of the Electric (1886) Lighting Co. He submitted an application of the Moscow Town Council to the President of the Council of Ministers, who replied that this question would be carefully considered at one of the early sittings of the Council; but that it was difficult to foresee what the result would be, for in this question financial circles of neutral countries were interested. Most of the shares of the company were in the hands of Swiss banks. The Minister of Trade and Industry appeared chiefly interested in the question of the recent prohibition of the Moscow Council, preventing the company using the current from Bogorod for the requirements of the town. Recognising the town's undoubted right to prohibit the delivery of Bogorod current into the town system, the Minister at the same time considers that the town should take into account the circumstances of the moment, and the general shortage of fuel. English coal is not being received at present. The Dombroff coal fields have been seized by the enemy, and the transport of coal from other fields is difficult. The company serving the town system has to use six wagon loads of petroleum per day; but the transport of the petroleum is difficult, and the price is very high. Meantime the Bogorod station has 11,000,000 poods of turf ready which should be used, because during the winter time it will become moistened and will deteriorate. Thereupon M. Chelnokoff stated that the question of prohibiting the admission of the current was already finally decided by the Town Council, and he was powerless himself to vary the decision. The Minister of Trade agreed with this view of the Governor, and said he would address the Moscow Town Council in a special communication asking it to vary the decree.

THE ELECTRICAL TRADE POSITION IN CHINA.

Mr. W. G. L. Riddle began his address to the Birmingham and District Electric Club on October 23rd by thanking members for their cable, received at Shanghai on New Year's Eve, informing him of his election to the presidential chair. He took as the theme of his address his visit to the Far East. The majority of his time in China was spent in Shanghai, which was the foremost commercial, industrial, and shipping centre of Asia. Shanghai had every cause to be proud of its progress as shown by the marked improvement in, and the gigantic dimensions of, so many of its constructional works, by the completion of its electric tramways system, its electricity supply system, and the various railroads which connected practically all China with Europe. In addition to these, there were the dockyards, shipbuilding, and engineering firms, all of which indicated progress in the right direction. There were 24 different nationalities represented in the one small municipality—the International Settlement. Mr. Riddle went on to refer in particular to the Shanghai electrical undertaking, its peculiar position, and the electrical trade generally in China.

He said that Germans were the greatest competitors in the electrical engineering trade in China. As a matter of fact, they had practically ruined the Far Eastern business by the severe cutting of prices. Subsidised by their Government, and helped by their bankers, they had been in a position to secure many contracts which, in the natural order of things, might have been executed in Britain. Since the outbreak of hostilities, neither Britain nor Germany had been able to take contracts, and, in his opinion, after the war was over Germany would be in the field again with renewed vigour. Before he left China in April last, America and Japan were securing the bulk of the trade, for there was a rapidly growing and almost limitless market, and an equally rapidly growing competition, which would doubtless be augmented by the serious efforts of the Japanese in the very near future. This Eastern nation was already producing very creditable copies of the best European and American practice, and, although their present production was insufficient to allow them to compete with advantage, it was certain that time would amend this, and they would have the advantage of low freights and insurance, and also of quick deliveries. The British merchants in China did not receive the help from the British manufacturers that was desirable to secure their share of the trade. Very few large manufacturers had their own representatives on the spot. The majority of them employed—without any salary—some firm of merchants, and if any help was required by the merchants, the British manufacturer would not give the desired help; hence, the success of the Germans.

Mr. Riddle said that he visited a Chinese city some 1,000 miles from Shanghai (600 miles by steamer and 400 by rail). In that city one was in China proper. There was not such a thing as a European building, and even if one stood in the street for a few seconds a crowd collected. He secured the best room in the best Chinese hotel—save the mark! In this country it would have been termed a shed. Let them picture to themselves a room with a European bedstead, a very small table and washstand, and with a charcoal fire in the centre. This was his abode for a fortnight, but there was a ray of light in this miserable shanty; it was lighted by a metal filament lamp! Current was supplied from sunset to sunrise by the Electric Light Co., who had some of the best machinery that English makers could supply. Such English makers had been paid every penny for their machines, but the merchants who had secured the business had not, hence his visit. In the same city a flour mill had been running for, say, twelve months. This, again, had been supplied by a good British firm; and, although they had been paid for their machinery, the merchants who secured the business had not. In this case the Chinese could not secure the requisite amount of flour which the makers guaranteed, but the merchants received no help from the British manufacturers. They might ask him, what about the future in China for British goods? The answer was beyond him. If ever the time did arrive when British manufacturers were in urgent need of orders—and they might live to see the day—their tactics would have to be changed if they wanted to fight against Continental competition. The British Government might have to help them, but certainly something would have to be done. "For meanness in the furtherance of British trade in the Far East, commend me to the British manufacturers!"

Mr. Riddle proceeded to make some suggestions to British manufacturers who proposed in the future to secure some of the Chinese business. Vast opportunities had been, and were still being, lost owing to the reluctance displayed by manufacturers in appointing engineer representatives in the more important centres of China. Salesmen only were not required. Take a good firm of electrical manufacturers who desired to open out in China: they should send out a smart young man who had been through their shops, and knew their machines, so that when orders were secured and the goods delivered this representative could see that the machines were erected properly, or could advise the Chinese on any technical point necessary. Salesmen who were not engineers only helped to retard British business in the Far East. As an instance of this, he cited the case of one of our largest and most powerful manufacturers of electrical machinery whose representation in the most important industrial and commercial city of Central China was, until recently, entrusted to a firm of general importers who were nothing if not non-technical. Indeed, the city in question was until recently entirely without technical representation of British electrical manufacturers. As against this, it should be noted that the leading German electrical houses supported no less than five responsible advising engineers, and maintained heavy stocks of electrical gear and supplies in that city. He was ready to admit that, having in mind the amount of business done, these firms could have shown little, if any, profit after payment of the heavy overhead charges thus incurred, and it was also reasonable to suppose that the Government subsidies had assisted Continental firms to survive these heavy initial expenditures. In this connection, it would appear that, granted that any Government considered that a venture was worthy of subsidies, it was reasonable to suppose that the said Government was not actuated by philanthropic motives, but rather by a desire to eventually participate in the resultant success of that venture, such participation in this case taking the form of increased export duties and the many other obvious advantages of increased trade. Nevertheless, the fact remained that they had thus introduced a serious element of competition which reacted to the disadvantage of the British manufacturers, and which would, in a great measure, be met by the more liberal introduction of technical representations.

It might be presumptious, or even precocious, on his part to comment upon the apparent policy of British firms seeking Eastern markets, as he had known them. A friend of his in Shanghai (an Englishman) had upon innumerable occasions had to recommend the purchase of electrical gear from Continental houses because of the advantage of their quotations as compared with those of British firms. It might be argued that sacrifice to cost was made at the expense of quality. In reply to this, he would point out that, as his friend was responsible for the subsequent efficient operation of the gear in question, he would obviously err upon the side of recommending quality even at slightly enhanced prices. His friend cited instances almost without limit where British firms had placed goods upon the Eastern market at prices 150 per cent. in advance of their own home quotations, and had expressed sentiments of outraged patriotism when their less ambitious Continental contemporaries secured the contracts. Prospective buyers' positions in China were the same as elsewhere. It was their obvious duty to obtain the best goods at the best price, irrespective of sentiments. Hence the amount of Continental apparatus which was being imported, and hence the wails which emanated from the British importers.

He had recently been told by a British representative that his firm were securing a fair profit, that their home works were fully occupied, and, because of this, they did not feel called upon to cut prices and seriously compete with the Continental houses. This representative spoke in the *present* tense. This appealed to the speaker as being a very typical attitude of British complacency in the face of an impending struggle for very existence.

He took this opportunity of informing the manufacturers that the greater proportion of apparatus exported to the Far Eastern market would be operated by a class of native to whom common-sense, as generally accepted, was an unknown quality; to whom brute force and ignorance were thoroughly understood; and to whom brass or copper in any form was an accepted currency. With this in view, gear should be robust, fool-proof, and without any unsecured brasswork which performed an essential function. He recalled the case of a consignment of excellent one-phase and three-phase motors which were bought for hiring purposes, and were constantly identified with bearing troubles owing to the fact that unsecured brass caps were provided for the oil wells and that brass oil-level indicators were provided. These were at once converted into currency, and the oil became a thing of memory only. Hence the constant annoyance of bearing failures, which were dealt with by the scrapping of the brass and the substitution of iron fittings. Circuit-breakers and other switchgear should also be devoid of brass fittings which did not carry current (and thus their own protection) for similar reasons to those given above. Considerable trouble was experienced owing to the repeated thefts of heavy brass dash-pots from the trip gear of a well-known make of circuit-breaker. In this case the dash-pots could as easily have been incorporated into the casting of the switch and thus have been invisible, and also free from experimental re-setting of the tripping values as carried out by the most inquisitive and information-seeking natives known to man. These, at first sight, might appear to be petty matters, but it would readily be believed that they had an important bearing upon the reputation of the apparatus concerned. Another excellent single-phase motor was supplied with an oil-immersed multi-contact switch controlling the starting operations of cutting out the starting windings and also, by steps, the rotor resistance. Not being provided with a positive "on" and "off" mechanism, it was possible to leave the controller in intermediate positions and thus obtain variable speeds at the expense of efficiency and the ultimate burning out of the rotor resistance, which was not sufficiently liberal in section to carry the rotor current for more than a few minutes. Notwithstanding incessant warnings to consumers, heavy loss and expenditure were involved in effecting the repairs thus rendered necessary, and that particular maker's reputation suffered in consequence, merely owing to lack of attention to essential practical detail.

Further, it must be borne in mind that in Central and Southern China the atmospheric conditions were extremely severe during four months of each year, when shade temperatures of 106 deg. F. were the rule and humidity was at saturation point. In consequence, the general experience was that a motor able to sustain a 20 per cent. overload during the cool months would quickly attain a dangerous temperature on full load only during the hot season. In view of this, it was advisable to provide efficient draught-inducing devices and liberal core-ventilating arrangements.

Owing to native characteristics, the speaker considered that wound-rotor motors used in conjunction with liquid starters were to be preferred to squirrel-cage machines, notwithstanding the slightly lower cost and higher frequency of the latter type. Given a geared-down slow motion liquid starter one had a robust and fool-proof combination possessing a good starting torque and not requiring skilled manipulation or heavy starting currents. If auto-transformers were utilised in conjunction with squirrel-cage motors, it was essential that they should be fitted with mechanism which did not allow the switch to be left in the starting position, so avoiding the trouble previously mentioned in connection with single-phase motors.

With a view to reducing freight charges, slide rails could be cheaply cast by native firms in China to standard patterns. The common practice of supplying motors with pulleys already fitted was to be deprecated, inasmuch that driven shaft speeds were a variable quantity, and, the motor pulley being generally smaller than the shaft pulley, it was better economy to effect the necessary changes to this rather than to the larger and more expensive shaft pulley. Finally, he urged upon manufacturers the desirability of duplicating name-plates and all plates giving information relative to capacity, voltage, etc., in Chinese characters, both for the purpose of ensuring proper use of the apparatus and also with a view to the advertisement gained by familiarising their names to users of their gear. A trade mark, or "chop" as it was known, carried a great deal of weight in China.

DIESEL ENGINE USERS' ASSOCIATION.

Lubrication of Diesel Engines.

The October meeting of the Association was held recently at the Institution of Electrical Engineers; several engineers having control of Diesel engine plants in Great Britain and abroad were elected members of the Association, and the membership now includes engineers connected with Diesel plants in such distant parts at Oudtshoorn (South Africa), Normanby (New Zealand), Delhi, and Colombo.

After reporting the progress made with the scheme for insurance at Lloyds against breakdown of Diesel engines, and in connection with the Association's efforts to obtain better terms from the Inland Revenue authorities for a reduction in regard to depreciation on the assessment of Diesel engine plant for income-tax, the discussion on the question of lubrication of Diesel engines was resumed.

Mr. C. O. Milton (Maidenhead) observed that much benefit had already accrued to several of the Diesel engine installations as a result of the circulation of data and particulars furnished by members of the Association. A careful consideration of the results obtained on various plants seemed to show that the consumption of lubricating oil on any particular engine was practically independent of the load at which it worked. He admitted that the consumption of lubricating oil must necessarily be somewhat higher when the engine was working on a heavier load, and, consequently, at a higher temperature; but his point was that the lubrication arrangements had to be generally set slightly on the liberal side, so as to suffice for such times as the engine might be called upon to do a heavy load, and that the increase in consumption of oil at the heavier load was comparatively negligible. He, therefore, arrived at the conclusion that a reasonable basis for comparison in the consumption of lubricating oil on various Diesel engine plants might be obtained by working this out in figures of gallons per b.h.p., per hour, taking for this purpose the maximum b.h.p. of which an engine was capable. Tests on the consumption of lubricating oil, to be of any value, must necessarily be taken over a long period of actual working, and in this connection he referred to the great importance of adopting the best means of filtering or treating the oil recovered for re-use.

Mr. P. H. Smith, who had been invited to attend the meeting, also laid stress on the great importance of dealing with the used oil by the best method, and considered that the low lubricating costs which had been arrived at on certain Diesel engine installations were to be attributed chiefly to the adoption of good methods of treating the oil.

Mr. R. W. Lyle (Hoffmann Manufacturing Co.) was of opinion that the filtered oil should be allowed to stand for some considerable time before being taken for re-use, and that as a rule about 10 per cent. of new oil should be added to vivify it. The necessity of keeping a good body in the oil was of importance to prevent undue wear and tear on the bearings. He discussed the varying practice on different installations in connection with the removal of the carbon deposit from the top of the piston and from the rings, as affecting the question of efficient lubrication of the cylinder.

Mr. G. Porter (Worthing) gave some figures of comparative tests which he had had carried out on new oil and on oil after use in his Diesel engines, and filtered or treated, which showed that the deterioration in its quality after a considerable amount of use was not very appreciable.

In the further discussion which followed it was generally agreed that the feeding of the lubricating oil to a Diesel engine could not in practice be regulated in accordance with the variations in load.

Mr. C. Gould (Letchworth) stated that he found that the consumption or destruction of oil increased considerably after the engine had been running for a long continuous period.

Mr. Dixon's experience (Leatherhead) showed that the worn condition of liners resulted in a very definite increase in the consumption of lubricating oil, as well as in that of the fuel oil.

The next meeting of the Association will be held on November 24th, when the subject of "Cracked Pistons" is to be further discussed. Information and particulars concerning the Association can be obtained from the Acting Hon. Secretary, Mr. Percy Still, 19, Cadogan Gardens, London, S.W.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

British Manufacturers Criticised.

I feel in penning the following that I am echoing the opinion of many other traders in the Colonies.

During these times one is frequently reminded of his duty to his King and country by the many resolutions passed by Chambers of Commerce, Trade Associations, Societies and others, hence the feeling of patriotism goes without saying; nevertheless, upon afterthought and experience one is reminded of the sacrifice incurred by so doing.

To mention our own experience, which is the rule rather than the exception, will give English manufacturers, the British Government, and others an idea of how we have to strain occasionally to make ends meet.

One of our principals has for some time been asking us to push for business in his line, and after strenuous efforts we succeeded in pulling off some orders, which were, in due course, forwarded, but although nine months have elapsed the goods have not yet been shipped!

Another of our principals, for whom we have worked hard and succeeded in securing some thousands of pounds' worth of trade, up to a week or two ago was requesting orders, and now informs us that not one of them has been dispatched, although some are six months in hand!

Over 16 months ago we placed a 12 months' contract with another manufacturer, who is still seeking trade, but who has, so far, only shipped one small consignment.

Yet another took our order for plant in October last year for delivery f.o.b. London within 12 weeks, and the plant has not left the works to date—and I might give many other instances.

Now munitions and other pressing work which must take first place probably interferes with factories, but why should we be asked for orders when there is apparently not the slightest chance of their being executed? We have two hundred and sixty-four (264) orders which have been over six months in British manufacturers' hands and are not yet dispatched, which is beyond a joke.

One firm who have had several orders from us for an important part of the installations of six different plants, which will be unable to give light and power to their many clients, have just informed us, although the orders have been in many cases many months in hand, and they are still quoting for business, that the materials for our orders have been acquired for munitions and cannot be dispatched, and as we cannot purchase elsewhere, and have deposited some hundreds of pounds as security for due fulfilment of contracts, and many other sub-contractors have probably done the same, one can imagine how far-reaching will be the effects.

Penalties are likely to be enforced—in fact, in almost all cases are threatened—such as forfeiture of deposit, or buying in against us and charging us with the difference in price, which is invariably higher.

If substitutes cannot be got for our material, the other sub-contractors for the balance of the plant cannot get their test and maintenance certificates and progress payments, and almost everybody concerned is much inconvenienced and out of pocket—possibly *except* the British manufacturer.

The loss of prestige, interest, profit and trade by the Colonial house is no small item, and as a result of this, in order to exist the concern has to find another market, hence the gain of such countries as America and Japan, &c., as is evidenced by the enormous influx of U.S.A. motor-cars into England, Australia and elsewhere, because of the inability of the British manufacturer to supply.

We have the consolation, however, that we have done our duty to the Mother Country, and hope that the goods we have lost have accounted for more of the enemy.

We are afraid that when the war is over it will be a tough proposition to dislodge the foreign trade, which, unfortunately, in many lines is fast getting a hold in British lands.

We think that if British manufacturers were to look at it from our point of view a little more, and not seek and accept business that they cannot hope to carry out, and were to release us for the time being from agreements, they would earn the appreciation of their representatives, who have to earn a living as best they can just now, and do not wish to make their lot any more difficult by any means.

I am, however, sure that it is the wish of all importers to support British industries, and that they will to the best of their ability keep trade within the Empire, but, at the same time, they desire reciprocity.

Æquo animo.

Australia, *September* 8*th*, 1915

The A.E.G. Meeting.

I have read with much interest the recent correspondence in regard to the Electrical Co., Ltd., of Charing Cross Road, which is, of course, nothing more or less than a branch house of the A.E.G., of Berlin. I am amazed at the apathy with which the matter is generally regarded, alike by the electrical trade in general and the otherwise excellent technical Press which represents it. I allude, of course, to the whole question of German trading houses, but the case of the Electrical Co., Ltd., will serve as a good example.

The apparent apathy of the trade can no doubt be better understood when it is remembered that nearly all the larger or important manufacturing concerns are "tainted" in a greater or less degree by German influence in some shape or form, so that although many of them would wish to enter the lists and voice their British and patriotic views, the "subtle influence" warns them to "go slow," and they must perforce remain silent.

The technical Press cannot be said to be "tainted" in the same manner as the trading part of the profession, but, nevertheless, the "subtle influence" is there all the same, and it warns the editor to be careful not to take too outspoken a view of the matter, but content himself with exercising a benevolent neutrality. He, therefore, confines himself to allowing those patriotic readers who choose to have full run of his "Correspondence" columns.

The correspondence, which started in a most promising form, has practically fizzled out, whereas a sympathetic leading article or two from your pen would have encouraged the opening-up of the whole subject, with the result that the electrical trade and profession would have been able to gauge the danger. That there is a real danger ahead I am convinced, and this quite apart from the patriotic or sentimental side of the question.

It is not too late to tackle the problem in earnest. Let us consider what is going to happen in the most favourable circumstances.

At the successful conclusion of the war, Germany will, from a manufacturing point of view, be very much in the position she was, say, 25 years ago, the only difference being that from the point of view of machinery and labour she will be very much up-to-date. Labour will be at a very minimum of cost, and in order to make up leeway the manufacturer will be prepared to make great sacrifices. Dumping will commence in earnest, and with our labour market as it is, and undoubtedly will be, every circumstance will be favourable.

Such concerns as the Electrical Co. will act as admirable distributing centres, and having been kept "warm" will be able to commence operations without any preliminary troubles. It will be too much to expect the purchasing section of the industry to resist the cheap prices. With a few notable exceptions, electrical contractors are without backbone, and they have so little independence that they will readily succumb. As to Municipal Electrical Committees, the case with them is already such a scandal that it does not need any labouring on my part.

The matter is one which should, at the outset, have been tackled by the technical Press as a whole in connection with the various Institutions, trade associations, &c. I am surprised that a matter so vitally affecting the B.E.A.M.A. and the E.C.A. should have been regarded by them with so much apathy. I am, however, informed that it is as much as either's existence is worth to interfere with or tackle the subject. If my informant is correct, the inference is obvious. At what a pass has the industry arrived! To expect the assistance or co-operation of the Institution in such a purely trade matter would be obviously childish.

As to the staffs who are running these concerns, it is difficult to believe they are British. Let them read of Edith Cavell, and thank Heaven they are serving such masters. If they think that they are saving up a good job for themselves, let them not be deceived. Their German masters, on their return, knowing that these pariahs will never get a decent job in any respectable firm, will take advantage, and their treatment of them will be a satisfactory punishment. For the present they should be regarded as outcasts, and should be expelled from any society they may be members of, and generally ostracised.

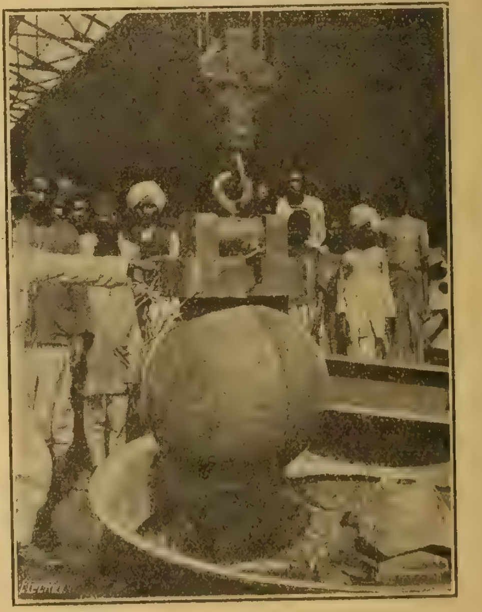
I would also warn the purchasing section of your readers against the neutral game which is now being played so generally. Only a fraction of the goods reputed to be of the particular neutral country could possibly have been made in that country. This is common knowledge in the particular neutral countries from which the goods come. These remarks apply to every neutral country that is sending us goods. There is a simple method by which the buyer can satisfy himself as to the genuineness of the country of origin. He should insist in every case that a descriptive invoice be furnished with the goods, stating explicitly that the manufacturer and the seller both guarantee that every portion of the article, whether in a finished or raw state, emanates from his country or some other neutral or friendly country, and that he guarantees that no part, finished or raw, emanates from an enemy country. If there be any hesitation on the part of the manufacturer or seller to give this guarantee, then the buyer may be fairly certain that the goods are of questionable origin.

I may very properly conclude this letter by remarking that I, personally, have no axe to grind. I am not interested from a personal point of view whether the enemy sends electrical goods to this country or not, now or hereafter. I neither buy German goods, nor is there any necessity for my selling to them, and from the commercial point of view I am quite unaffected.

Anti-Humbug.

[So far as our correspondent's reference to the technical Press is concerned, we think that we can leave it to those of our readers who have consistently read our war articles to judge as to their "outspoken" character. With regard to the "subtle influence" which "Anti-Humbug" wrongly imagines to be constantly hanging over the heads of editors, those who have made a study of our advertisement pages will have observed that since the outbreak of war a large number of advertisers have been eliminated from our pages. We think that we have made it pretty clear that it is our policy to admit advertisements only from those with whom the Government Regulations declare trading to be legal—and not always from these.—Eds. E.R.]

An Improvised Lifting Magnet.



I think the enclosed photograph will interest you. We required a tup for breaking scrap iron, and decided on an electromagnet for lifting it, the tup to be of about 1½ tons weight, and 2 ft. 6 in. in diameter. The magnet consists of a piece cut from a scrap crankshaft, the pole faces being turned hollow spherical to embrace the ball. The pole section is about 32 sq. in.; the magnet is supplied with 6½ amperes, D.C., at 110 volts.

P. H. Browne.

H.H. The Nizam's Mint,
Hyderabad, *September* 30*th*, 1915.

The Institution and Alien Enemy Members.

I regret that I have to ask your indulgence to insert a further letter in connection with the exclusion of all alien enemies (naturalised or not) from the Institution of Electrical Engineers, but having heard that there is a likelihood of members not wishing to notify the Secretary that they are in accord with such exclusion, having regard to the fact that it might be prejudicial to their business, I now solicit the help of your paper to get assistance from all Associations numbering amongst their members those of the Institution to pass resolutions to this effect, which I understand has been done already by one or two such bodies. I also ask that the hon. secretaries of the Local Sections (both at home and abroad), will formally pass resolutions to this effect.

I think the time has arisen when the Institution should not fail to take the lead given it by the Iron and Steel Institute, a body quite worthy of being followed in this respect.

I trust those members who have not yet sent in their names to the Secretary will do so, or, failing that, show their approval by refraining to attend any meetings of the Institution, either in London or at the Local Sections, until this policy has been adopted.

Station Engineer.

October 25*th*, 1915.

I notice in your issue of October 15th a letter from "Station Engineer" respecting the exclusion of all members of the Instiution of Electrical Engineers of enemy origin (whether naturalised r not).

If we are believers in keeping to our obligations, and in not reating these in the manner the Germans do, we should certainly honour "scraps of paper" in the form of naturalisation papers, specially when these have been preceded by the denationalisation of the individual in his native country.

Moreover, apart from the question of honour, surely those naturalised British subjects, whose social and business interests are bound up in this country, are entitled to be treated as ourelves, as, from a materialistic point of view, they must surely work with us in the interests of this country, and must, therefore, be "for us." In any event, it savours too much of German methods o suggest expelling *all* members of enemy origin, irrespective of heir pre-war history.

I have in mind a man with whom I have been associated for years—of enemy birth—who was known for years before the war or his anti-German views, whose ideals are, and have been, British or 25 or 30 years, whose every penny is in this country, whose children hardly speak a word of German, whose honour I can vouch for; and yet such a man, because of the accident of his birth, must be hounded out of our institutions, &c.

If, however, the majority of the members of the Institution hould decide for some action, at least let them arrange that each case shall be treated on its merits.

October 26*th*, 1915. **A.M.I.E.E.**

Electric Heating.

Now that electric heating is becoming more and more universal throughout the country, one is surprised to find a supply authority going out of its way to retard the progress of the above, which to us electrical engineers can be proved to be a remunerative load. The effects of this policy must be felt by the local contractors, and by the wholesale suppliers and manufacturers, with the result that t is almost impossible to canvass and educate the consumers to the uses and superiority of electricity as a domestic asset.

The writer himself is convinced, now that coal is at such a high price, and the gas authorities intend to raise their prices still more per 1,000 cubic feet to the consumers, that electricity even at 2d. per unit, can make it worth while for the ordinary consumer to install an electric fire. In Chiswick the consumer is not encouraged to lay out any money, on what some people call necessities, n fact assets to supply authorities. We are supposed to be poor men, afraid to spend half a crown, yet the writer has willingly spent a few half crowns, knowing that he will save a certain amount, that will repay his outlay

Perhaps others readers will help to take this matter up, and ensure a sufficient co operation between consumer and supplier; so that other consumers will be able to save their half crowns, and ndirectly promote the business interests between manufacturer and contractor, as well as between the contractor and the consumer.

I give the above information for what it is worth, and have much pleasure in enclosing my card.

Wholesale Supplier.

October 26*th*, 1915.

LEGAL.

Dealings in Marconi Shares.

The hearing of the plaintiff's appeal in Segar *v.* Isaacs was continued, and on Friday last Mr. Leslie Scott, K.C., brought to a close his arguments, which had lasted nearly four days. He contended that the agreement set up by the plaintiff was a perfectly proper compromise.

Mr. Greer, K.C., opening the case for Mr. Isaacs, submitted that the case put forward for the plaintiff was a perfectly impossible one. The more possible view was that there was no agreement at all, but, if any agreement was entered into, it was more from threats in the nature of blackmail. In either case, judgment was properly entered for the defendant, but he asked the Court to find that the blackmailing was unsuccessful, and that the contract was never made.

At the conclusion of the arguments, which had extended over seven days, their Lordships on October 26th reserved judgment.

Harrison *v.* Ottley and Others.

A settlement was announced in Mr. Justice Darling's Court, in the King's Bench Division, on Monday, in this special jury case, relating to an agreement for the purchase of a secret process for the manufacture of metallic filaments for electric lamps.

When an application in the case was made recently, it was stated that Mr. Harrison was suing Sir John Ottley and the other defendants for alleged breach of agreement, and that their principal defence was an allegation that the plaintiff had not properly disclosed the process for the purpose of a test.

Counsel now announced that the case had been settled on terms that would be endorsed on their briefs, with a Judge's order, if necessary.

BUSINESS NOTES.

Catalogues and Lists.—Messrs. L. Andrew & Co., Manchester.—Price leaflet of "Wrendal" metallic-filament lamps and "Capella" carbon-filament lamps.

Edison & Swan United Electric Light Co., Ltd., Ponder's End.—Ten-page illustrated list, giving particulars and prices of a variety of accessories for electric light fittings, including ball fittings, cord grips, caps, ceiling plates, carriers, glass holders, cord shorteners, window brackets, &c.

Messrs. Baxendale & Co., Ltd., Miller Street, Manchester.—List No. 51,016 contains illustrated descriptive matter and prices of electric grillers and toasters, electric cookers, various electric ovens, kettles, food-warmers, electric fires, and other cooking and heating apparatus.

The Jackson Electric Stove Co., Ltd, 38, Blandford Street, London, W.—Sixteen-page pocket pamphlet, giving very full particulars of the Jackson electric fires. The closing pages contain illustrations of a few types and a note of prices. A separate folder tells the reader "How to Solve a Domestic Problem," and why the electric is superior to the gas or coal fire.

The Titan Packing Co., Dunstable.—Priced circular respecting their compressed jointing, "Titanite."

Osram Painting Books.—Originality in advertising is a rare quality, and it is exceptionally difficult to attain in connection with an article so long and so variously advertised as the electric lamp. But the General Electric Co., Ltd., of 67, Queen Victoria Street, London, E.C., has tapped a really novel source of interest in a series of children's painting books. Each of three books has, on the left-hand pages, a coloured drawing, and on the corresponding right-hand pages the same drawing in outline. The pictures illustrate rhymes which, in simple fashion, sing the virtues of Osram lamps. The drawings have a quaintness which will appeal to the children who are set to enjoy the pleasant task of colouring them, while both they and their parents will receive a happy impression of the Osram lamp. These painting books are being distributed among electric light consumers, and have already proved very popular.

Book Notices.—*Analyst and Client.*—By C. H. and N. D. Ridsdale. Middlesbrough: Ridsdale & Co. Price 6s.—This is a collection of notes on chemical and physical testing for the use of works managers, engineers, &c., and is, we should think, unique in form and substance. Its aim is to assist analysts and their clients to understand each other better, and to help the latter to utilise the information obtainable from the former. It is divided into three sections, dealing respectively with questions affecting all public analysts, questions affecting analysts who are technical specialists, and the testing of electrical conductor rails. Numerous tables are provided, with forms for recording analyses, sample analyses of known brands of materials, &c., as well as much information for the guidance of the client. We are mainly concerned with the third section, in which for the first time, we believe, a quantity of data has been accumulated relating to the quality, &c., of steel conductor rails, a matter which has become of considerable importance and will increase in importance. This section comprises 10 tables, giving the resistances of rails expressed as "times copper," and in terms of ohms, also resistance conversion tables for weight and volume measurements, temperature effects, reciprocals, areas, variations of density, &c. The amount of information that has been brought together in connection with what at first sight appears to be a subject of limited possibilities is quite surprising, and we should think that the book will prove very useful to engineers and others interested in the electrification of railways.

"Rubber Machinery." By H. C. Pearson, editor of the *India-Rubber World.* New York: *India-Rubber World.* Price (in U.S.A.) $6, post free,

"The Practical Design of Steel-Framed Sheds." By Albert S. Spencer. London: Constable & Co. Price 10s. 6d. net.

Proceedings of the American Institute of Electrical Engineers. Vol. XXXIV, Part 10. October, 1915. New York: The Institute. Price $1.00.

Bankruptcy Proceedings.—J. Taylor Peddie, mechanical engineer, London.—The public examination of this bankrupt took place on October 22nd. According to the *Times* report, debtor stated, in reply to the Assistant Official Receiver, that he was born in Canada, was an expert rifle shot, patented a wind-gauge rifle sight, formed in 1903 the Peddie Small Arms Corporation, Ltd., was departmental manager to the B.S.A. Co., Ltd., and in recent years had turned his attention to obtaining a controlling interest in the Consolidated Diesel Engine Manufacturers, Ltd., against which a compulsory winding-up order was made in 1914, debtor losing £2,700. He was a writer on economic subjects, a Fellow of the Statistical Society, and was now interested, with others, in the formation of the Institute of Industry of Great Britain and Ireland, Ltd. He ascribed his failure to speculations on the Stock Exchange and to loss in the Diesel Co. The examination was concluded, the debtor estimating his liabilities at £8,775, against assets, nil.

Herbert Page (Smeeton & Page), electrical engineer, London, E.C.—November 6th is the last day for the receipt of proofs for intended dividend by the trustee, Mr. E. S. Grey, Bankruptcy Buildings, Carey Street, W.C.

Arthur Faraday Hawdon, electrical engineer, of Gosforth, Northumberland.—At Newcastle-on-Tyne Bankruptcy Court on October 21st this examination was closed.

Trade Announcement. — Messrs. Cave & Higgin, Ltd., agents in Lancashire and Cheshire for Pirelli's cables and for the Midland Electric Manufacturing Co., Ltd., state that Mr. C. A. Cave, formerly director and secretary of their company, is not now connected with them, all his interest in the concern having been acquired by the remaining directors. The company will shortly be removing into larger premises; meanwhile all communications should be addressed to 23, Hardman Street, Deansgate, Manchester.

Liquidation. — Meldrum Bros., Ltd., Timperley.—Liquidator (Mr. T. Gregory), released August 25th, 1915.

Aerial Wire Ropeways.—Messrs. R. White & Sons, of Widnes, have just executed a smart piece of work for the War Office. They received an order for two of their aerial wire ropeways for the use of the troops, and, as the matter was urgent, they succeeded in getting the whole of the two ropeways dispatched within three weeks of the receipt of the order, complete with all the driving gear, engines, carriers, &c.

South African Electrical Imports.—The imports of electrical material into South Africa during last year only attained a value of £874,627, as contrasted with £983,624 in 1913.

LIGHTING AND POWER NOTES.

Accrington.—Sewage Pumping.—An application from the Accrington and Church Joint Outfall Sewerage Board for a supply of electricity for power purposes has been granted on the understanding that the Board pays the cost of laying the service cable from the main.

Certain employés in the electricity department have made application for increased wages, and it has been decided to give them an extra ½d. per hour, with time and a half for Saturday overtime, and double time for Sunday overtime.

Argentina.—An electric power station is shortly to be installed in the town of Deheza (Province of Cordoba).

The Supreme Court of the Nation has given judgment in the action brought by the Compania Alemana Transatlantica de Electricidad against the municipality of Moron. The municipality declared null and void a contract made with the company in 1906 for the supply of public lighting for a term of 20 years. The company then brought an action before the Supreme Court of the Province, which decided in its favour, declaring the concession valid. The municipality appealed to the Supreme Court of the Nation, which has confirmed the judgment of the Provincial Supreme Court.

The Provincial Government of Buenos Ayres has the intention to establish an electrical power house at La Plata, the principal object of which will be to supply light to Government offices, which, under present conditions, pay about $96,000 per annum for this service.—*Review of the River Plate.*

Banbridge.—E.L. Proposal.—The D.C. has requested Messrs. R. J. Hale & Co. to submit plans and particulars of their proposals for supplying electric light to residents in the district from their electric lighting plant, to the town surveyor for his approval. If the surveyor reports favourably the matter will be submitted to the Law Committee for consideration.—*Irish Builder.*

Barnsley.—Prov. Order.—The R.D.C. has agreed to support the application of the Electrical Distribution of Yorkshire for a prov. order.

Bawnboy (Co. Cavan).—Street Lighting.—The D.C. has accepted the tender of the Ballyconnell Electric Light Co. to light the town by electricity.

Bexhill.—Price Increase. — The Corporation has decided to increase the charges for electricity by 10 per cent. owing to the increased cost of coal.

Blackpool.—Free electric current is to be supplied by the Corporation for the Y.M.C.A. hut at the Lancashire Hospital, Clifton Park.

Bradford.—Committee's Report.—A recent report by the Electricity Committee on the work of the department during the year, shows that the war has temporarily reduced the rate of progress of the past few years, the increase of output being only some 739,628 units over the previous year. The total output sold was 28,743,718 units, which included 7,549,223 units, bulk supply for power, &c., 5,612,245 units private power and heating, and 11,400,000 units for traction purposes. There were 2,378 motors, of 11,086 H.P. on general supply, and 537 motors of 6,924 H.P. on bulk supply. The success of the rateable value tariff for supply to domestic consumers is referred to:—807, or 60·5 per cent. (as against 56·5 per cent. in 1914) of domestic consumers were charged on this tariff, and took 797,303 units, or 988 per consumer (as against 613,807 units, or 970 per consumer, in 1914). The generating plant capacity was 15,890 KW., and the maximum load 11,745 KW. The year's income was £147,584, an increase of £3,672 on 1914, and the net profit, £18,956, was the largest yet recorded, due in part to the adoption of the principle of accumulating sinking funds in connection with various Corporation undertakings, which resulted in reducing the percentage to capital of this contribution. Of the year's profits, £5,000 went to relief of rates, £6,910 was expended on capital works, £114 applied to meter depreciation, and £9,437 transferred to depreciation and renewals.

Owing to restriction of borrowing, the anticipated extensions to plant, &c., have been much curtailed. At Valley Road works, an induced draught plant has been brought into use with satisfactory results. The two cooling towers in the extension scheme are both in use, also a new storage battery. The new 5,000-KW. turbo-generator has undergone preliminary trials, and two 1,500-KW. rotary converters are practically completed.

As a result of improvements, it has been found possible to run the Sunbridge Road, Odsal and Thornbury sub-stations in parallel with the Valley Road generating works, on the direct-current as well as the alternating-current side, with resulting greater economy and improvement in the traction supply; 35 E.H.T. transformer chambers are now in commission, with two others nearing completion, and 52 6,000/400-volt three-phase transformers of 7,859 K.V.A. capacity are in use in them. Bulk supply agreements were concluded for 2,900 KW. during the year, and the total number of consumers at March 31st last was 4,510.

While the Committee looks forward with confidence to the future, it recognises that working costs and financial charges and rates will be higher during the present year, and the financial result is not expected to equal that of last year.

Canada.—Several private concerns have offered to supply electricity in bulk to the municipality of Edmonton, and an offer from the Edmonton Hydro-Electric Power Co. has been favourably received by the City Council. The company proposes to erect generating plant on the River Saskatchewan, and to construct an electric railway along the route of the power transmission line. The capital outlay contemplated is £1,200,000. The promoters include Sir John Jackson & Co., of London.

Cheadle and Gatley.—Proposed E.L.—The U.D.C. has decided to ask the Corporations of Manchester and Stockport for their terms for providing a supply of electricity to the district.

Chesterfield.—Price Increase.—The local Chamber of Trade has asked the T.C. to re-consider the decision to advance the price of current to small consumers for lighting by 12½ per cent.

Clones.—Price Increase.—The Electric Light and Power Co. has increased the price of current from 5d. to 6d. per unit.

Coventry.—Proposed Extension.—The Daimler Co. has informed the T.C. that in the near future it will probably require a further supply of current for power beyond that for which it has already applied. In order to accede to the application, further extensions will be necessary at an estimated cost of about £30,000. The Council has decided to ascertain from the Government whether, in the event of further extensions being carried out, it will make a similar financial arrangement to that made in respect of the extensions now in progress.

Darcy Lever.—Street Lighting.—The Council has adopted electricity for lighting Long Lane to Darcy Lever. The installation is automatically controlled by means of an electric time switch.

Darlington.—Proposed Loan.—The Corporation Electricity Committee, on October 22nd, decided to apply to the L.G.B. for a loan to cover the cost of a 3,000-KW. set.

Eccles.—Correspondence has taken place between the town clerk and the Minister of Munitions respecting war service badges and the prohibition of the employment of men employed at the electricity works, by others, without the consent of the Corporation, and these matters, together with the question of the expediency of applying for the electricity works to be deemed a "controlled establishment," have been referred to a Sub-Committee.

Fakenham.—E.L. Scheme.—The Walsingham R.D.C. has received a communication from Mr. Best, of Bradford, relative to the formation of a company to provide an E.L. scheme for Fakenham, and desiring to be informed as to the probable attitude of the Council towards the project. It was decided to refer Mr. Best to the Fakenham Parish Council.

Glossop.—Street Lighting.—The T.C. has accepted the offer of the Urban Electric Supply Co. for public lighting, at £1 18s. per lamp per annum, on condition that the lamps were not lighted for more than 600 hours in 12 months, and a charge of 1s., plus 10 per cent., for each additional hour over and above the 600 hours per annum during which the whole 45 lamps were lighted. The contract is for a period of two years.

Hornsey.—The T.C. has accepted a recommendation of the Electricity Committee that in certain cases of current to be used for manufacturing purposes, a special two-rate system should be adopted on the basis of 1d. per unit, for use during daylight, and 2½d. per unit after daylight, subject in every case to the borough electrical engineer being able to make suitable arrangements as to load, payment for special meter, &c.

Hull.—Price Increase.—The Electricity Committee has decided, owing to the increased cost of materials, to raise the price of current in proportion to the said increase.

Greenock.—Year's Working.—The annual report of Mr. F. H. Whysall, the borough electrical engineer, for the year ended June 30th, shows that the total income was £62,705, as against £51,358 in 1913-14; the gross profit £32,117 equalled 10·2 per cent. on the average capital, and after deducting interest £9,298, sinking fund £9,980, and depreciation £2,442, the net surplus was £10 397, as against £3,463 in the previous year. The total units sold were 14,207,575 as compared with 11,451,483 in 1913-14, or 24 per cent. increase, being 14 per cent. from Greenock and 10 per cent. from Port Glasgow, for the first eight months' supply. Of the total, 10,339,151 units were sold for power purposes in Greenock, and 1,148,896 units for power in Port Glasgow. The total connected load amounted to 16,093 kw., exclusive of tramways, and the maximum load to 6,042 kw.; the generating plant capacity was 11,900 kw., and the load factor 26·8 per cent., as against 24·6 per cent. in the previous year. The new 5,000-kw. turbine set has been almost continuously used during the year, and work on the second 5,000-kw. set is well advanced; an additional chimney has been brought into use, and a new economiser is being completed. The generating cost averaged ·372d. per unit; and with distribution amounted to ·411d., while total costs were ·520d. per unit., as compared with ·613d. in the previous year. On the output sold the saving of ·072d. per unit in generating costs represents £4,262. The converting plant at Messrs. Scott's works will shortly amount to 3,150 kw., while another factory will have 1,000 kw. of transformers; the four rotary sub-stations at Port Glasgow have a total capacity of 4,000 kw. The installation department supplied 297 kw. of apparatus, mainly radiators, cookers, irons, &c., during the year. A total of 894 motors, of 11,773 h.p. is now connected to the mains.

Irish Water-Power Scheme.—The Limerick Fishery Board has considered the probable effect of the proposed Shannon water-power scheme on the fisheries of the river. It was stated that the syndicate proposes to construct a tunnel from Lough Derg with the power house at Clontara, near Limerick City; for five or six months of the year the company would require the full flow of the Shannon, and more than the full flow if 10,000 h.p. was generated, and if the project was carried through, it would seriously affect that portion of the Shannon between Limerick and Killaloe. It was decided to communicate with the Irish Board of Works and the Department of Agriculture on the subject.—*Irish Times.*

Latchford. — Church Lighting. — At the Chester Consistory Court last week a faculty was granted for the removal of the gas standards at St. James' Church, Latchford, and for the introduction of an electric lighting installation. It was stated that the church had not a lofty roof, and that the use of gas rendered the atmosphere very oppressive. The Chancellor said the substitution would be a great improvement.

Liverpool.—At the final meeting of the Tramways Power and Lighting Committee, the progress of the electricity undertaking was reviewed by the chairman, who stated that the capital expenditure up to the end of 1914 amounted to close upon 2¼ millions, and the revenue for the year 1914 was more than £300,000, while the increased revenue for the six months ending June was about £8 000 over that of the corresponding period of last year. The profits of the undertaking since its purchase in 1896 by the Corporation have permitted £862,128 to be set aside for repayment of capital, a further sum of £390,000 had been placed to reserve, depreciation, and other contingencies, and £285 000 allotted to the relief of the rates. The contribution under this head for the current year was £25,000; there were about 11,500 consumers connected as compared with 10,800 in 1914. During the year 1914 over 48,000,000 units of electricity were supplied for lighting and power purposes, and during the first eight months of this year an increased output of over 3,000,000 units had been supplied, *i.e.*, an increase of about 11 per cent. During the year close on 6 000 h.p. of motors had been connected, and to assist small power users motors were supplied on the hire-purchase system, while to encourage the use of electrical energy for domestic and other purposes suitable apparatus for heating and cooking was supplied on the same system. The demand for electric ovens, radiators and other heating apparatus had considerably developed during the past 12 months.

London.—L.C.C.—The Finance Committee recommends the sanction of the borrowing by the Poplar B.C. of £3,688 for electricity mains.

Hammersmith.—Owing to the extraordinary demand for energy by factories in the Hythe Road area, a comprehensive scheme for supply in that direction has been submitted, and it is proposed to accept a tender of Messrs. Callender for 1,350 yards of cable required.

St. Pancras.—The wages of the stokers at the B.C.'s electricity works are to be increased from 5s. 3d. to 6s. per full shift of eight hours.

Lymington. — Street Lighting. — The T.C. has accepted the offer of the Electricity Co. for lighting river lamps at 4d. per unit, with market prices for renewal of lamps.

Maidstone.—Annual Report.—The report of Mr. E. E. Hoadley, borough electrical engineer, on the past year's working of the electricity undertaking, mentions that the net surplus, £1,553, was the largest yet earned. With the outbreak of war, much difficulty and expense arose in regard to coal supply, but, on the other hand, three small sets were sold for telegraphic purposes, and it was possible to arrange for the installation of a 1,250-kw. Ljungstrom turbine set, with rotary converter and switchgear, which, it is hoped, may be running by Christmass, with resulting economy in working. The output generated during the year was 3,595,584 units, and the output sold, 2,887,857 units; the maximum load was 1,221 kw. lighting, 100 kw. traction, and 76 kw. public lighting. Power units form more than half the total output, and have increased 31 per cent. on last year's figures. The average total cost per unit sold was ·836d., and, including capital charges, 1·36d.

New Zealand.—The Napier B.C. proposes to expend £18,000 in extensions of electric lighting and power plant at the power house.—*B. of T. Journal.*

Oldham.—At the request of the Electricity Committee, whose cables are overloaded in the district, the Tramways Committee has acceded to an application from Messrs. J. Spencer & Co., Hallins Road, for a supply of electricity, the supply to be given from the tramway cables.

Pembroke (Co. Dublin).—New Plant.—The Council has had under consideration the question of the electricity supply for the lighting of the township. It was stated that the Diesel engine had not been in working order for some time, and that whilst the claim was being pressed against the contractors, there was a possibility of a failure in the electric light supply. It was eventually decided that, subject to advice of senior counsel, a new engine be purchased, at a cost not exceeding £2,000.—*Irish Builder.*

Rawtenstall.—It has been reported to the T.C. that, owing to the increased demand for electricity for power purposes, it would be necessary to increase the output of the generating station in the near future. The past half-year had been a very successful period.

Salford.—Loan Application.—Application is to be made to the L.G.B. for sanction to the borrowing of £734, to cover capital expenditure in connection with the electricity undertaking from September 12th to November 12th, 1915, in respect of loans sanctioned by the Board prior to March 12th, 1915. Application is also to be made to the L.G.B. for sanction to borrow £900. to cover the cost of affording a supply of energy to the works of Isaac Bury, Ltd.

Sutton.—Assessment Rate.—In order to encourage the use of electrical heating, the South Metropolitan Electric Tramways and Lighting Co. has introduced an assessment rate, a reasonable number of units being allowed (and presumably used for lighting) at 5½d. per unit, while all excess units will be charged at 1½d. per unit, for any purpose. This arrangement obviates the necessity for special wiring and meters for heating supply, and undoubtedly simplifies the electrical heating problem.

Warrington. — Electrically-Operated Bridge.—The new bridge at Sankey, which crosses the canal, was officially tested and opened last week. The bridge, which is for vehicular and passenger traffic, is raised and lowered by electricity.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. System.—The T.C. has received a letter from the International P.A.Y.E. Tramcar Co., Ltd., asking the Council to reconsider the question of the resumption of the "pay-as-you-enter" system, more especially as women were now employed as conductors. After discussion, it was decided to forward the letter, with a proposal "to alter and restore to their original position and condition the stairs and platforms on the cars for some time in use on the system known as P.A.Y.E. cars," to the Tramways Committee for consideration and report.

Ayr.—Annual Report.—In his annual report on the working of the Corporation tramways, the general manager (Mr. Wm. Grant) states that the revenue for the year amounted to £17,984, being a decrease of £1,392 as compared with the previous year. Receipts per car-mile worked out at 9·17d., as against 9·86d. for the previous year. The number of miles run by the cars were 448,725, an increase of 3,923 miles. The electrical energy consumed during the year was 442,969 units, or ·98 of a unit per car-mile, as compared with ·94 of a unit per car-mile in the previous year. Working expenses, exclusive of power charges, amounted to £8,476.

Australia.—The Electrical Supply Co., of Victoria, has contracted to give a supply of electrical energy for the Ballarat and Bendigo workshops of the Victorian railways for a periods of five years.

Birmingham.—The Corporation Tramways Committee is appealing to professional business men who are ineligible for the Army to volunteer to train as tramway drivers. The tramway services will have to be reduced unless men are found to replace the large number who have enlisted.

Blackpool.—Contract Tickets.—The proposal to increase the price of tramway contract tickets from £3 to £4 per annum was discussed at a meeting of contract holders last week, and a resolution was adopted protesting against the proposed increase, and also requesting the issue of sectional contracts at 30s. It was stated at the meeting that 163 persons who held contracts—there are nearly 1,500 contract holders in the town—had declared that they would not pay the increase.

Burnley.—War Bonus.—The Association of Tramway Workers has applied to the Corporation for a war bonus of 3s. per week on behalf of the conductors and drivers, but the General Purposes Committee cannot see its way to accede to the request.

Croydon.—Traffic Receipts.—The net increase in the traffic returns of the Corporation tramways over the corresponding period of last year was £2,600, or £4,378 gross. In the same period 250,000 more passengers had been carried on a reduced mileage run of 3,500, and a decrease of 100 units in energy consumption.

Darwen.—War Bonus.—The Tramways Committee has received a request from the Association of Tramway Workers for a war bonus of 3s. on behalf of the drivers and conductors. It has been decided to receive a deputation, to include 10 of the employés.

Glasgow.—Female Motor Drivers.—Owing to the lack of motormen, it is now proposed to ask the women conductors if they are prepared to undertake the driving of the cars, should the necessity arise.

Halifax.—Six Months' Working.—For the six months ended September 30th the income from the tramways amounted to £62,081, as compared with £61,303 for the corresponding period of the previous year. The expenditure was £49,537, compared with £48,676. The profit was £12,544, as against £12 620.

The Tramways Committee has authorised the borough engineer to reconstruct the tramway at North Bridge, at an estimated cost of £1,840.

Leicester. — Women Conductors. — The T.C. has decided to employ women conductors on the tramcars.

London.—L.C.C.—The Highways Committee reports that a licence has been entered into with the P.L.A. in respect of the additional condensing water facilities at the Greenwich generating station, under which the Council is to pay the P.L.A. £200 a year from March 1st, 1915, to February 29th, 1916; £400 a year from February 29th, 1916, provided that the output of the station does not exceed 43,000 kw.; £600 a year when the output exceeds 43,000 but does not exceed 47,500 kw.; £800 a year when the output exceeds 47,500 but does not exceed 52,000 kw. In the event of the output of the station exceeding 52,000 kw., or the existing suction plant assessed at £600 a year being removed, the amount payable by the Council is to be reassessed.

The Committee reports that the B. of T. has now agreed to the running of trailer-cars on authorised routes at all times of the day.

L.C.C.—Female Conductors.—It is suggested that women should be employed on the Council's trailer and single-deck cars only, to the number, approximately, of 120. Questions have been raised by the Trade Unions regarding the conditions of labour, and are now under discussion. In engaging men for tramway service preference is being given to wounded soldiers who have left the service.

Manchester.—New Depot Opened.—The car-shed extension and new stores at Hyde Road were formally opened on Tuesday by the Lord Mayor, who was presented with a gold key by Ald. Bowes, chairman of the Tramways Committee. Ald. Bowes himself was presented with a piece of plate in recognition of his 25 years' municipal service. The Hyde Road sheds and roofed buildings now cover over 10 acres, and there is accommodation there for 355 cars, the new extension (which has cost £46,000) having increased the capacity to the extent of 90 cars.

Ald. Bowes stated on Tuesday that 2,060 men from the tramway department had joined the Colours, and the allowances to the dependents and the war bonuses to those workers now employed meant something like £90,000 per annum, £70,000 being paid to dependents and the rest being war bonuses.

Newcastle.—Owing to the shortage of men and in order to meet the demand for additional cars for the service of workmen employed on Government work, the Tramways Committee has adopted the recommendations of Mr. Hatton, the manager, and will run 200 cars in the workmen's services, both morning and evening, the whole of which will be available to workmen with coupons; to provide this service most of the cars would start at 5 p.m. and finish at 9.30 p.m. At present 135 workmen's cars are run in the morning and 43 in the evening; the traffic staff consists of 487 men and boys, 158 women conductors, and 76 volunteer motormen and conductors.

New Zealand.—The Napier B.C. has decided to raise a loan of £37,500 for the construction of tramway track, overhead works, extension of car-sheds, purchase of five cars, and installation of one engine with equipment at the power house.—*B. of T. Journal.*

Oldham.—The application of tramwaymen for a war bonus of 3s. per week has been referred to a Special Committee of the Corporation, which is considering the whole question of war bonuses as it affects the various municipal departments.

References at a recent meeting of the Tramways Committee to the satisfactory way in which the new women car-conductors are doing their work have apparently given offence to some of the male workers. At a meeting of the Committee last week, it was pointed out that the remarks were not intended as a criticism of the men.

Rochdale. — Women Conductors. — The Tramways Committee has authorised the tramway manager to engage the services of women as car-conductors should the necessity arise.

With reference to the request of tramwaymen that a permanent advance of wages should be granted in lieu of the war bonus, a deputation from the workers' union waited on the Tramways Committee last week, and as a result the Committee has decided not to renew the war bonus arrangement when it expires on November 18th. A Special Sub-Committee was appointed to consider the question of an advance of wages.

TELEGRAPH and TELEPHONE NOTES.

Wireless Telephony.—It is reported that on October 20th officials at the naval wireless station, Washington, U.S.A., called up the Eiffel Tower in Paris by means of a wireless telephone, and afterwards learned that they had been heard. The Eiffel Tower is not provided with wireless telephone equipment capable of replying, but the officers stationed there cabled their acknowledgment of the American message, together with their congratulations on the achievement.

Dr. Lee de Forest is reported to have said to a representative of the *Electrical World* that the Western Electric Co.'s engineers used in the Arlington installation "some 300 audion oscillion bulbs in multiple, from each of which they obtained about 0·5 ampere of high-frequency current," and to have claimed that the use of the audion principle had made trans-Continental telephony possible. Prof. Pupin said that the greatest problem of all wireless work, particularly wireless telephony, was the elimination of static disturbances; he had solved this problem, but because of pending patents, he was not at liberty to state what the solution was.

Mr. E. J. Nally, general manager of the Marconi Wireless Telegraph Co. of America, said that the work of Dr. Lodge and of Mr. Marconi in tuning the circuits was indispensable, and that undoubtedly Prof. Fleming's invention of the vacuum valve was "the keystone of the arch on which this successful demonstration is supported." It seems clear that the thermionic principle is the basis of the present achievement, as it was also of the trans-Continental wire telephony that was accomplished in January last.

Further particulars have now been received regarding the important progress that has been made in the United States. It is reported that speech transmitted from the wireless station at Arlington to San Francisco was also heard at Pearl Harbour in Hawaii, 4 900 miles away. While the details of the apparatus employed have not yet been disclosed, it is understood that the system depends upon thermionic apparatus used as relays, as generators of high-frequency currents, and as amplifiers. In the *Electrical World* it is stated that the American Telephone and Telegraph Co. erected an experimental station early this year and commenced transmission from this point to existing stations up to 200 miles away; later, a receiving station was erected about 1,000 miles from the sending station, and the results of the experiments conducted between these led to the trans-Continental achievement recorded in our pages on October 8th.

The above-named company and the Western Electric Co. obtained the use of the Navy Department station at Arlington, and succeeded in transmitting speech from there to Darien, on the Isthmus of Panama, 2,100 miles away, on August 27th, and to San Francisco, 2,500 miles, on September 29th. An important feature of the latter tests was the successful relaying of speech transmitted by wire from New York to Arlington, and by wireless from that point to San Francisco. The wave length used was about 6,000 metres, and the sending antenna current was about 100 amperes. The standard office instruments were used for sending and receiving. Conversation between the United States and Japan and Europe is now within the bounds of possibility. Atmospheric disturbances constitute the principal obstacle. Mr. J. J. Carty, chief engineer of the American Telegraph and Telephone Co., anticipates that the function of wireless telegraphy will be primarily to reach inaccessible places where wires cannot be strung, and to act as a feeder and extension to the wire system. Owing to atmospheric interference, it can never replace the wire, and the fact that any listener provided with a suitable receiver can hear the message is a fatal bar to its commercial use.

CONTRACTS OPEN and CLOSED.

OPEN.

Bradford. — November 13th. Corporation. Twelve months' supply of lamp fittings, insulating material and tramway stores for the Tramways Committee. Specifications from the Tramway Offices, 7, Hall Ings.

Cape Town. — November 5th. Corporation. One 4,000-k.v.a. (or alternatively smaller or larger, according to whichever can be delivered earliest) steam-turbine-driven alternator; also one 1,000-kw. converting plant. Specifications, &c., from Messrs. Davis & Soper, 54, St. Mary Axe, E.C.*

Australia.—December 7th. P.M.G.'s Department (various States). Non-encrusting zincs, carbon and manganese powder, manganese chloride, chloride of ammonia, porous pots (2 in.), outer jars for cells, carbon blocks, resistance boxes of 5,000 ohms, &c. See "Official Notices" October 15th.

SYDNEY.—December 6th. Municipal Council. 33,000-volt outdoor transformers and switchgear. Specifications (10s. 6d.) from Electric Light Department, Town Hall.

December 20th. Metropolitan Board of Water Supply and Sewerage. Centrifugal pumps and electric motors at the Marrickville low-level pumping station.

January 12th, 1916. N.S.W. Railway and Tramway Department. Two water-tube boilers, &c., for the Zara Street power house, Newcastle. See issue of October 8th for further particulars.

January 31st, 1916. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

MELBOURNE.—December 14th. Deputy P.M.G. Eleven sections of a lamp-signalling trunk-line switchboard, and other material necessary for increasing the equipment of Melbourne trunk exchange from 108 to 240 lines. Schedule 1,207.*

December 14th. P.M.G. For delivery in all States, 18,670 common-battery wall pattern telephones, manufactured in Australia. Sched. No. 1,264. Tenders will also be considered for instruments manufactured in countries other than Australia.

January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

PERTH.—December 8th. 294 accumulators, and power board complete, for P.M.G.'s Dept. See "Official Notices" October 8th.

Dublin.—November 4th. Great Northern Railway Co. (Ireland). Twelve months' supply of stores, including a number of electrical items. See "Official Notices" October 15th.

November 15th. Twelve months' supply of stores for Dublin United Tramways Co. See "Official Notices" to-day.

Grimsby.—November 4th. Corporation. House service boxes (lead), and fittings; house fuse boxes and fittings. See "Official Notices" October 22nd.

Lanark.—November 1st. The District Committee of the Middle Ward of the County of Lanark invites tenders for executing the electric lighting works at Hairmyres Colony, East Kilbride. Schedules from the consulting engineer, Mr. William Arnot, 163, Hope Street, Glasgow.

London.—November 3rd. L.C.C. Installation of 193 wiring points, 240 lights, at Thornfield Road Elementary School, Coverdale Road, Hammersmith, W. See "Official Notices" to-day.

Manchester.—November 16th. Tramways Committee. (*a*) steel girder tramway rails; (*b*) permanent way special track work; (*c*) permanent-way points, tongues and crossings. Specifications, &c. (one guinea each, returnable), from Mr. J. M. McElroy, General Manager.

New Zealand.—DUNEDIN.—November 3rd. City Council. Insulated and bare copper wire for a period of two years.*

November 3rd. City Council. One 3,000-volt regulator.*

Rochdale.—Contract A 107. Ash-handling system, with hoist and bunker, with discharge chutes, for Dane Street electric power station. C. C. Atchison, M.I.E.E., Engineer and Manager, Dane Street.

Spain.—November 11th. The municipal authorities of San Ildefonso (Province of Segovia) are inviting tenders for the concession for the electric lighting of the town.

St. Helens.—November 17th. Erection of engine house and other works at Cropper's Hill power station. Particulars from Mr. E. M. Hollingsworth, Borough Electrical Engineer (£1 1s. returnable).

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The Electricity Committee of the Sydney Municipal Council recommends that the following material be ordered under existing contracts:—

20,000 type C straight-stem insulators, £790.—W. G. Watson & Co., Ltd.
12,000 10,000-volt straight-pin insulators; 6,000 10,000-volt strain insulators; 2,000 33,000-volt straight-pin insulators, £4,350.—F. S. Lee.
6,000 33,000-volt strain insulators, £2,250.—Australian General Electric Co.

The City of Melbourne Municipal Council has accepted the following tenders:—

Meters and maximum demand indicators.

Group A: £580.—Edison & Swan United Electric Light Co.
" B: £192.—Ferranti, Ltd.
" C: £727.—Reason Manufacturing Co., Ltd.
" D: £910.—General Electric Co., Ltd.
" E: £69.—British Westinghouse Co.

—*Tenders.*

The following contracts have been placed:—

POSTMASTER-GENERAL'S DEPARTMENT, VICTORIA.

8 tons hard-drawn copper-wire, 600 lb. per mile, £908.—British Insulated and Helsby Cables, Ltd.

COMMONWEALTH HOME AFFAIRS DEPARTMENT.

Two 100-KW. suction-gas power plants, one delivered, Kalgoorlie, £3,871; one delivered, Port Augusta, £3,203.—Gibson, Battle & Co.

PRAHRAN & MALVERN TRAMWAY TRUST.

1,050 tons of rails, £18,355.—R. W. Cameron & Co.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE.

50 miles two-twisted rubber-insulated copper wire, £387.—Siemens Bros Dynamo Works.
100 miles twisted pair V.I.R. copper wire, £1,625; 4 tons tinned copper rubber-insulated wire, £700.—Callender's Cable and Construction Co., Ltd.

—*Aust. Statesman and Mining Standard.*

Chorley.—The B. of G. has accepted the tender of the Turner-Dictograph Telephone Co. (£140 10s.) for an installation of telephonic intercommunication throughout the workhouse.

Dublin.—The following tenders were received by the Pembroke U.C. for the erection of a cooling tower at the South Lott's electricity works:—

Wm. Beckett & Son, Ltd.	(accepted)	£374
J. Pemberton & Son		598
Premier Cooling and Engineering Co.		457
Davenport Engineering Co.		550
W. H. Roy & Co.		339

Irish Builder.

London.—L.C.C.—The Stores and Contracts Committee reports that the current contracts for the supply of general stores will, with a few exceptions, expire on December 31st, 1915. This group of contracts is the largest of the several groups dealt with each year, and generally includes all such goods as metals and metal goods, electric cables, lamps, fittings and materials, chemical and scientific goods, &c. Owing to the special circumstances which have arisen in consequence of the war, it is proposed to continue the present practice of purchasing some classes of goods at the current market rates or under special quotations, until trade conditions again become normal or until it is considered that the time is favourable for new contracts to be entered into. In all other cases new forms of tender and schedules are being issued, The tenders will be received o November 1st and November 8th, 1915, and, as the number of tenders will probably be comparatively large, the Committee recommends that the Stores and Contracts Committee be authorised to open the tenders to be received for the supply of the goods included in the general stores schedules, 1916.

The Highways Committee has received the undermentioned tenders for the supply of boiler fittings for the Stirling boilers at the Greenwich generating station:—

	Price of each nose piece.		
	Item A.	Item B.	Item C.
	s. d.	s. d.	s. d.
T. Summerson & Sons, Ltd.	2 8	2 7	2 7
R. Hyde & Son, Ltd. (accepted)	2 8	2 8	2 8
The Brightside Foundry Engineering Co., Ltd.	3 0	3 0	3 0
A. T. Green & Sons, Ltd.	3 2	3 0	3 0
Bricknell, Munro & Rogers, Ltd.	3 9	3 9	3 9
J. Crowley & Co., Ltd.	5 4	5 3	5 3

The lowest tenderer was unable to offer satisfactory delivery. In view of the exceptional circumstances prevailing, the Committee has authorised the purchase of coal for use at the Greenwich generating station, as and when it can be obtained; about 4,768 tons of coal have been purchased under contract, at a cost of £4,380, and about 26,490 tons out of contract, at an approximate cost of £34,464.

The Committee has also purchased from Messrs. Wm. Cory & Son 10,000 tons of coal, at 30s. per ton, to be stored by the firm, and to be delivered at the generating station as and when required within 12 months from August 1st, 1915.

The undermentioned tenders have been received by the Highways Committee for the supply of machine tools for the third section of the central car repair depôt:—

Name of firm.		Universal grinding machine.	Measuring machine.
A. A. Jones & Shipman, Ltd.	(accepted)	£115 0	—
H. W. Ward & Co.		145 0	—
C. W. Burton, Griffiths & Co.		184 0	£26 5
Pollock & Macnab, Ltd.		187 10	—
The Selson Engineering Co., Ltd.		192 10	—
Chas. Churchill & Co., Ltd.		228 0	—
Buck & Hickman, Ltd.		231 0	£141 15 (accepted) plus 2½ per cent.

The Committee accepted the following tenders for the purchase and removal of old materials from depôts for the ten months ending July 31st, 1916:—

Thos. W. Ward, Ltd.—Steel rails, small; Tee section, from the central stores, and steel track shoes from the central car repair depôt.
Samuel Isaacs & Sons.—Steel track shoes and cast-iron (various) from the central stores.
Moss Isaacs, Ltd.—Cast-iron brake blocks from the central stores, and cast-iron, fishplates, cuttings from rails and short pieces of rail from Belvedere Road depôt.
George Cohen, Sons & Co.—Points and crossings from Belvedere Road depôt, and steel car tires and iron and steel (heavy) from the central car repair depôt.
Donald McCall & Co.—Turnings and borings and iron and steel (light) from the central car repair depôt.
C. A. Robinson & Co.—Cast-iron from the central car repair depôt.

The Highways Committe has received the undermentioned tenders for the supply of a new motor required in connection with the testing of electricity meters :—

General Electric Co., Ltd.	(not to specification)	£101
" " "	(alternative)	189
Electromotors, Ltd.	(accepted)	105
Veritys, Ltd.		144

The estimate of the chief engineer was £105.

The Committee has also agreed, in exceptional circumstances, to increased prices being paid to three contractors for the supply of tramway fittings, &c., under the annual contracts for 1915-16.

BATTERSEA.—The Electricity Committee recommends the acceptance of the offer of Messrs. R. Dempster & Sons, Ltd., for the provision of a run-way in the rotary room at the generating station for £135.

HAMMERSMITH.—The Electricity Committee reports that for the supply of seven additional transformers of 50, 100 and 200 KW, five tenders were received, including a proposal from the British Electric Transformer Co., Ltd., to supply the transformers, as required, over a period of three months, at the same prices as those accepted on July 8th, 1914, plus 7½ per cent. in the case of the 200-KW. transformers. The Committee, after comparison with the other tenders, finds that the company's terms are the most favourable, and having regard that the plant previously supplied by the company has given every satisfaction, recommends the Council to enter into a contract with the British Electric Transformer Co. on the terms submitted.

For the supply of 1,350 yards of feeder cable in the Hythe Road district, the following tenders have been received :—

Western Electric Co., Ltd.		£1,285
Johnson & Phillips, Ltd.		1,310
W. T. Henley's Telegraph Works Co., Ltd.		1,312
British Insulated and Helsby Cables, Ltd.		1,312
Callender's Cable and Construction Co., Ltd.	(accepted)	1,312
W. T. Glover & Co., Ltd.		1,342
Siemens Bros. & Co., Ltd.		1,351
Macintosh Cable Co., Ltd.		1,400

The Committee reports that, in considering the above tenders, it was impressed by the desirability, at the present time, of arranging that, where possible, contracts of this nature should be placed with houses which are entirely British, subject to such houses being able to supply in accordance with the Council's specification. In these circumstances, and in view of the fact that the Council has formerly been supplied with cable, which has proved most satisfactory, from Messrs. Callender's Cable and Construction Co., Ltd., the Committee is of opinion that that company's offer should now be accepted.

Manchester.—The Education Committee has accepted the tender of Messrs. Seddon & Sons, Manchester, for an electric lighting installation in the extension of the Harpurhey Girls' High School.

New Zealand.—The Public Service Stores and Tender Board, Wellington, has received the following tenders :—

1,500 red and 2 000 white three-conductor cords :

Lawrence & Hanson Electrical Co.	(accepted)	£489

3,000 B.B. wall telephones, 1,000 ohms :

B. L. Donne	(accepted)	£8,250
G. Winter		7,900
Richardson, McCabe & Co., Ltd.		8,043
India-Rubber, G.-P. and Teleg. Works Co., Ltd.		9,887
R. W. Cameron & Co.,		9,950
Alternative		9,627
Alternative		10,597
Alternative		10,286

25 miles twisted pair V.I.R. insulated cable :

Hughes & Cossar	(accepted)	£237
Richardson, McCabe & Co.		256
Lawrence & Hanson Electrical Co.		301
A. & T. Burt, Ltd.		315

New Zealand Shipping and Commerce.

Plymouth.—The Corporation Tramways Committee has accepted the tender of the Brush Electrical Engineering Co., for bodies for six new tramcars ; and that of the British Westinghouse Electric and Manufacturing Co., Ltd., for electrical equipments for the same.

Rawtenstall.—The Electricity Committee has placed a contract with Messrs. J. Morris & Co., for 2,000 tons of Astley and Tyldesley slack, for the electricity works during the ensuing six months. It has also accepted the tender of Messrs. Davidson for a fan in connection with the induced-draught plant at the electricity works, and that of the British Thomson-Houston Co., Ltd., for the motor for driving the fan.

Salford.—The Health Committee has accepted the tender of Mr. E. Beal, of Eccles, to supply during the next 12 months 500 Mazda electric lamps, at £8 6s. 8d. per 100, to Ladywell Sanatorium.

The Tramways Committee has accepted the tender of Messrs. Frances Motors, Ltd., of Gaythorne, Manchester, for the supply of two Ford motor-vans.

The Electricity Committee has accepted the following tenders :—

W. Geipel & Co., London.—20,000 pairs of flame arc lamp carbons, £181.
Earl of Ellesmere.—2,000 tons No. 1 washed slack coal, 16s. per ton.
Andrew Knowles & Sons, Ltd., Pendlebury.—2,500 tons washed slack coal, 17s. per ton.

Taunton.—The T.C., in order to have a reserve stock of coal for the electricity works, has decided to extend the contract with Messrs. Cory Bros. to cover 2,600 tons, at £1 5s. 6d. per ton delivered, this being the estimated consumption for a year after the expiration of the current contract.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, October 29th. At 8 p.m. At Institution of Civil Engineers, Great George Street, S.W. "Thomas Hawksley" lecture on "The World's Sources of Fuel and Motive Power," by Dr. D Clerk, F R.S.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, October 29th. At 7 30 p m At Bolbec Hall, Newcastle. General Meeting. Inaugural address by the president, Mr. H. B. Rowell.

University College (University of London).—Friday, October 29th. At 5 p.m. First of six lectures on "Electric Heating and Electric Furnaces," by Prof. J. A Fleming, F.R.S

Greenock Electrical Society.—Friday, October 29th. At 7.45 p.m. At Temperance Institute, 19, West Stewart Street. Paper on "Cable Jointing," by Mr. J. L. Hogg.

Association of Mining Electrical Engineers (Lancs., Cheshire and North Staffs. Branch).—Saturday, October 30th. At 6.30 p.m. At Grosvenor Hotel, Deansgate, Manchester. Presidential address by Mr. G. S Corlett. Paper on "Colliery Electric Lighting," by Mr. Corlett, will be discussed.

Association of Mining Electrical Engineers (Notts. and Derbyshire Branch).—Saturday, October 30th. At 3 30 p.m. At University College, Nottingham. Paper on "The Use and Abuse of Oils on Mining Plant," by Mr T. C. Thompson.

Association of Supervising Electricians.—Tuesday, November 2nd. At 8 p m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Accumulators," by Mr. R. Rankin.

Institution of Civil Engineers.—Tuesday, November 2nd. At 8 p.m. At Great George Street, S.W. Presidential Address by Mr. A. Ross.

Rontgen Society.—Tuesday, November 2nd. At 8 15 p m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Presidential Address, by Mr J. H. Gardiner. Exhibition of New Apparatus.

Institute of Marine Engineers.—Tuesday, November 2nd. At 7 p.m. At Tower Hill, E. Paper on "Development in Mechanical Ventilation Hygienically, Aboveground, Uuderground, and Underdeck," by Mr. J. Keith.

Chemical Society.—Thursday, November 4th. At 8.30 p.m. At Burlington House, W. Ordinary Meeting.

University College, London.—Friday, November 5th. At 5 p.m. Second Lecture on "Electric Heating and Electric Furnaces," by Prof. J. A. Fleming, F.R S.

Salford Technical and Engineering Association.—Saturday, November 6th. At 7 p.m. At Royal Technical Institute, Peel Park. Members' Short Papers.

NOTES.

The Russian Language.—The Council of the North-East Coast Institution of Engineers and Shipbuilders has, in a recent circular to its members, drawn attention to classes in Russian that have been arranged under the auspices of Armstrong College. They are being held at the College of Medicine, Northumberland Road Newcastle-on-Tyne.

Electricity in Wool.—The question of electricity in wool manufacture is receiving serious consideration just now by textile experts in the West Riding of Yorkshire, and research work is proceeding. A member of the Council of the Textile Institute states that not only are woollen spinners subject to troubles caused by the presence of static electricity in their staple, but the same effect is found to a lesser degree when cotton and silk are under treatment. Several methods for the eradication of the trouble have been tried, notably electric neutralisers and radio-active salts, the latter ionising the air between the fibres and an earth-plate, and thus enabling the electricity to escape to earth.

Institution and Lecture Notes.—National Illumination Committee of Great Britain.—A meeting of this Committee was held at the Institution of Electrical Engineers on October 20th, when it was reported that Mr. Jacques Abady, of London, had been nominated by the Institution of Gas Engineers as a member of the Committee, to fill the vacancy caused by the death of Mr. Edward Allen, of Liverpool. The Committee elected Mr. W. Duddell, of London, to be its chairman, in succession to the late Mr. Edward Allen, and Mr. John Bond, of Southport, to succeed Mr. Duddell as one of the vice-chairmen. Reports on observations carried out, at the instance of the Committee, at a number of technical laboratories, on the height to which the flame of the Hefner amyl-acetate lamp should be raised to afford a light of one International or English standard candle, were discussed, and a report prepared by Dr. E. Ott, of Zurich, on researches which had been carried out in Switzerland on the "Effect of Atmospheric Pressure, Humidity, and Vitiation on the Light afforded by the Hefner Standard Lamp," was considered.

Institution of Electrical Engineers (Newcastle Local Section).—The chairman, Mr. P. V. Hunter, will deliver his inaugural address on Monday, November 8th. The only other arrangement yet made for the session is for January 10th, 1916, when Mr. J. R. Beard will probably give his paper on "The Design of High-Pressure Transmission Systems." Mr. J. R. Andrews is the hon. sec. of the Section.

Electrolytic Copper in Germany.—The share capital of the Huttenwerk Niederschonweide is being increased from £77,500 to £150,000, for the purpose of erecting plant on an existing available site for the production of electrolytic copper. It is stated that the plant will be brought into use at the beginning of next year.

Appointments Vacant.—Assistant engineer, junior shift engineers, station fitter, engine drivers, stokers, stoker trimmer, wireman and mate, for a Military Camp in North Yorkshire ; switchboard attendant (27s. 6d.), for Borough of Lancaster ; plumber-jointer (£2 2s) for Newport Corporation ; temporary shift engineer (35s.), for Pembroke U.D.C. Particulars are given in our advertisement pages.

Inquiry.—Makers of the "Rapid" vacuum cleaner are asked for.

Volunteer Notes.—Engineering Institutions' Volunteer Training Corps.—

Company Orders.—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week commencing November 1st, 1915 :—

Drills, 6.15 to 7.15 ; 7.15 to 8.15 p.m.

Monday, November 1st.—Section 1, Technical ; Section 4, Squad or Working Party.

Tuesday, November 2nd.—Section 2, Technical ; Section 3, Shooting Working Party.

Thursday, November 4th.—Section 3, Technical ; Section 2, Shooting Working Party.

Friday, November 5th.—Section 4, Technical ; Section 1, Squad or Working Party.

Saturday, November 6th.—Company Parade 2.30 p.m.

Sections for Technical Drill will fall in at the Headquarters of London Electrical Engineers (T.F.), at 46, Regency Street, S.W.

Sections for Squad, Signalling, Shooting and Working Parties will fall in at the new Headquarters, Chester House, Eccleston Place, S.W. All Members who have not yet been measured for Uniforms will attend at Headquarters, on Friday, the 5th inst., for this purpose. All men who draw haversacks and water bottles for week-end Working Parties are requested to return them to Headquarters on the following Monday. Members desiring to have their own haversacks and water bottles can purchase them at Gamages'. The following Corporals have been appointed :—C. McArthur Butler, Section 2 ; H. J. Golding, Section 3 ; B. C. Garman, Section 4 ; R. T. Morris, Section 4 ; T. Spiers, Section 3 ; H. Jantzen, Section 2 ; E. A. Ullmann, Section 1 ; J. M. Smith, Temporary Corporal.

E. G. Fleming,
Company Commander and Acting Adjutant.

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, October 28th, 1915 :—

Week-end Parades.—Saturday.—The Battalion will parade, as strong as possible, at Baker Street Station at 2.30 p.m., and proceed by train to Wembley Park, for Field Operations. Orders have been issued to those concerned.

Sunday.—The Battalion will parade at Liverpool Street Station (Low Level entrance, G.E.R.) at 9.30 a.m., and proceed by train for Entrenching duties, returning at 4.59 p.m.

The Quartermaster will make the necessary arrangements for Lunch.

Special Employment.—Names of men are required at once who will volunteer and are suitable for special employment, the nature of which they can ascertain by applying to their Company Commanders. As the Authorities require this return by November 1st, members are requested to give their names in as soon as possible, and Company Commanders must hand them in to the Adjutant on Parade next Sunday, the 31st inst.

Musketry.—Saturday next, the 30th inst. There will be shooting at both Acton and Bisley Ranges, as usual. Members proceeding to Acton must parade there at 2 p.m. punctually. Those shooting at Bisley must report themselves to Sergeant Cotter, at the barrier of No. 9 Platform, Waterloo Station, at 12.45 p.m.

Tuesday, November 2nd. Shooting at Acton, as usual, at 2 p.m.

A. G. Joiner, *Major and Adjutant*, O.B.C.

Zinc from Quebec.—The first Canadian zinc reduction plant to be started in Canada will be in operation before November 1st. The newly-incorporated Canadian Zinc Co., which is owned by the Weedon Mining Co., has acquired a large industrial plant, and has entered into a contract for electricity, the present arrangement being for an initial allotment of 1,000 h.p. Initially United States ores will be used, but it is expected that in a few months the mills will be supplied from the mines owned by the company at Nottingham (Quebec).—*Financier.*

Quoting from a U.S. Consular report, the *Chemical Trade Journal* says it is officially announced by the President of the Consolidated Mining and Smelting Co., Toronto, that the Dominion Government has contracted with that company for the entire output of the new zinc reduction plant now being installed at Trail, British Columbia. After long experimentation the metallurgists of this company have discovered a satisfactory process of reducing the ores by electrochemical treatment, the experimental plant being now capable of producing 500 to 1,000 lb. a day. It is said that the Trail smelter will be one of the best in America, and that it will be producing 25 tons of spelter a day before the end of the year. The new zinc plant will be installed with a capacity to use 10,000 hydro-electric h.p. from the West Kootenay Power Co.

The Navy's Need for Skilled Engineers.—Munition work, as we understand it to-day, that is to say, work in the shop and the factory, forms by no means the only opportunity for skilled engineers to serve their country at the present time. The Navy is always glad of their services. Transference from munition work to the Navy is not encouraged, but amongst those skilled mechanics who are not at the present moment engaged on munition work there must be many who would be glad to find an outlet for their technical abilities, by becoming members of the Naval Service. It is felt that if the opportunities and the requirements which exist in this respect were more fully known, there would be no difficulty in keeping up the supply of electrical artificers and engine-room artificers who are needed by the Navy. This branch of Naval Service has many attractions, not the least of which is the comparatively high pay received, which amounts, on entry, to nearly £2 per week, and which may be very considerably improved by good service. Thus, with much better pay and prospects than those of the ordinary seamen, they have the same opportunity for seeing the world, and for leading a fine, healthy open-air life, at the same time as driving their own trade, which usually keeps them so closely confined to the workshop. As they enter the Navy with the rating of chief petty officers they mess in the chief petty officers' mess and have the same opportunities for leave when they are in port. If they are sufficiently skilled they are drafted at once on to a battleship and come immediately to grips with their work. Their opportunities for advancement to commissioned rank are excellent. During the period of the war, men are accepted between the ages of 21 and 45. For rating as engine-room artificers, men who have experience and are competent workmen in the trades of engine fitters and turners, coppersmiths, boiler makers, and engine smiths are required. An examination is usually held on entry, but in the case of a candidate who holds a Board of Trade certificate as a first class or a second class engineer, and can produce certificates of character and ability from the works in which he has learnt his trade, exemption is granted. Engine-room artificers are entered as chief petty officers, a position which carries with it many privileges. A free kit is provided on entry, and this, of course, is not the ordinary blue-jacket's slacks and jumper, but what is known in the Navy as "fore-and-aft rig," that is to say, a peak cap and reefer jacket. Fitters, turners and instrument makers are required by the Navy as electrical artificers. Candidates for this rating are accepted for the period of the war between the ages of 21 and 45. The pay is the same as that of engine-room artificers, and an examination in fitting and turning or instrument making is imposed. Electrical artificers may be recommended for a practical course of training which is carried out on board the *Vernon*, which is moored at Portsmouth, or on board the *Defiance* at Devonport. During this period they may be accommodated either on board ship, or in the magnificent Naval barracks which are situated in these two towns. This avenue to naval life is certainly one not to be neglected by the skilled engineer. There is no quicker way of entering for actual service, and none which secures immediately better pay, prospects and position. Entering the Navy as a chief petty officer he immediately steps into a rank which takes the man who enters as ordinary seaman many years to achieve.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Electricity Committee of the St. Pancras B.C. has recommended that the wages of the boiler foreman at the King's Road electricity station be increased from £2 15s. to £3 per week.

Mr. J. A. H. Clifford has been appointed engineer-in-charge of the Belfast Corporation electricity station, and Mr. Girvan, switchboard attendant, has been promoted junior engineer-in-charge.

General.—Mr. J. F. Avila has been appointed works manager at the Birmingham works of Simplex Conduits, Ltd. Important business operations have necessitated certain changes, and these having to be made hurriedly, Mr. Avila was unable to take leave of all his London district friends. For the last nine years he has acted as London manager to this company, and has been in touch with many electrical men in the London district.

The North-East Coast Institution of Engineers and Shipbuilders at its meeting to-night will present Institution gold medals as follows for papers read last session :—Mr. J. W. Hobson, for a paper on "Industrial Locomotives"; Mr. E. W. Fraser Smith, for a paper on "The Future of British Engineering and Shipbuilding."

Mr. W. Dundas Fox, power representative to the Bradford Municipal electricity department, has resigned his position, and has joined the staff of the British Westinghouse Electric and Manufacturing Co., Ltd., at Trafford Park.

The wedding took place at Christ Church, Eccleston, a few days ago, of Mr. Robert C. Shaw, of Prescot, and Miss Gwendoline D. Wheeler, of Eccleston Park, Prescot. Among the presents received were a marble clock and afternoon teacups from the staff at the British Insulated & Helsby Cable Works.

The following announcement appears in the *London Gazette* :—Royal Marines Submarine Miners, Temp.-Lieut. to be Temp.-Capt., Horace M. Taylor.

At St. Mary's Parish Church, Whitby, on October 20th, the marriage took place of Mr. Wm. Harold Cowling, electrician, Saltburn-by-the-Sea, and Miss Margaret Jane Barry, of Whitby.

The marriage has taken place at Tarrant Monkton Church, Dorset, of Mr. Leslie Hampden Pratt, of Streatham, and Miss Victoria Agnes Hall, second daughter of Mr. Edward H. Hall, Rugby. Mr. Pratt is serving in the Royal Naval Division.

New Justices of the Peace appointed for the County of Kent include Mr. Thos. Octavius Callender, of West Heath House, Abbey Wood, managing director of Callender's Cable and Construction Co., Ltd., of Erith.

Lieutenant-Colonel R. E. P. Pigott, C.I.E., late of the Bombay, Baroda and Central India Railway Rifles, has been appointed to the command of a service battalion. He commanded the 1st Battalion of the Rifles for the usual period, and is the chief electrical engineer of the Bombay, Baroda and Central India Railway.

On the occasion of his marriage, Mr. W. Wood, electrical and telegraph superintendent, North-British Railway, was presented by members of the staff with a silver tea service.

The Ministry of Munitions and the Local Government Board have invited Mr. J. M. McElroy, general manager of the Manchester Corporation Tramways Department, to come to London for the purpose of advising on the best means of dealing with transit difficulties in a portion of the Metropolitan district, where munitions workers are employed in large numbers.

The *London Gazette* announces that the undermentioned have been appointed second-lieutenants in the London Electrical Engineers:—Sapper W. J. Rawlings, Sapper J. D. Ross.

Roll of Honour.—Mr. Tom A. Fraser, who was with the Electrical Co., Ltd., for 13 years, latterly as manager of the cable and metals departments, was killed in action in Flanders on October 16th. He joined the H.A.C. soon after the outbreak of war.

Sergeant-Major Eric Eaton, of the 11th Manchesters, an electrician, of Broadstairs, has been missing at the Dardanelles since August 22nd.

Private Harry Seed, of the 8th Battalion King's Own Scottish Borderers, who is reported to have been killed in France, was formerly engaged in electrical work at Stockton Heath, Warrington.

Lieutenant Fergus R. Forbes, of the Royal Engineers, formerly engaged at the Hayle (Cornwall) electricity works, has been killed in action in France.

Gunner Percy Edgar Russell, of the Royal Field Artillery, who was, prior to enlistment, with Messrs. Willans & Robinson, Ltd., of Rugby, has been killed in France.

Bugler Wilfred Lintern, 12th Battalion Rifle Brigade, who has fallen in action in France, was prior to the war engaged at the Rugby works of the British Thomson-Houston Co., Ltd.

Private Reginald Stallard, of the 10th Battalion Worcestershire Regiment, who left the staff of Messrs. Heenan & Froude, refuse destructor makers, of Worcester, to join the Forces, has been killed in action.

Lance-Corporal W. Bridgett, of the 1/5th North Staffs. Regiment, engaged until the outbreak of war with Messrs. Siemens at Stafford, has been wounded in the ankle in France, and is now in hospital in England.

Private Clifford Bentley, 12th Yorkshire Regiment, who has died from wounds received in action in France, was engaged at the electricity works of the Heckmondwike U.D.C.

Sapper A. Snow, 95th Field Company, Royal Engineers, who was on the electricity staff of Hanley Corporation, has been wounded in action in France. He is in the Whitchurch Military Hospital at Cardiff.

Private Frank Whittaker, who was, prior to the war, engaged with the Yorkshire Electric Power Co., is reported missing at the Dardanelles, where he was drafted on July 3rd.

Private H. A. Garratt, of the 1/4th Leicestershire Regiment, who was engaged with a firm of electrical engineers at Leicester, has been wounded in action, and is in hospital at Aberdeen. His wounds are in the right shoulder and hand.

Private Ernest Tuson, 4th Battalion South Wales Borderers, who has been killed in action at the Dardanelles, was an electrician engaged in the railway telegraph department at Abergavenny. Previously he was a foreman in the electrical department of the L. & N.-W.R. Co. at Warrington.

Private J. A. Ellis, of the Coldstream Guards, who was on the staff of Messrs. Siemens Bros., at Stafford, has been killed in action.

Sergeant-Major Ernest G. Thomas, of the 1/5th North Staffs. Regiment, formerly on the electricity staff at the Burslem municipal works, has been killed in action.

Obituary.—We regret to learn that Prof. Vivian B. Lewes, Professor of Chemistry at the Royal Naval College, Greenwich, chief superintending gas examiner to the City of London, and a lecturer and expert whose statements respecting the hygienic value of gas lighting and heating have frequently interested electrical men, passed away on Saturday night last. He was taken ill with double pneumonia while on a lecturing visit to Mold, Flintshire. He was 63 years of age.

The nation has lost one of its greatest ordnance experts and the head of the renowned Armstrong-Whitworth organisation, at Elswick, by the death of Sir Andrew Noble, who died last week at the age of 83 years.

We regret to record that Mr. Ernest Hartjen (of Messrs. H Hartjen & Co.) passed away on October 8th, after an operation for appendicitis. The business will be continued as usual under the personal supervision of Mr. F. W. Lang.

Mr. W. A. Luntley, who had been manager of the Wolverhampton Corporation Tramways since 1902, died on Monday after a long illness, the result of an accident. Prior to his appointment, deceased, who was a Wolverhampton man, was associated with the Birmingham tramways before they were municipalised.

CITY NOTES.

Dick, Kerr & Co., Ltd.

Mr. Claud T. Cayley (chairman) presided at the annual meeting, held on October 21st, at the Cannon Street Hotel. In moving the adoption of the report, the Chairman said that just over a year ago, when they last met, he fancied the large majority fully anticipated that before they met again the war would be over, and they would be in a position of considering their own affairs from a normal point of view. As it was, the position remained much as it was. They were in a state of suspense, living from hand to mouth, as it were; all their normal development stopped and their energies transferred to the special requirements of the time. He told them last year that, in the opinion of the directors, the company would experience some lean years after the war before they could hope for the re-establishment of their standard business, especially in heavy manufacturing, and he had no reason to alter this opinion. The profit on this year's trading was principally derived from orders and contracts taken before the war, and which were gradually falling in to a finish. These, as could be readily understood, were not being replaced by others of similar nature, so that, although they were busy now on abnormal work, there was bound to be a transition period occupied in re-establishing normal conditions; and it was because of this that the directors could not see their way to recommend a dividend on the ordinary shares. They felt that some reserve must be made to bridge over that period. He had mentioned that they were busy now, but not on normal work; and although the directors were primarily pleased because they believed they, as a company, were assisting the Government to a material extent, they were also hopeful that some reasonable profit proportionate to the efforts being made would be permitted—sufficient, at all events, to make it unnecessary next year to put such a large percentage of profit to reserve for contingencies. Clear indications, however, had been given, first in the Munitions Act, and secondly in the Budget, of the Government's intention to absorb excess profits, especially if derived from work due directly to the war. No person could object to this principle, but at the same time no one, at all events outside of the Government, could predict to what extent it would be applied, and it, therefore, behoved them to be ultra-conservative in dealing with their accounts at the present time. There was no abnormal change to draw attention to in the accounts. Contracts were larger than they had been for some years. One cause was found in the Metropolitan Water Board contract, where a very large amount of plant was required, and the work was going on, although suffering to some extent for want of labour. Another cause was in connection with certain changes and developments on the manufacturing side of the business, respecting which; however, he could not go into details. His speech was a short one, but fairly to the point. Owing to the company being engaged in work for the Government it was necessary for him to make it short. The balance-sheet was made up to June 30th, 1915, during which period they were not as heavily engaged in the manufacture of war material as at the present time, and as they expected to be in the future. The figure for contracts was £460,365, and although he had referred to contracts being large, still there had been previous years when they were larger still. It would be noticed that they had transferred £25,000 to a special reserve fund for contingencies.

Mr. R. H. Prestwich seconded the motion, and it was carried without discussion.

The retiring directors were re-elected, and Mr. John Sampson, in reply, said he thought the shareholders had reason to be fairly well satisfied with the position of affairs, considering all the circumstances.

Mr. Barber Glenn proposed a hearty vote of thanks to the board and staff, and this was seconded by Mr. Dixon, who observed that all the members of the board were practical business men, and if they could not make a success of the company, nobody could.

The vote was acknowledged by the Chairman, who paid a warm tribute to the work of Mr. Walter Rutherford, the managing director, and the staff.

Cape Electric Tramways, Ltd.

The directors report that for the year ending June 30th, 1915, the profit and loss account shows a profit of £80,615, and after providing for debenture interest, redemption of debentures, and taking into account the balance brought forward from last year, a net credit balance of £44,286 remains. From this amount the reserve fund has been credited with £12,000, leaving a balance of £32,286. The directors therefore recommend the payment of a dividend in respect of the past year of 5 per cent. on the ordinary share capital of the company. This will absorb £24,561, leaving a balance of £7,725 to be carried forward. During the year the tramways carried 21,680,070 passengers, earning £206,123, as against 20,886,146 passengers, earning £200,409 in 1913-14. While the traffic shows some expansion, the state of war in South Africa during the year under review has added considerably to the working costs of the tramways by reason of the additional cost of labour and the allowance granted to those employés who have gone on active service, over and above which, there is also an increase in the cost of all supplies. The profit on the year's working must, therefore, be regarded as satisfactory, especially as it has had to be earned in a period covering the Rebellion and the German South-West African Expedition. The conditions prevailing call for the exercise of economy and retrenchment wherever possible, and the management in South Africa is fully alive to the necessity of most careful supervision in every department of the company's business. The directors again refer to the valuable services rendered by the local boards in Cape Town and Port Elizabeth, also by the general managers in Cape Town and Port Elizabeth, and the staffs under them. Mr. Jameson, who was secretary of the company since its formation, died suddenly in March last. Mr. F. Haines, who was acting-secretary, has been appointed his successor.

Annual meeting: November 10th.

Yates and Thom, Ltd.—The net profit for the year ended August 7th, after providing for depreciation of plant and machinery, interest on mortgage debenture stock, and writing down investments to market value, is £36,553, plus £8,428 brought forward. The directors propose to pay one year's dividend on the ordinary shares at 10 per cent., less tax, transfer to reserve fund £20,000, and carry forward £8,346. —*Financial Times.*

West India and Panama Telegraph Co., Ltd.—The directors recommend the following dividends:—6s. per share on the 1st and 2nd pref. shares, for the six months ended June 30th, and 9d. per share on the ordinary shares, free of income-tax.

Huelva Gas and Electricity Co., Ltd.—A financial contemporary says that the directors announce that it will be impossible to provide the interest due on November 11th next on the debenture stock.

New St. Helens and District Tramways Co., Ltd.—A dividend of 2½ per cent. (2s. 6d. per share), on the preference shares is announced. £5,000 has been placed to reserve and £6,557 carried forward.

Kaministiquia Power Co.—The directors have declared a dividend of 1½ per cent., or at the rate of 6 per cent. per annum on the common stock for the quarter to October 31st.

Brisbane Electric Tramways Investment Co., Ltd.—A dividend of 4s. per share, free of income-tax, on the ordinary shares is announced.

Lisbon Electric Tramways, Ltd.—The directors have declared an interim dividend of 2½ per cent., free of income-tax, on account of earnings of current year.

Parsons Marine Steam Turbine Co., Ltd.—The directors recommend a dividend of 13 per cent. (actual), making 25 per cent. for the year.

Westinghouse Brake Co., Ltd.—Interim dividend of 5 per cent., less income-tax.

Anderston Foundry Co., Ltd.—Interim dividend of 4s. 6d. per share, less income-tax.

Delabole Electric Light Co., Ltd.—A dividend of 5 per cent. for the year is announced.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange cannot complain that it has any lack of features in the way of market movements. Within the past week or so such rises have occurred in Brazilian, Mexican, and Canadian securities of all kinds as fairly to merit the designation of breathless. A good deal of it, of course, has been somewhat artificial. Where there is little stock on offer and a good deal of demand, prices go up with a swing; and this is what has happened in the cases of the utility companies of the three countries mentioned. At home, too, securities are improving in value in many departments: in fact, the Home Railway market is about the only section where there is no appearance of firmness or business.

The heavy rises of last week in Mexican utility issues have been further improved upon during the past few days. At the beginning of the week there came a slight set-back in the general buoyancy, and some of the ordinary issues gave way under quiet pressure to sell. The sudden revulsion of feeling as regards Mexico brought about a lively gamble in New York, and the excitement spread to Montreal, thence to London. A very little inquiry for the utility companies' bonds sent up prices by leaps and bounds, and some holders consider that the rise has been carried quite far enough for the present. It is only necessary to refer to several of the recent reports from Mexican companies to understand how thoroughly exhausted the country is. Food in Mexico City, we read in one of these reports, is at prohibitive prices, because scarcely any crops were sown, on account of brigandage and the confiscation of draught animals.

The exchange was said at the end of June last to be a nominal few pence. The Mexico Tramways, it was recently stated, had lost the controllers off its cars. The Mexican Light and Power Co. was unable to collect its debts, although at the same time it was expected to maintain its upkeep, the purchase of machinery having to be made, of course, in gold, while what takings the company secured were in the frightfully debased currency of the country. Carranza has indeed a colossal task in front of him. Money, no doubt, will pour into Mexico from the United States; but it stands to reason that the Americans will insist upon stiff terms for their financing of the companies. The words Prior Lien and First Mortgage stand an unhappy chance of losing much of their sacrosanctity in the light of what is probably going to happen in Mexico during the next year or two.

Canadians have been booming in consequence of the fresh reports reaching this country as to several of the well-known companies being overwhelmed with war orders. The particular star is Canadian General Electric, the common stock of which rose 10 points in one day, and 7 or 8 more in less than a week; the price has soared to 130, whereas at the outbreak of war it stood a little below par, and in the early part of the present month the price was about 108. The preferred stock is almost neglected, its dividend being fixed and carrying no participating rights. Shawinigan Water common stock further rose to 145. The shares of the various electric lighting and power companies of the United States, as well as Canada, have been eagerly sought after; and, judging from the way in which American rails have been pushed up to almost ridiculous values, there is some justification at least for the buying that is going on in the industrial departments.

Brazil is considered to have definitely turned the corner, and a remarkable feature of the week is the way in which Brazilian Traction common shares have gone ahead. Unlike the improvements in some of the other stocks and shares just mentioned, the rise in Brazil Tractions has been accompanied by a satisfactory amount of business. Montreal as well as London is supporting the shares on this side, and the price is now within easy distance of that current at the time that war broke out—namely, 66. The company's preferred shares have risen at the same time, standing now about 89½. Rio de Janeiro Tramway bonds improved materially, in sympathy with the substantial recovery in all things Brazilian; and the whole of this Latin-American utility list, so dry and stagnant hitherto, is once more a centre of lively animation and keen buying which would have rejoiced the heart of poor Dr. Pearson, the head of the group, who, it will be remembered, was murdered by the Germans in the sinking of the *Lusitania.*

The home markets are generally steady, with the exception of that for Home Rails. The latter is as depressed and neglected as ever: every week, in fact, brings further declines; and what claims the market has to the consideration of investors are entirely overlooked. Central London assented ordinary is easier. There are falls in Metropolitans, Underground Electric ordinary shares and income bonds. Underground income stock, however, is firm at 103¼.

Electricity supply shares are maintaining their prices in most cases; where shares come in, they usually have an effect upon the quotation. County of London, for instance, are easier at 10; and the 4 per cent. debenture stock of the Metropolitan Co. is marked down 5 points to 85.

Debenture stock holders of the South Metropolitan Electric Light & Power Co. are being asked, in a circular signed by the chairman of the undertaking, to support the board's proposals for an alteration of the trust deed. The trustees for the debenture stockholders differ from the board of directors on a point touching the company's obligation to carry a portion of the profits to the credit of the depreciation account. It is unusual for the directors and the trustees for the debenture holders of a company to hold divergent views; but where the security of debenture stockholders is in any way in question the matter is manifestly one that calls for very careful consideration indeed.

The telegraph market is better, the only decline being one of ⅛ in Eastern Extension shares, which have lost the fraction gained last week. Anglo-American Telegraph preferred has again risen, and New York Telephone bonds are a point higher. Up to the present, the results of the Anglo-French Loan in New York have been disappointing and unexpected, for the rate of exchange between the London and New York is no whit more settled than it was before the negotiations began: in fact, the exchange presents serious difficulties to finance at the present time. West India and Panama shares are up ⅛.

Marconis continue listless. The extraordinary achievement of wireless telephony between New York and Paris brought forth the supposition in the London-American market that, upon the resumption of peace conditions, arbitrage business would be conducted through the medium of speech instead of that of cable. American Marconis are almost as quiet as their parents, but the New York speculation in electric industrials goes on with fierce determination.

Telegraph Constructions are up another £1 at 32½. The rubber market also is good, notwithstanding comparative dullness in the price of the raw material. There is nothing much going on in the armament list; and amongst copper shares the prevailing tendency is still heavy.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Oct. 26, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	7¼	—	£6 18 4
do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	3½	— ¼	7 2 10
do. do. do. 4½ Pref. ..	4½	3¾	—	6 0 0
do. do. City Pref.	4½	3½	—	6 8 7
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4¼	—	5 17 8
do. 4½ Deb.	4½	87	—	5 3 6
City of London	9	12½	—	7 7 0
do. do. 6 per cent. Pref. ..	6	10¾	—	5 11 4
do. do. 5 Deb.		100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10	— ½	7 0 0
do. do. 6 per cent. Pref. ..	6	10½	—	5 17 8
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6¼	—	7 4 0
London Electric	4	1⅜	—	8 3 4
do. do. 6 per cent. Pref. ..	6	4½	— ⅛	6 13 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	3½	2¼	—	7 15 7
do. 4½ per cent. Pref. ..	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	85	— 5	5 6 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6¾	—	7 8 2
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6¾	—	6 13 4
do. 4½ Pref.	4½	4⅛	—	5 9 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	102	+ ½	5 18 0
do. Def.	1½	22¾	—	6 11 10
Chile Telephone	8	6½	—	6 3 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11¾	— ⅛	*6 16 2
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord...	7	120	+1	*6 14 0
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	82	+1	4 18 0
Globe Tel. and T. Ord.	6	10	+ ⅛	*6 17 0
do. Pref.	6	10	+ ⅛	6 0 0
Gt. Northern Tel.	22	33½	—	6 11 4
Indo-European	13	47	—	6 18 4
Marconi	10	1⅞	—	6 8 0
New York Tel. 4½..	4½	102½	+ 1	4 7 9
Oriental Telephone Ord.	10	1 15/16	—	5 8 1
do. Pref.	6	⅞	— ⅛	6 17 2
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5¾	—	*8 2 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	— ⅛	8 17 9
Western Telegraph	7	12¼	+ ⅛	*6 11 4
do. 4 Deb.	4	80	—	5 0 0
Home Rails.				
Central London, Ord. Assented ..	4	68	—1	5 16 0
Metropolitan	1½	22¼	— ¾	5 8 8
do. District	Nil	13	—	Nil
Underground Electric Ordinary ..	Nil	1¼	—	Nil
do. do. "A"	Nil	5/6	—	Nil
do. do. Income ..	6	70½	— ½	*9 12 6
Foreign Trams, &c.				
Adelaide Sup. 6 per cent. Pref. ..	6	5	—	6 0 0
do 5 Deb.	5	97	—	5 3 0
Anglo-Arg. Trams, First Pref. ..	5½	3½	—	7 17 2
do. 2nd Pref.	5½	3	—	9 3 4
do. 4 Deb.	4	74	—	5 8 1
do. 4½ Deb.	4½	74	—	6 1 7
do. 5 Deb.	5	75	—	6 13 4
Brazil Tractions	3½	57½	+7½	6 1 9
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	34	—	Nil
do. 5 per cent. Bonds ..	—	50	+3	Nil
do. 6 per cent. Bonds ..	—	44	—	Nil
Mexican Light Common	Nil	30	+2	Nil
do. Pref.	Nil	40	+2½	Nil
do. 1st Bonds	—	10	+4	—
Manufacturing Companies.				
Babcock & Wilcox	14	2 3/16	—	6 8 5
British Aluminium Ord.	5	1 1/16	—	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	10⅜	— ¼	7 4 7
do. Pref.	6	5⅛	—	5 2 2
British Westinghouse Pref.	7½	84/-	—	8 10 8
do. 4 Deb...	4	72	—	5 11 1
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref...	5	4½	—	5 11 8
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	61/-	—	4 18 6
Edison & Swan, £3 pd.	Nil	10/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	57	—	7 0 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/9	—	7 1 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	12½	—	*9 2 0
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	8	—	6 5 0
Telegraph Con.	20	32½	+1	7 12 0

* Allowance made for dividends being paid free of income-tax.

Empire District Electric Co., Ltd.—The directors have declared a dividend of ¾ per cent. The policy of the board is to continue payment of a similar dividend on the preferred stock monthly until all accumulated dividends are paid, and to then disburse the regular dividend of one-half of 1 per cent. each month thereafter.—*Financier.*

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, October 27th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a ,, Nitric	,,	..	..
a ,, Oxalic	per lb.	1/-	..
a ,, Sulphuric	per cwt.	..	..
a Ammoniac Sal	,,	..	..
a Ammonia, Muriate (large crystal)	per ton	£50	..
a Bleaching powder	,,	£9	..
a Bisulphide of Carbon	,,	£23	..
a Borax	,,	£23	..
a Copper Sulphate	,,	£28	..
a Lead, Nitrate	,,	..	..
a ,, White Sugar	,,	..	..
a ,, Peroxide	,,	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	..	..
a Potash, Caustic (88/90 %) ..	per ton	..	..
a ,, Chlorate	per lb.	1/4½	..
a ,, Perchlorate	,,	1/6	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	,,	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers ..	,,	£11 10	..
a ,, Recovered	,,	...	..
a ,, Lump	,,	£8 10	..
a Soda, Caustic (white 70/72 %) ..	,,	..	..
a ,, Chlorate	per lb.	1/3½	..
a ,, Crystals	per ton	45/-	..
a Sodium Bichromate, casks ..	per lb.	5½d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	..	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	..	..
b ,, Sheet, in ton lots ..	,,	..	..
p Babbitt's metal ingots	,,	..	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/0¾ to 1/1	..
c ,, Tubes (solid drawn) ..	,,	1/1¼ to 1/1½	..
c ,, Wire, basis	,,	1/1¼ to 1/1½	..
c Copper Tubes (solid drawn) ..	,,	1/1½ to 1/1¾	¼d. inc.
g ,, Bars (best selected) ..	per ton	£103	£3 inc.
g ,, Sheet	,,	£103	£3 inc.
g ,, Rod	,,	£103	£3 inc.
d ,, (Electrolytic) Bars ..	,,	£88 10	..
d ,, ,, Sheets ..	,,	£106 10	..
d ,, ,, Rods ..	,,	£95 10	..
d ,, ,, H.C. Wire	per lb.	11½d.	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
a German Silver Wire	,,	1/10	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	2/5½	..
l Iron Pig (Cleveland warrants) ..	per ton	67/7½	3/1 inc.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£26	..
g Lead, English Pig	,,	£25 15	15/- inc.
g Mercury	per bot.	£15 15	..
e Mica (in original cases) small ..	per lb.	6d. to 3/-	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/6 to 14/- & up.	..
o Nickel, sheet, wire, &c.	,,	Nom.	..
p Phosphor Bronze, plain castings	,,	..	..
p ,, ,, rolled bars & rods	,,	..	..
p ,, ,, rolled strip & sheet	,,	..	..
o Platinum	per oz.	198/-	8/- inc.
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	,,	£154 10 to £155 10	£4 15 to £5 15 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/7	..
p White Anti-friction Metals ..	per ton	..	..
k Zinc, Sh'ts (Vieille Montagne bnd.)	,,	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

South Metropolitan Electric Light and Power Co., Ltd.—According to a financial daily, a meeting of the debenture holders was called for Wednesday to consider a proposal to vary the trust deeds as regards the amount agreed to be set aside to reserves or depreciation. The existing arrangement allows for 2½ per cent. on the share and loan capital to be so set aside annually until 1923, and the proposal now made is to reduce this to 1½ per cent. on the total capital, less freehold lands and investments, the period to be extended to 1931. Such an alteration should bring nearer the payment of ordinary dividends. The trustees have issued a circular opposing the proposed modification of existing rights.

Trafford Park Estates, Ltd.—The profit for the year ended June, 1915, was £20,792, plus £4,405 brought forward, and the net available profit due to the redemption of chief rent £44,763, makes the available profit £69,960. A dividend of 4 per cent. is to be paid, carrying forward £45,070. The capital expenditure of the year, mainly on new buildings, was £46,897.

THE IDEAL TRANSMITTER.

Somebody defined the piscatorial art as "A rod with a fool at one end and a worm at the other." The telephone may often have a swearing man at one end of the line. It has now, however, reached a high state of perfection; exchanges are wired on the most approved principles, "Cross talk," in both senses of the word has been reduced to a minimum, while the double-pole Bell receiver (which is very nearly perfect) is a marvellously sensitive piece of apparatus.

The chief object of this article is to indicate what is required of a perfect transmitter, rather than to show how it may be constructed.

The advent of the "Hunnings" granular transmitter has done for telephony what the incandescent mantle has accomplished in the gas world.

The chief requirements of an ideal transmitter would be:—

1. Very little or no current used when not being spoken into, though the circuit be closed.
2. Absolute freedom from "frying" and "boiling" sounds and foreign noises of all kinds.
3. No tendency to "pack."
4. It should be loud speaking, that is, its resistance should show great variation with but slight vibration of its diaphragm.
5. Lastly, it should be clear speaking.

The other desirable characteristics, such as cheapness, strength, &c., are more easily attainable.

To deal with things in their proper order, I will begin with No. 1.

The only transmitter, so far as I am aware, which passes no current (whether speaking or not) is one which is constructed on the principle of the condenser, and which varies its capacity in unison with the sound vibrations, and being connected across the line in such a manner that the value of the current flowing through the receiver is varied, it thus transmits speech.

The non-success of this form, though it speaks very clearly, and is absolutely free from foreign noises, is due to its very feeble results, which in turn are due to the difficulty of making a "sensitive" condenser which shall have great variations of capacity.

Coming now to condition No. 2, this is perfectly fulfilled by the above-mentioned transmitter and also by one or two other forms, some of which I believe have not got much beyond the laboratory stage.

If a small mirror be affixed to a vibrating diaphragm in such a manner that a beam of light may be made to impinge upon a selenium cell with greater or less intensity, the said cell being in circuit with a battery and receiver, speech may be thus transmitted.

The objections to this type are, amongst others, the necessity of an illuminant and the unstable and delicate nature of the selenium cell.

As to No. 3, this is one of the great drawbacks of the "Hunnings" granular type, and is due to the gradual settling down of the granules; this may be temporarily overcome by giving the transmitter a half turn occasionally, thus shaking up the particles.

A form was introduced in which the tendency to "pack" was partly prevented by little silk tufts on the back electrode, but was not very satisfactory.

One of the advantages of the "Hunnings" type is the fact that its resistance varies considerably with a comparatively slight movement of the diaphragm; in other words, it is sensitive and loud-speaking. This is due to the great number of points of contact, and, therefore, available paths for the current.

Thus it will be seen that condition 4 is fairly well fulfilled by the "Hunnings"; it is also fairly clear, but if we try to increase its loudness by increasing the voltage, we also increase the "boiling" and foreign noises, &c.

No. 5 is a very important condition, and this combined with loud speaking and freedom from foreign noises would be an ideal combination.

The great point to bear in mind is that a transmitter is required that shall vary greatly in resistance with the comparatively small vibration of its diaphragm, but that it shall not do so in steps; as an instance of my meaning, I may take an adjustable resistance in which the studs are marked 10, 20, 30, &c., ohms, and a water resistance in which a plate of metal is gradually immersed as in a motor starter.

The transition from the minimum current to the maximum current may be as sudden as you please, but it must be continuous, and not rise by jumps like a man going upstairs.

The "boiling" and "frying" in the granular type is caused by actual arcing between the granules and by the making and breaking of a great number of separate and tiny contacts, and is increased by an increase of voltage. The Bell receiver has been used as a transmitter and is very perfect, but the speech, though very clear and absolutely free from "boiling," &c., is too feeble for practical use; it is of course used without a battery, as it generates its own current, which is in this case alternating, besides fluctuating in strength.

Another form utilises the principle of the inductive spiral, that is, a spiral of fine wire is caused to close up and open out by the movement of the diaphragm, thereby varying its self-induction or impedance. This form is quite free from "boiling," &c., but is too feeble.

The difficulties in the way of the production of a perfect transmitter are far greater than those which occur in the design of a receiver; several forms of receiver have been made which are free from hysteresis, impedance, and capacity, which all containing iron and coils of wire, must possess.

The performance of a transmitter is, of course, dependent on a lot of conditions outside itself, such as whether an induction coil is used, the resistance and capacity of the line, receivers, &c., whether the supply is from batteries or power, if from power the type of the line coils, &c., but this article only concerns the transmitter itself.—C. M.

INCREASING THE COST TO THE CONSUMER.

[BY OUR LEGAL CONTRIBUTOR.]

Certain companies and other bodies supplying electricity have recently been compelled to raise their prices. Into the reasons which have compelled them to take this course it is not proposed to inquire at any length. Increased cost of getting and transporting coal and shortage of labour have tended to enhance the cost of running nearly every generating station in the country.

Whatever the cause, retrenchment has become necessary. In the case of a local authority working under provisional order, the increased cost must be borne either by the ratepayer or the consumer. With the fear of the Local Government Board before their eyes, members of Electric Lighting Committees will not unnaturally seek to make the consumer pay the loss. The fact that "profit," so-called, was written off against the rates during the piping times of peace, is not likely to persuade the Local Government Inspector to make the ratepayer pay the loss accruing owing to the war. Consequently the tendency will be to make the consumer bear the brunt. In the case of a company, the decision must be in favour of the consumer or the shareholder; and the directors will not unnaturally seek to protect those for whom they are trustees so far as they can do so within the four corners of the Act of Parliament which has sanctioned their undertaking.

It is proposed to examine the legality of some of the methods which have been, or are being, adopted to prevent electrical undertakings being run at a loss.

It appears that, in some instances, after notice has been given, an addition of 10 per cent., or thereabouts, has been added to the consumers' account. Can the addition be lawfully demanded? If not, what other courses are open to the supply authority?

It is manifest, of course, that an arbitrary levy of 10 per cent. on each consumer's bill cannot be supported. If the undertakers have agreed to supply electric light at x d. per unit, they have no right to demand $xy + xy/10$, where y equals the number of units registered by a consumer.

On the contrary, if notice has been given to each consumer that at the end of his current contract he will be charged at the added rate, the operation is perfectly legal provided all consumers are treated alike.

From the strictly legal point of view, therefore, no lawyer acting for an electric lighting company or local authority, could advise his client to adopt a sudden 10 per cent. increase as a legitimate way of reducing losses.

It may be that in many cases the added cost of production is so serious that it will be necessary for the entire scale of charges to be revised. Current contracts being observed to the letter, it will be competent for those supplying electricity to increase the charge per unit, provided the statutory limits are not exceeded, and provided (further) that no preference is shown to any consumer or class of consumers. Thus the lighting rate must be raised uniformly in the district, and the power consumers, as a class, must also be uniformly treated. The method to be adopted for increasing rates is clearly laid down in the Electric Lighting Acts, which, of course, do not make any provision for expediting matters owing to the exigencies of a European war.

It is worth while to glance at them. The maximum prices usually allowed to be charged by provisional order are: "(1) Where the undertakers charge any consumer by the actual amount of energy supplied to him at the following rates per quarter: For any amount up to 20 units, 13s. 4d., and for each unit over 20 units, 8d." (Electric Lighting Clauses Act, 1899, Schedule, Clause 31). Lower prices than these are sometimes inserted, but so long as the statutory limit is not exceeded, electric supply undertakers, whether local authority or company, may charge what they like by agreement. Thus by Clause 33 of the Schedule above referred to: "Subject to the provisions of the special order and of the principal Act, and to the right of the consumer to require that he shall be charged according to some one or other of the methods above mentioned (*i.e.*, the methods by 'actual amount' or electrical quantity), the undertakers may make any agreement with a consumer as to the price to be charged for energy and the mode in which those charges are to be ascertained, and may charge accordingly."

It is to be borne in mind that the powers of the Board of Trade to interfere with the *amount* of charges only extends (*a*) to variation of the maximum charge at certain periods; (*b*) to companies supplying electric light. The Board has no power to alter the charges made by local authorities.

The conclusion of the whole matter is that but little can be done to impose the burden on the consumer until such time as his agreement with the undertakers runs out.

DECIMAL COINAGE AND THE METRIC SYSTEM.

(*Continued from page* 517.)

The Standard Electrical Co., of Keighley, "quite agree that Continental business relations would be greatly facilitated by the universal use of the metric system in its entirety," and Messrs. Dorman & Smith, Salford, say: "Although we recognise the difficulty of introduction, we should very much welcome the general use of the decimal system in everyday commerce." The Sterling Telephone & Electric Co., Ltd., say: "Experience in the actual country where decimal coinage is used will only convince British manufacturers of its real importance."

Mr. L. M. Waterhouse, managing director of Messrs. Simplex Conduits, Ltd., writes:

> I have all along been very much in favour of the introduction of the decimal coinage and the metric system, which, I feel confident, if generally adopted would tend to the simplification of business, the extension of Continental trade, and probably result in greater all-round accuracy and uniformity.
>
> In addition to the above, the general adoption of the metric system would most certainly simplify calculations, the preparing of price-lists, and obviate continual reference to tables and the mistakes, annoyances and delays which frequently occur in business relations with Continental and foreign customers.
>
> As my replies to your questions show, I have not as yet taken any steps to introduce the decimal and metric system in connection with this business, as I feel strongly that individual effort in this direction would only tend to further complication, and I am of the opinion that nothing but a general adoption of the decimal coinage and metric system throughout the country will do any lasting good and put us in a position to compete on an equal basis with other nations

Messrs. Best & Lloyd, Ltd., Birmingham, say:

> We have advocated this for many years. We believe that had we not adopted the system years ago in connection with our foreign trade, the latter would have gradually ceased—instead of growing, as it did until the war broke out.

Messrs. Higgs Bros., Birmingham, are in favour of the adoption of both decimal coinage and the metric system, but remark that "all English screws and diameters are fixed in inches at present, and the use of the metric system necessitates using both measures on the same drawings, which is very confusing." We may point out, however, that in practice the use of both systems on one drawing, if required, is not necessarily found confusing (see letter from the Cambridge Scientific Instrument Co., Ltd., below).

Messrs. H. W. Smith & Co., Ltd., of Lydbrook, say they "have recently felt the necessity of the adoption of the metric system entirely, and hope the time of its adoption will not be long delayed." Similarly the Walsall Electrical Co., Ltd., say that, in their opinion, "it is imperative if we intend to capture the Continental and American business." A firm in the North, replying in the affirmative, says "it cannot be denied that the use of the British system of weights and measures is a considerable obstacle to British foreign trade."

Messrs. G. P. Wall say:

> We are ardent advocates of the all-round adoption of the metric system, as it is much simpler than our own cumbrous system. For this reason, our opinion is that the metric system would tend to greater efficiency.

Messrs. S. Bowley & Son, London, say:—

> We are certainly in favour of the general adoption in this country of both decimal coinage and metric weights and measures, provided the obstacles are not too great. One has to bear in mind that there are in the country thousands of pounds' worth of packages in actual use made on English weights and measures. Then again, all weighing and filling systems in use would have to be discarded or re-adjusted, and this would entail considerable expenditure, which might not be regarded as worth while or necessary. With regard to coinage, it would take a long while to introduce new values, and there are various other points to be considered.

Messrs. Isenthal & Co., London, welcoming our attempt to crystallise the opinion of English manufacturers on the subject of uniformity in weights and measures, write:—

> We have for a long time past felt the urgent need of bringing English catalogues into line with those of Continental manufacturers by weights and measures in units which are intelligible and of direct comparative value to the Continental buyer. There is, however, one difficulty which we have met with in practice, and that is, that though we endeavour as far as possible to dimension our workshop drawings on the decimal system, we have often to depart from this system because the material is not obtainable at present without much difficulty and extra expense in decimal dimensions—for instance, taking brass or steel rods which are to be worked up in the turret lathe, and which we desire to have 12 mm in diameter, we have to take ½ in. material as it is available, and as it adds too much to the expense to turn it down to 12 mm., the finished article is left at ½ in. A similar thing applies to the thickness of sheets, which at present can only be obtained in s.w.g. or some other gauge, and not in millimetres.
>
> Again, we still have to adhere, especially for Government work, to the B.A. system of threads and to the Whitworth

> system for ordinary engineering practice, so it seems to us difficult at the present time to carry through a thorough reform.
>
> It is different with regard to coinage and weights, and the advantages of the decimal system are so obvious that we cannot understand how anyone could hesitate to undergo the slight initial hardships of mastering this system.

As a matter of fact, the British Association system of screw-threads is entirely metric. We shall deal with the question of screw-threads later.

Messrs. Ozonair, Ltd., London, write that they are entirely at one with us in our aims:—

> Generally speaking, we are in favour of both decimal coinage and metric weights and measures, provided both are adopted and used for engineering and technical work generally. We would point out to you, however, that even in those countries where the decimal system is standardised, a large bulk of general or ordinary transactions are conducted in the special weights and measures appertaining to the particular country.

That is of little consequence—we are mainly concerned with the development of our export trade at the moment.

The whole of the foregoing firms support the adoption of decimal coinage as well as of the metric system. There are those, however, who approve of one without the other, as we have already remarked. For instance, the Westminster Tool & Electric Co., London, oppose decimal coinage, and while they approve of the metric system, they think, desirable as its adoption is, it should come into use gradually, and not as a result of forced legislation. A Northern firm, on the other hand, is in favour of decimal coinage, but not metric measures, as the latter would mean "such a large expenditure in new jigs, gauges, and drawings, or alterations to those already existing." Again we question the accuracy of this supposition. Messrs. Wilson Hartnell & Co., Ltd., Leeds, also have no objection to decimal coinage, but prefer a binary system of weights and measures. They would like our present system amended to remove the factors 7 and 11:—

> The decimal system facilitates calculation, and is most convenient in dealing with small quantities and ratios of quantities, as in photography and theoretical chemistry, but is not convenient for dealing in ordinary commercial goods. The only excuse for introducing the metric system is that our measures of area and bulk are so varied and require standardising on a simple basis.

A very important firm, which desires to remain anonymous, favours decimal coinage, but does not wish for the adoption of metric weights and measures, "in view of the amount of work involved in changing workshop standards, drawings, etc.," a view which we do not share. Messrs. T. Harding Churton & Co., Ltd., Leeds, think that the advantage to be gained by a change in coinage and weights and measures may be easily exaggerated, and it is open to question as to whether the advantage would justify the trouble which making a change would involve; they think it best to leave changes of this kind to come about gradually, as a natural development rather than by a general upheaval. Messrs. W. T. Henley's Telegraph Works Co., Ltd., London, say the question is a very big one; from the point of view of their own business, they at present consider that the disadvantages would outweigh the advantages. Messrs. Hick, Hargreaves & Co., Ltd., Bolton, have used the metric system in certain cases, and are "quite of opinion that there is a great deal to be said for its adoption," but hardly think that the time is ripe at the moment, in view of the upset in the engineering world caused by the war. A London firm answers the questions in the negative, but adds, "Our reply under No. 4 would be modified if there was a consentient opinion amongst manufacturers in the country in favour of adopting a decimal coinage and the metric system." A similar attitude is adopted by Messrs. Rhodes Motors, Ltd., Doncaster, who state that they are members of the B.E.A.M.A., and would only be too pleased to come in line if the plan had to be adopted by other members. The Endolithic Manufacturing Co., Ltd., London, say that they "constantly use the metric system and decimal coinage," but prefer not to adopt a definite policy off-hand. The Wilson-Wolf Engineering Co., Ltd., Bradford, think "it might be convenient to use decimal *weights*, if not decimal measures, in which case it would be logical to use decimal coinage; but the soveregn should be the unit, divided into florins, each florin containing 10 cents and 100 mils." Another firm is not prepared to discuss the question, as the Engineering Standards Committee has so recently set up definite figures, which have been almost universally adopted. We shall refer to this question in due course. Messrs. Marshall, Sons & Co., Ltd., Gainsborough, are opposed to the changes under consideration, their objection to the adoption of the metric system being that, with so many established sizes of various parts of their machinery, they would either have to "convert the existing sizes into decimals, which would in many cases run to three or four decimal points (which you will readily understand would be confusing to our workmen), or we should have to alter our sizes to bring them to even figures in the metric system, which would be out of the question." This point also will receive our attention later. We conclude this section of the subject with extracts from two very interesting letters, and a table giving the names and businesses of the firms that have replied to our inquiries, except where they have asked for anonymity, together with the sense in which they have "voted" on the questions 4 (*a*) and 4 (*b*).

Messrs. W. Sisson & Co., Ltd., Gloucester, write as follows:—

> We are not in favour of adoption in this country of decimal coinage.
>
> As to the exclusive adoption of metric weights and measures, we certainly admit the enormous advantage of the simplicity of correlated weights and measures under some system or another, and if such a system is to be adopted, there is now, we consider, no question but that the system universally known as the metric system must be adopted. We are, however, seriously impressed (1) by the fact that an enormous preponderance of mechanical construction of all kinds has been carried out under the British measurements, and has found its way to countries all over the world, whether they are countries which have adopted the metric system or not. (2) Even where British or American firms have worked on the metric system we have noticed that they have, in many cases, still retained the Whitworth standard screw dimensions. (3) The exclusive adoption of the metric system in works unfortunately involves the practical destruction of nearly every gauge, and also a modification of every tool, and even if the Whitworth screw system is retained, the question of destruction, disuse, or modification of standard apparatus of all kinds is a very serious matter. It appears to us, therefore, that compulsory adoption of the metric system would be too serious an interference with the mechanical constructive practice in this country. . . . It is quite clear that any radical change in the direction of a decimal system or correlated weights and measures must be the adoption of the French metric system, since this has, of course, been for many years firmly established in the usage of physicists and chemists, and its use for practical mechanical construction of all kinds has very largely increased.

Mr. C. C. Mason, joint managing director of the Cambridge Scientific Instrument Co., Ltd., writes:

> We employ the metre as a unit of length—or, more correctly, the millimetre—in our shops for practically the whole of our manufactures. Occasionally on large work, where no great accuracy is required, inch measurements are used, but we do not hesitate to use both systems of units in the same drawings, according to convenience. Similarly, with regard to weights, both the gramme and the ordinary English measures are equally used in our shops. Not even abroad does the metric system seem to be applied to the measurement of time; consequently, we only have the English system for use in this case. On the other hand, when dealing with electrical units only the metric ones exist; consequently, here we only use one system. To reply, therefore, to your questions in detail, we employ both the metric and other systems in our correspondence with both English and foreign clients. We might add that low temperatures seem to be measured on the English scale almost universally in this country, but that high temperatures are measured on the metric scale by the great majority.
>
> 2. (*a*) Our English catalogues are generally produced with terms in both metric and English measures, but the class of customer for whom the catalogue is intended is always borne in view, so that possibly only one system is required, or is given the chief prominence.

(*b*) When publishing foreign lists, when prices are included, they are generally put in the coinage of the chief country using that particular language. It is necessary to remember that a German list may be used in Austria, a country which does not use German coinage.

3. We have already answered.

4. (*a*) The writer personally is not particularly in favour of the decimal coinage. In practice it is not so convenient. There are great merits in our particular sub-divisions of the pound.

(*b*) The writer is certainly not in favour of the English measure being entirely abolished, and the metric system being made compulsory. The present arrangements of both systems being permissible seem satisfactory, and it certainly would not be practical to entirely abolish the English units. It is quite easy to apply the metric system to English units, only one unit being used at a time. For instance, weights should be given in tons or pounds, decimals being used as required. Weights should not be given in tons, cwt., quarters, and lb. simultaneously. This reform should be brought about by a gradual education of the business world. In this no doubt the technical Press can help.

5. These remarks represent the writer's personal opinion. He cannot speak for other members of the company. With this explanation, you can make any use of the above that you like.

ADOPTION OF DECIMAL COINAGE AND THE METRIC SYSTEM.

THOSE IN FAVOUR.

STYLE OF FIRM.	MANUFACTURED PRODUCTS.
Anderson Boyes & Co. Ltd.	Electrical machinery.
A. P. Lundberg & Sons	Electric light switches, etc.
Associated Battery Co., Ltd.	Primary batteries.
*Aster Engineering Co. (1913), Ltd.	Internal-combustion engines.
†Bastian Electric Heating Synd., Ltd.	Heating apparatus.
†Bat Meter Co., Ltd.	Electricity meters.
Best & Lloyd, Ltd.	Electroliers.
British Mica Co., Ltd.	Mica.
British Thomson-Houston Co., Ltd.	Electrical machinery and apparatus.
British Xylonite Co., Ltd.	Celluloid.
C. A. Vandervell & Co.	Car-lighting equipments.
Connolly Bros., Ltd.	Insulated wires and cables.
D. H. Bonnella & Son, Ltd.	Electrical accessories.
Donovan & Co.	Electrical apparatus and switchgear.
Dorman & Smith, Ltd.	Switchgear, fuse-boards, etc.
D. P. Battery Co., Ltd.	Accumulators.
*Duncan Stewart & Co., Ltd.	Steam engines.
E. Brook, Ltd.	Electric motors.
Eckstein Heap & Co., Ltd.	Electrical apparatus.
Edgar Allen & Co., Ltd.	Steel.
Electric Control, Ltd.	Electrical apparatus.
†Erith's Engineering Co., Ltd.	Steam plant.
Etchells, Congdon & Muir, Ltd.	Electric lifts.
Falk, Stadelmann & Co., Ltd.	Electrical apparatus.
Ferranti, Limited	Electrical apparatus.
Foster Engineering Co., Ltd.	Transformers and lamps.
Fredk. Braby & Co., Ltd.	Iron tanks and cisterns.
G. Brady & Co.	Electric lifts.
General Electric Co., Ltd.	Electrical machinery and apparatus.
G. P. Wall	High-grade steel and steel wire.
Griffiths Bros. & Co.	Paints and varnishes.
G. St. John Day (Patents), Ltd.	Electrical accessories.
Harry W. Cox & Co., Ltd.	X-ray apparatus.
Higgs Bros.	Dynamos and motors.
H. W. Smith & Co., Ltd.	Insulated wires and cables.
International Electric Co., Ltd.	Telephones, bells, etc.
Isenthal & Co.	Heating and cooking apparatus.
J. F. & G. Harris, Ltd.	Wood casings and fittings.
John Tullis & Son., Ltd.	Leather belting.
Joseph Sankey & Sons, Ltd.	Iron stampings.
Lea Recorder Co., Ltd.	Water consumption recorders.
L. M. Waterhouse (Simplex Conduits, Ltd.)	Conduits, fittings, etc.
London Electric Firm	Electrical apparatus.
London Label Co., Ltd.	Labels.
London Shafting & Pulley Co.	Shafting and pulleys.
Major & Co., Ltd.	Insulating materials.
Marryat & Place	Electrical apparatus.
Mawdsleys, Ltd.	Dynamos and motors.
M—L Magneto Syndicate, Ltd.	Ignition magnetos.
Morley Electrical Engineering Co., Ltd.	Mining plant.
Mosses & Mitchell	Vulcanised fibre.
Muirhead & Co.	Telegraphic apparatus.
Newton Brothers (Derby), Ltd.	Dynamos and motors.
Park Royal Engineering Works., Ltd.	Electrical apparatus.
Pitman, Cesar & Co.	Water-power plant.
Premier Electric Heaters, Ltd.	Heating and cooking apparatus.
Premier Gas Engine Co., Ltd.	Gas engines.
Pulsometer Engineering Co., Ltd.	Vacuum pumps.
Rhodes Motors, Ltd.	Motors.
*Robt. W. Paul	Electrical instruments.
St. Helens Cable & Rubber Co., Ltd.	Insulated wires and cables.
Sandycroft, Ltd.	Electrical machinery.
S. Bowley & Son	Oils and varnishes.
Standard Electrical Co.	Motors and fans.
Sterling Telephone & Electric Co., Ltd.	Telephones, etc.
Stirling Boiler Co., Ltd.	Steam boilers.
Synchronome Co., Ltd.	Electric clocks.
Venner Time Switches, Ltd.	Time switches and signs.
Walsall Electrical Co., Ltd.	Electrical apparatus.
Ward & Goldstone	Electrical apparatus, wires and cables.
Wardle Engineering Co., Ltd.	Lanterns and fittings.
W. E. Burnand & Co.	Electrical apparatus.
Westminster Engineering Co., Ltd.	Electrical apparatus.
†Westminster Tool & Electric Co.	Electric drills, blowers, etc.
W. F. Stanley & Co., Ltd.	Mathematical instruments.
Whipp & Bourne, Ltd.	Switchgear, rheostats, etc.
Wilson Apparatus Co.	Induction coils, transformers, etc.
*W. R. Sykes Interlocking Signal Co., Ltd.	Railway signalling apparatus.
"Z" Electric Lamp Mfg. Co., Ltd.	Tungsten lamps.
A	Dynamos.
B	Insulated wires and cables.
†C	Electrical accessories.
D	Arc lamps.
E	?

ON THE CONTRARY.

Attwater & Sons	Mica.
*Hawkins Bros. & Co., Ltd.	Insulated wires and cables.
J. H. Heathman & Co.	Ladders, tower wagons, etc.
Joshua Buckton & Co., Ltd.	Machine tools.
Marshall, Sons & Co., Ltd.	Steam engines and boilers.
Reid Gear Company	Gearwheels.
W. Canning & Co.	Electroplating apparatus.
‡Wilson Hartnell & Co., Ltd.	Electrical machinery.
W. T. Henley's Telegraph Works Co., Ltd.	Insulated wires and cables.
A	Slate and marble.
*B	Electrical apparatus.
*C	Mechanical engineers.
D	Electrical machinery.
E	Machine tools.
F	Steam engines.
‡G	Dynamos.
‡H	Electrical apparatus.
I	Steam packing.
J	Electrical instruments.

NEUTRAL OR NOT DECIDED.

H. T. Boothroyd, Ltd.	Electrical machinery.
British Insulated & Helsby Cables, Ltd.	Insulated wires and cables.
Endolithic Manufacturing Co., Ltd.	Labels and tablets.
Hick, Hargreaves & Co., Ltd.	Steam engines and boilers.
Kendall & Gent, Ltd.	Tools.
Ozonair, Ltd.	Ozone generators.
Partridges, Ltd.	Screws and rivets.
Sperryn & Co., Ltd.	Accessories and fittings.
T. Harding Churton & Co., Ltd.	Motors.
Willans & Robinson, Ltd.	Steam engines and turbines
Wilson Wolf Engineering Co., Ltd.	Electrical apparatus.
A	Electrical machinery.
B	Arc lamps.
C	Wire-work.
D	Die sinkers.
E	Accumulators.
F	Engineers' stores.
G	?

*No decision on decimal coinage.
†Opposed to decimal coinage.
‡Not opposed to decimal coinage.

(*To be continued.*)

TRADE STATISTICS OF SIAM.

THE following figures, showing the imports of electrical and similar goods into the port of Bangkok during the year ended March, 1915, are taken from the recently-issued official trade statistics; the figures for the year ended March, 1914, are included for purposes of comparison, and notes of any increases or decreases are given. Imports stated to be from Singapore and Hong-Kong are for the most part the products of other countries shipped *via* these two ports.

	1913-14. Ticals.	1914-15. Ticals.	Inc. or dec. Ticals.
Parts of lamps.—			
From Singapore	17,000	9,000	– 8,000
,, Hong-Kong	6,000	7,000	+ 1,000
,, United Kingdom ...	22,000	11,000	– 11,000
,, Germany	21,000	5,000	– 16,000
,, United States ...	5,000	7,000	+ 2,000
,, Other countries ...	14,000	7,000	– 7,000
Total	85,000	46,000	– 39,000
Lamps.—			
From Singapore	58,000	49,000	– 9,000
,, Hong-Kong	33,000	104,000	+ 71,000
,, United Kingdom ...	66,000	53,000	– 13,000
,, Germany	50,000	15,000	– 35,000
,, United States ...	3,000	10,000	+ 7,000
,, Japan	93,000	70,000	– 23,000
,, Other countries ...	7,000	9,000	+ 2,000
Total	310,000	310,000	—
Electrical goods and apparatus.—			
From United Kingdom ...	297,000	112,000	– 185,000
,, Germany	575,000	167,000	– 408,000
,, United States ...	155,000	64,000	– 91,000
,, Singapore	24,000	12,000	– 12,000
,, Sweden	2,000	8,000	+ 6,000
,, Italy	12,000	9,000	– 3,000
,, Austria	5,000	11,000	+ 6,000
,, Holland	1,000	7,000	+ 6,000
,, France	25,000	6,000	– 19,000
,, Japan	1,000	70,000	+ 69,000
,, Other countries ...	27,000	7,000	– 20,000
Total	1,124,000	473,000	– 651,000
Manufactures of brass.—			
From Hong-Kong	469,000	483,000	+ 14,000
,, United Kingdom ...	58,000	48,000	– 10,000
,, China	102,000	76,000	– 26,000
,, Germany	76,000	5,000	– 71,000
,, Japan	12,000	8,000	– 4,000
,, Other countries ...	51,000	41,000	– 10,000
Total	768,000	661,000	– 107,000

	1913-14. Ticals.	1914-15. Ticals.	Inc. or dec.	Ticals.
Manufactures of copper.—				
From Hong-Kong	2,000	1,000	–	1,000
,, United Kingdom ...	22,000	36,000	+	14,000
,, Other countries ...	34,000	7,000*	–	27,000
Total	58,000	44,000	–	14,000
* Singapore £4,000.				
Scientific instruments and apparatus.—				
From United Kingdom ...	36,000	43,000	+	7,000
,, Germany	92,000	24,000	–	68,000
,, Austria	11,000	—	–	11,000
,, Other countries ...	39,000	55,000*	+	16,000
Total	178,000	122,000	–	56,000
* France £26,000.				
Rail locomotives.—				
From Singapore	—	4,000	+	4,000
,, United Kingdom ...	9,000	1,000	–	8,000
,, Germany	89,000	61,000	–	28,000
Total	98,000	66,000	–	32,000
Prime movers other than road locos, marine, milling and agricultural machinery.—				
From United Kingdom ...	113,000	27,000	–	86,000
,, United States ...	23,000	1,000	–	22,000
,, Germany	6,000	2,000	–	4,000
,, Other countries ...	5,000	3,000*	–	2,000
Total	147,000	33,000	–	114,000
* Sweden £2,000.				
Machinery unenumerated, including detached parts, and not including textile or sewing machines.—				
From United Kingdom ...	881,000	480,000	–	401,000
,, Germany	124,000	63,000	–	61,000
,, United States ...	56,000	388,000	+	332,000
,, Other countries ...	33,000	33,000*		—
Total	1,094,000	964,000	–	130,000
* Italy £7,000.				
Machine belting.—				
From United Kingdom ...	59,000	62,000	+	3,000
,, Germany	33,000	13,000	–	20,000
,, Other countries ...	3,000	7,000	+	4,000
Total	95,000	82,000	–	13,000
Iron and steel wire manufactures.—				
From United Kingdom ...	49,000	48,000	–	1,000
,, Germany	23,000	12,000	–	11,000
,, Belgium	17,000	10,000	–	7,000
,, Other countries ...	12,000	8,000	–	4,000
Total	101,000	78,000	–	23,000
Railway material.—				
From United Kingdom ...	336,000	529,000	+	193,000
,, Germany	302,000	230,000	–	72,000
,, Belgium	76,000	234,000	+	158,000
,, United States ...	617,000	288,000	–	329,000
,, Other countries ...	44,000	3,000	–	41,000
Total	1,375,000	1,284,000	–	91,000
Cars or trucks for railways or tramways.—				
From Germany	165,000	4,000	–	161,000
,, United Kingdom ...	44,000	233,000	+	189,000
,, United States ...	8,000	5,000	–	3,000
,, Other countries ...	3,000	40,000	+	37,000
Total	220,000	282,000	+	62,000
Caoutchouc manufactures, other than tires.—				
From Singapore	46,000	55,000	+	9,000
,, United Kingdom ...	41,000	28,000	–	13,000
,, Germany	14,000	11,000	–	3,000
,, Other countries ...	6,000	7,000	+	1,000
Total	107,000	101,000	–	6,000

NOTE: £1 ⇒ about 13 ticals.

Board of Trade Inquiries.—The Commercial Intelligence Branch of the B. of T. has lately received further inquiries respecting names of British makers of electric lamps, metal-ilament; packing materials, corrugated, for electric lamps; porce-ain goods, for electrical purposes; and zinc sheet, for dry batteries.

A Canadian agent (Montreal) desires to get into touch with British makers of hardware and electrical supplies. Particulars can be obtained at the Board of Trade Commercial Intelligence Branch in London.

APPRENTICESHIP IN THE ELECTRICAL CONTRACTING INDUSTRY.

At a recent meeting of the Association of Supervising Electricians, the presidential address was delivered by Mr. A. H. Dykes, and dealt with the subject of apprenticeship in its relation to the new conditions that would obtain after the war.

Not only this country, but the greater part of Europe, would be poorer both in men and in wealth; the whole world would have to set to work to build up again all the good things which the war had destroyed.

Hands, brains, and capital were working together to defeat the ruthless tyranny against which we were fighting, and the same unselfish co-operation would be even more needed in the economic struggle that would begin directly military operations had come to an end.

The happiness of our citizens, the future of our industries, and the prosperity of our nation would depend very largely on the extent to which we could succeed in inducing men to take an increased pride in their work.

Probably, all would agree that the Royal Navy was the most efficient organisation which Great Britain had produced, and one had only to come in contact with the men to see that that efficiency was combined with a very high level of happiness and contentment amongst the workers. If one could succeed in obtaining the same high standard in our industrial army, we should have no more fear of the result of the coming industrial and economic fight than we had of the result when—if ever—the Grand Fleet met the Kiel Canal Fleet.

A boy joined the Navy directly he left school, and immediately came under a strict, but wholesome, discipline. Whilst learning all the practical duties of his profession, he was required to attend during a certain number of hours a day classes forming what was practically a continuation school, these classes being continued for about two years.

What we had to do was to start in a similar way with the young boys just beginning their industrial life, to see that their education was continued after they left the elementary school, to subject them, both at home and in the schools, to firm but kind discipline, to teach them as much as possible of the history and principles underlying their trade, and to try and induce in them a pride and interest in the work of the firm of which they formed a unit, so that they would scorn to scamp their work, and would take a pride in helping to make the products of their firm second to none.

In the old days, a boy wishing to learn a trade was bound apprentice to a master craftsman, who undertook, generally, to feed and clothe him, and teach him his trade. The period of apprenticeship was, normally, seven years, it being considered that this term was none too long for a boy properly to learn his trade, and to reimburse his master by service for the training he had received. The boy was bound to serve his master, to keep his secrets, not to waste his goods, and to obey all his lawful commands, and fairly drastic powers of correction were given to the master in the event of the apprentice proving idle or disobedient. On completion of his apprenticeship, the boy became a journeyman, and was eligible to join the guild, and, in time, to take apprentices of his own.

With the substitution of trading companies for the individual master, and the general change in the whole industrial world brought about by the introduction of power-driven machinery, the system became greatly weakened. To the older, longer-established trades, it still remained the generally accepted channel of entrance; but in many trades the greater proportion of the men now engaged had drifted into the work without any proper training at all.

The need for something to take the place of the old apprenticeship had led to the institution of technical schools, which had necessarily been restricted to evening classes, and, splendid as had been the work which they had done and were doing, it must be confessed that they did not meet all requirements, more particularly for the rank and file of the industrial army.

The average boy of this class left school at the age of about 14, an age when he was only just beginning to be in a position to take advantage of educational facilities, and, only too frequently, he was put to that employment which offered the greatest immediate salary, without any consideration being given to his future prospects. The result was that after a few years, when he wanted a man's job and a man's wage, he could get neither, and joined the army of unemployed.

The standard of discipline, both at home and at school, had fallen very greatly of late years, and, in the absence of any compulsion, it was only the exceptional boy who steadily attended the evening school, and profited by what it had to offer.

Quite apart from this, however, the average course in, say, electrical work, tries to cover so much ground, and to meet the needs of lads in so many different branches of electrical work, that the boy often gets out of his depth, becomes discouraged with the difficulty and remoteness from his trade life to the class work, and gives up before the end of the session. The net result was that only a very small percentage of those entering the electrical contracting trade ever received any systematised training in it.

His own belief was that they would in time have to make attendance for about eight hours a week at a trade continuation school compulsory up to the age of at least 18, this attendance being made in working hours.

In the town of Munich (population 600,000), every boy between the ages of 14 and 18 must attend in the day time the special trade school instituted for members of his trade alone. There were schools for every trade capable of providing more than 20 pupils. These schools were entirely free, and were each managed by a committee representing the trade, the municipality, and the school, the expense being shared equally by the municipality and the trades concerned.

The boys attended for an average of eight hours weekly, between 7 a.m. and 7 p.m., either one whole day or two halves, to suit the convenience of the employers, who were obliged in every case to allow the time, and see that their young employés or apprentices attended. Every boy, whatever his trade, devoted one hour weekly to trade arithmetic and book-keeping, one hour to composition, business letters and reading, and one to citizenship, good behaviour, and hygiene, the remaining time being directed to drawing, and information about his special trade, goods, and tools. During the first two years he did no practical work, as he was supposed to be learning that in his master's shop, but in the last two years he got practical work of a higher grade than he was likely to get in the shop.

The results of these schools had been most excellent, over 90 per cent. of the boys who left the elementary school at the age of fourteen going straight to definite taught trades.

There were signs that the principles underlying the Munich system had found acceptance also amongst many of our leading educationists and business men.

The Gas Light and Coke Co., realising the need for a better system of training boys wishing to become gas fitters, approached the London County Council, and a joint scheme of practical training and general educational classwork had been evolved.

Boys were indentured for a term of four years, commencing between the age of 14 and 16. For the first six months they were engaged in a special workshop, which the company had erected for the purpose, where they learnt the use of tools, and received brief, simple lectures, from the company's foreman, dealing with the practical part of their work. The next six months they went out in the district with the fitters. In the second year, the same routine was followed, the first six months in the shops, at more advanced work, and the next out with the fitters. During the whole of these two years they spent 9 to 10 hours per week, during working hours (generally three afternoons), at the Westminster Technical Institute, where the L.C.C. had arranged a special continuation school for them in mechanical drawing, workshop arithmetic, spelling, punctuation, English composition, and letter writing. After the end of the second year, the education classes were held in the evening, every boy being required to attend two evenings a week (4½ hours) at classes in gas supply and English, and, after the apprenticeship was over, they were still expected to attend at least two evenings a week.

By a system of weekly, monthly, and terminal reports, the company was kept in close touch with the educational work, and could ensure punctual and regular attendance.

The results had been most satisfactory. In summing up the results, the manager of the company, in a paper he read on the scheme some little time back, said :—

"Compare the boy trained as I have described—one who has pride in his work, and a real knowledge of his craft—with one who has been allowed to pick up information anyhow. The one can go all over the world and earn a good wage; the other is, as a rule, amongst those who are only tolerated by an employer, and who are discharged first when work is slack."

Mr. Paul had worked out a somewhat similar scheme at his works for training instrument makers. Perhaps enough had been said to show the lines on which experience had shown that they could best proceed. He would urge the employers in the London district to make a commencement by agreeing on a uniform system of apprenticeship. There should be no premium asked, or, at any rate, only a nominal one. The term should be for at least four years, terminable by the master at any time, in the event of laziness, disobedience, or improper behaviour on the part of the apprentice.

It should be one of the conditions of the indenture that the master allowed the necessary time, and that the boy attended the trade school of his particular trade for at least eight hours per week, during the whole term of his apprenticeship, the classes being, at any rate for the first two years, held during working hours.

He had reason to believe that there would be no difficulty in arranging with the County Council and Board of Education a scheme of combined practical and theoretical education, the masters undertaking the practical work, including instruction by foremen and practical men, and the County Council providing special continuation classes at, say, two convenient centres. These classes could be held in some existing institutes, which were principally used for evening classes and were frequently, not fully occupied during the day.

Both employers and employés would be represented on the board of management. and a healthy rivalry might be created between the lads of different firms, with the result that they would take a pleasure in working to make their shop superior to all rivals. In this way, they would acquire the habit of taking a pride in their work, to their own contentment and happiness. and to the great profit of the nation.

Employers must remember that the goodwill of a firm consisted not in its past history, or in its list of customers, but in the possession amongst its staff and workmen of that love of good work and pride in themselves and their shop, which would not allow them to let a piece of bad work pass them.

Discussion.

In opening the discussion, Mr. **Rashleigh Phipps** agreed that some such scheme as that outlined by the President was badly needed, and would yield important results. Not the least difficulty was that of the starting wage. A boy fresh from school, with no particular education or training, could earn anything up to a pound a week in blind-alley trades, and, even if he were kept out of the latter, there was always the difficulty of keeping him from leaving his job for the sake of an extra shilling or two a week somewhere else.

Mr. J. M. **Crowdy** considered that nothing useful could be done in this direction without compulsion. Things had been allowed to drift haphazard; definite, concerted measures should be adopted. Some agreement would be very fruitful, for instance, between their Association and the Electrical Masters' Association in reference to boys now employed in the electrical trade.

Mr. C. J. **Banister** spoke from experience concerning the difficulty of maintaining good attendance and doing useful work at evening classes. With the best of intentions, boys were physically unable to take on night classes after a full working day. Afternoon classes were essential, though it would often be difficult to spare boys from their practical work to attend them. By giving adequate wages a good deal could be done to induce apprentices to make earnest, steady endeavour. The Liverpool Branch of the Electrical Contractors' Association had adopted a form of indenture including a scale of wages rising from 2s. 6d. a week during the first to 12s. 6d. a week during the fifth year of apprenticeship. That was certainly not adequate remuneration for boys in the London area.

Mr. R. **Rankine** spoke of the difficulty of getting workers either to work whole-heartedly or to co-operate in schemes for their betterment. The old pride of the craftsman in his knowledge and skill seemed a thing of the past. Their best hope was to get at boys and instill loftier ideals at the very commencement of their career.

Mr. C. R. **Bates** thought it would be all right for the masters to form an active apprenticeship committee, but any activity of that sort could only be regarded as providing definite proof of the necessity and justification for a national programme. He believed lack of practical instruction in board schools was at the root of the trouble, but nothing less than a national treatment of the whole problem would be really effective.

Mr. H. **Marryat** described the main features of his own apprenticeship scheme. It was a condition of the indenture that his firm should pay for evening classes and that the boy should attend. Unfortunately, attendance fell off terribly, due, he believed, to the nature of the instruction given.

Other speakers discussed schemes for splitting apprentices into groups so that afternoon classes might be worked without inconvenience, and emphasised the importance of co-operation between night schools and masters of apprentices. Tuition should be adapted to the real needs of the trade, and bonuses might be offered to apprentices making best progress.

Mr. C. R. **Bates** asked whether something definite could not be done to get a model scheme in operation. The question really lay with the electrical masters; the cost of comprehensive action would doubtless be an obstacle, but something definite ought to be done right away.

Mr. **Rashleigh Phipps** thereupon suggested that the Association form a committee to discuss the matter with the Electrical Contractors' Association. In the meantime, he undertook to present to the E.C.A. the views expressed that evening.

In reply, the **President** emphasised the distinction between the proposed continuation classes and ordinary technical classes. A good deal of general education would be included to broaden the boy's mind. Co-operation was essential to secure efficiency, and it might be possible to teach the same matter for a whole week to permit apprentices to attend at the most convenient time. If electrical masters were willing to undertake their share, the Board of Education and the L.C.C. would give assistance in respect of tuition and accommodation.

THE TEXTILE INSTITUTE.

Sir William Mather, of Messrs. Mather & Platt, the president of the Textile Institute, speaking at the Autumnal Congress of the Institute, at Huddersfield, on October 21st-22nd, referred to the importance of mechanical power to the great textile industry. Generally speaking, he said, the inventions and improvements of machinery on which the textile industries depended for their continued development and progress, must come from those whose lives were spent on the manufacture of such machinery. The highest efficiency and economy in motive power, so essential to the success in the textile manufacturing industry, could only be secured by the aid of those branches of engineering occupied with the construction of prime movers worked by steam, gas, hydraulic, and electrical power. It was astonishing that such a vast industry as the textile industry should have grown to more than ten times what it stood at a hundred years ago without creating for tself a great national—even Imperial—institution to record ts progress and achievements at home and abroad, and to promote its continuous development. It was owing largely to he existence of the Institutions of Civil Engineers, Mining Engineers, the Iron and Steel Institute, and the Mechanical Engineers that Great Britain had held the leading, and for a ime supreme, position in the metal industries throughout the world almost unchallenged, and, even with the competition of America and Germany, we in this country could rely on hese institutes to keep Great Britain at any rate in the front rank. The Textile Institute, which was formed five or six years ago, now intended to assume a national importance, and o pursue a vigorous policy, as the other institutions to which he had referred had done

Referring to the war, Sir William advised his hearers "when t war to prepare for peace," and declared that our arrangements for conducting trade and commerce, for educating the people, for improving our sociological institutions, and so orth ought to occupy our minds now, so that when peace was declared we could commence a new life with new principles, and with new aspirations and inspiration to make our country what it might have been fifty years ago if these things had been in the minds of our forefathers. The feeling that trade and commerce was to be followed for the advancement of certain individuals was a great mistake. It led them far away rom the true patriotism upon which this country would have o depend in the future for its existence. They were, unfortunately, encompassed now in every trade by the new device of limited liability companies, and capital was poured into every kind of industry largely by people who did not even understand what the name of the industry meant, but who only understood the price of stocks and shares and the paying of dividends. They had behind them a great army of working people who were concerned that the profits that were being made were going into the pockets of people far and wide who did not care for the workmen or for anything connected with he industry so long as they got a dividend twice a year. The constitution of our industries on that line was radically wrong, and out of it could never come industrial peace.

The pursuit of wealth was so magnified in the estimation of many people that he thought it had vitiated our English life most terribly. He did not know whether there had ever been a millionaire in the cotton industry. He knew that in engineering the thing was impossible, especially so if a firm were engaged on munitions of war. There would be some revelations about that by-and-by. He thought the engineers would want outdoor relief. His point, however, was that the gain of wealth ought to be dropped as a purpose in life.

In the course of a discussion, later, on "The Economic Effects of the War," Mr. J. F. Crowley (of Messrs. Siemens Bros., London) expressed the belief that the period immediately following the war would be a very busy period, and hat the period of depression would come later. He strongly urged that everything possible should be done to encourage our export trade during the war. In his judgment there was nothing more vital, apart from the intensive concentration on the actual immediate object of producing war munitions, than concentration on our export trade; and he was not at all sure that it would not be a desirable thing, even now, to have a special effort made in Government circles to encourage the export trade of this country. After all, it was on our export trade that we depended to pay for the war, and unless our export trade was encouraged, we should not get through the financial part of the war as well as we otherwise might.

Mr. R. S. Dower, M.A. (Lecturer in the Department of Economics, University of Leeds), who had introduced the subject, said that, in his opinion, the disorganisation caused by the stoppage of war work and the difficulty of getting back to normal life would be such that there would be a period of from six to twelve months of comparative stagnation and falling prices immediately following the war. He did not agree with Mr. Crowley on that point, but he did agree with him respecting the importance of keeping up our export trade.

WAR ITEMS.

Royal Engineer Commissions.—The University of London Officers' Training Corps, under the command of Lieut-Col. Capper, commences its eighth year of training this month. The contingent consists of Artillery, Engineer, Infantry and Medical Units. The training is mainly of a continuous character, carried out in or near London. The number of commissions obtained up to August, 1915, is just short of 2,000. The Engineer Unit of the above contingent should appeal strongly to engineers who are desirous of obtaining commissions in the Royal Engineers. Arrangements are made whereby training can be carried on continuously, or for part time only for those men who cannot leave their civil posts until actually gazetted. Candidates for enrolment in the Engineer Unit should apply personally to the O.C. Engineer Unit at the University of London, South Kensington. on Tuesday or Thursday evenings between 5.30 and 7.30 p.m.

American Electrical Exports in July.—The U.S. electrical export trade was over 60 per cent. greater in July, 1915, than in July, 1914. The figures compiled by the Bureau of Foreign and Domestic Commerce show the total increase to have been over 700,000 dol. For the first seven months of 1914 and 1915 there is a difference in favour of the present year of more than 500,000 dol. The principal gains in July were in wire, motors, and telephones. The trade in generators showed a slight falling off; in fact, the total for the year up through July is considerably less than for last year. While the motor trade showed a large gain in July, the total for the seven months ended July still showed a large decrease in comparison with the first seven months of 1914. The same is true to a less extent of telephones. The largest total increase during the seven months was in insulated wire and cables, in which trade the value of the 1915 exports was 650,000 dol. greater than that of the 1914 exports. Interior wiring supplies, batteries and meters and other measuring apparatus also registered large increases.—New York "Electrical World."

ELECTRICAL EXPORTS FOR JULY AND FOR SEVEN-MONTH PERIOD.

	July, 1915.	July, 1914.	Seven months ended July, 1915.	Seven months ended July, 1914.
Electrical machinery, appliances and instruments:				
Batteries	$91,344	$59,714	$749,485	$386,231
Dynamos or generators	156,191	195,983	1,232,617	1,632,095
Fans	28,438	23,629	215,268	248,116
Insulated wire and cables ...	817,379	127,697	1,513,217	863,136
Interior wiring supplies, etc., including fixtures	80,933	45,077	555,964	357,893
Lamps.				
Arc	453	1,672	15,212	28,249
Incandescent—				
Carbon-filament	9,715	3,143	80,202	59,732
Metal-filament	55,929	13,581	346,473	109,037
Meters and other measuring instruments	55,463	31,585	338,993	31,585
Motors	381,695	161,798	1,765,446	2,028,645
Telegraph instruments (including wireless apparatus)	8,536	5,340	58,653	71,749
Telephones	101,277	59,347	632,018	692,515
Transformers	73,292	72,443	346,145	655,125
All others	916,682	614,351	5,321,455	5,466,451
Total electrical machinery, etc.	$2,147,307	$1,415,360	$13,171,148	$12,630,559

The Zurich Bank for Electrical Undertakings.—It has been customary to attach importance to the annual reports of the Bank fur Elektrische Unternehmungen, of Zurich, not only because they have generally covered a wide scope, but also because they are issued by an investment and underwriting institution having connections in most parts of the world, and now representing a combined share and loan capital which amounts to about £8,000,000. At the same time, it has to be remembered that the bank owes its origin to the Berlin A.E.G., and there is no reason for assuming that any interruption has taken place in the friendly relations existing between the two companies in the course of years. Bearing this fact in mind, we append the following remarkable extracts from the Bank's report for the year ended with June 30th, 1915.

The report states that the year was under the influence of the world war, which is not only a contest of weapons, but also an economic dispute of an extension and bitterness not thought of hitherto. Government vetoes on payments and exports, naval warfare and blockades, have rendered difficult or hindered the interchange of goods and payments, and the calling up of a large portion of the working population to the Colours has deprived trade and industry of many mental and manual workers. Heavy troubles burden all countries, which stifle the incentive to new undertakings in so far as they are not intended to satisfy the requirements of war. Conditions hitherto unknown in the economic life of nations have been developed, so that it may be said to be almost a wonder how the nations could accommodate themselves relatively satisfactorily to these new and unexpected conditions. The nations cut off from foreign trade have carried out the transition from world economy to an intensive domestic economy without great upheavals, supported by the resolute intervention of the Governments and the enormous orders which devolved upon industry and trade for the satisfaction of army requirements. The money market, which otherwise stood at the disposal of local authorities, trade and industry, is now dedicated to national purposes, since the savings are invested in war loans. By this means, and through the lack of any spirit of enterprise for industrial works, the powers are dried up from which otherwise considerable amounts flowed to industry. An indication of what an indispensable requirement electricity has become is afforded by the circumstance that the electricity supply works, in so far as they are not directly situated in the fighting area, had, until a short time ago, suffered comparatively little under the war, in any case less than what might have been apprehended. After a heavy decline in the receipts from the outbreak of the war a revival soon set in, and in the case of many undertakings the receipts almost reached the level of those of the previous year, and in certain instances they exceeded them. The hampered shipping and the high rates of freight brought about almost everywhere, but particularly in the countries having no national coal mines, a very considerable increase in the cost of fuel, so that notwithstanding comparatively satisfactory receipts, the net profits were frequently less than in the preceding year. In certain countries the scarcity of petroleum has led to a strong demand for current for lighting purposes, which, however, could not be always met owing to the lack of skilled workmen to carry out the requisite new installations. The works of the undertakings closely associated with the Bank which have suffered the least from these conditions are those which are situated in Germany and Spain, as well as those which utilise water power in Italy. On the whole, the electricity works were able to record a satisfactory course of business. In the case of the tramways, the diminution which took place on the advent of the war has not been counterbalanced in every instance, mostly on account of the lack of a suitable staff.

The report proceeds to remark that, notwithstanding the disturbed times, electrical engineering, in consequence of scientific progress in the branch of the production of certain products by electro-chemical methods, has recorded further important achievements. Thus there are several works in course of construction which serve, among other purposes, for the production of nitrogenous products out of atmospheric nitrogen, according to thoroughly tried processes. Altogether the electrical industry has therefore exhibited great and unexpected elasticity under the different conditions of the period covered by the report. So far great damages through the war, or unrest in the works connected with the Bank, have hitherto fortunately not taken place, and the attempt made in one country at war to bring about a premature dislocation of the concessions of two of the Bank's companies has in the main, been averted by the directors in association with other friendly companies. In other localities concessions had to be made to the nationalistic currents in the sense of occasioning the retirement of deserving administrators and officials from their positions. From the experience of the past few months of the present year the before-mentioned recovery and upward movement in the case of many works, however, has no longer continued at the same rate. The constant calling up of further circles of men engaged in the economic life has not remained without economic effects. The families left behind are compelled to exercise economy and limit their consumption of light; small motors are more frequently at a standstill owing to the absence of many manufacturers and their assistants; and in many cases in the heavy industries the scarcity of skilled and unskilled workers, as well as of certain raw materials, has resulted in a decrease in the consumption of energy. If in these instances some equalisation is in progress through the employment of female labour, changes in occupations, and alterations in the raw materials used in the products of industry, it would be well in any event not to accept as completely assured the continuation of the comparatively favourable situation of the electricity works during the further course of the war. The report, which sets forth in detail the company's investments, is accompanied by the accounts, of which an abstract is given below for the two years:—

	1913-14.	1914-15.
Share capital	£3,750,000	£3,750,000
Loan capital	3,746,000	4,202,000
Gross receipts	641,000	604,000
Interest on loans	152,000	171,000
General expenses, taxes, etc. ...	43,000	45,500
Reserve for war taxation	—	12,500
Net profits and balance forward	412,000	332,000
Dividend	375,000	300,000
,, per cent.	10	8
Carried forward	19,000	19,000

Are Central Station Employés Munition Workers?—An interesting question is engaging the attention of Sir George Askwith, of the Industrial Commission, in consequence of a request made on behalf of employés of the Oldham Corporation, who are members of the Gas Workers' and General Labourers' Union, that a ruling should be given as to whether men engaged at gas works and electricity generating stations are considered as munitions workers. The point urged is that these men, being employed on work necessary to the continuance of work at local factories engaged on munition making, should be classed as munition workers. Last week Sir George Askwith invited a deputation from the Town Council to meet him in London with a view to ascertaining their views. The whole question has arisen in consequence of an application presented to the Oldham Corporation for an advance of wages, and on this question Sir George Askwith intimated during the week-end that he proposed to hold a conference between the parties at the Midland Hotel, Manchester, on the 27th inst. Failing a settlement of the question the men intend to cease work.

Installation Materials in Germany.—As a consequence of the increasing difficulties experienced in the provision of raw materials, particularly metals, and the resulting additional expenditure, together with further rises in wages, the leading makers of installation materials in Germany have raised the prices of most articles by 10 per cent., thus making a total advance of 30 per cent. since the outbreak of the war. The higher prices apply to switches, fuses, lampholders, etc., and have been brought into immediate operation.

Enemy Interests in English Companies.—The "Financial Times" states that in the House of Lords the Earl of Halsbury on an early day will present a Bill to amend the Companies Clauses Consolidation Act in respect of a company of whom the individual corporators are wholly or in the great majority alien enemies.

The Petrograd Lighting Co.—Apparently the Russian Government officials have not yet reached the end of their inquiries into the actual situation and controlling nationality of the Petrograd Electric Lighting Co. of 1886, as it is reported from that city that the police authorities have just made an exhaustive domiciliary examination of the company's offices. Various safes are stated to have been forcibly opened and a number of documents seized. According to German accounts, the examination proves how active is the "famous company for liberation from German yoke," of which the new Minister for Home Affairs is the president.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

14,365. "Fluid-pressure valves." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). October 11th.

14,377. "Dynamo-electric machines." A. H. Neuland. October 11th. (Complete.)

14,382. "Contact-breakers of induction coils." M. A. Codd. October 11th. (Complete.)

14,396. "Method of laying telephone or telegraph wire." J. E. Neale. October 12th.

14,405. "Electric heating device for cooking utensils, particularly those made of earthenware, glass, china, and metal china." L. Heller. October 12th. (Convention date, July 16th, 1914, Germany.) (Complete.)

14,416. "Automatic electric lock for the doors of railway carriages." J. E. Evans-Jackson (H. R. Sandford, India). October 12th.

14,423. "Frequency multipliers." Marconi's Wireless Telegraph Co., Ltd., and I. Shoenberg. October 12th.

14,436. "Automatic coupling for coupling mechanically and electrically wires, metal cords, and the like." O. Bajma-Riva. October 12th. (Complete.)

14,438. "Device for use principally in recording telephone calls." W. F. Kobabe. October 12th.

14,454. "Electric inspection lamps for use in connection with motor vehicles and the like." C. Bradwell. October 13th.

14,468. "Electric arc soldering and deposition of metals." E. H. Jones. October 13th.

14,482. "Protective devices for electric distribution systems." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). October 13th.

14,484. "Sparking plugs." J. A. Kennedy-McGregor. October 13th.

14,496. "Filling with insulating compound of electric cable junction boxes." W. T. Henley's Telegraph Works Co., Ltd., & F. Harris. October 13th.

14,499. "Guards for the cords or wires of telephone sets." O. Yates, Sen., H. Gambling, & L. F. Parker. October 13th. (Complete.)

14,500. "Radio-telegraphy." J. Bethenod & E. Girardeau. October 13th. (Convention date, October 15th, 1914, France.) (Complete.)

14,503. "Mercury breaks or interrupters on inductive circuits." H. W. Cox and Co., Ltd., & J. P. T. Bruggenkate. October 13th.

14,516. "Dynamo-electric machine for transforming alternating-current into continuous current or *vice-versa*." J. L. la Cour. October 14th. (Convention date, October 14th, 1914, Germany.) (Complete.)

14,533. "Mounting of electrical apparatus in frames or cases." H. B. Prentice. October 14th.

14,539. "Electric arc lamps." H. T. Harrison. October 14th.

14,548. "Electro-mechanical driving arrangements for vehicles and other purposes." H. Reik & Oesterreichische Daimler-Motoren Akt. Ges. October 14th. (Convention date, September 2nd, 1913, Austria.) (Complete.)

14,594. "Membranous or diaphragm transmitters for submarine sound signals." Signal Ges. M.B.H. October 15th. (Convention date, October 15th, 1914, Germany.) (Complete.)

14,630. "Means for holding and adjusting in any required position the carbons of electric arc lamps." W. Mitchell, B. Mitchell, A. Wyndham, and M. Wyndham. October 16th.

14,633. "Dynamo-electric machines." F. A. Heys (Neuland Patents, Ltd., U.S.A.). October 16th. (Complete.)

14,643. "Dynamo-electric machines." F. A. Heys (Neuland Patents, Ltd., U.S.A.). October 16th. (Complete.)

14,650. "Alternating-current electric motors." J. G. Shaw, C. R. Shaw, and H. G. Sharp. October 16th.

PUBLISHED SPECIFICATIONS.

1914.

16,080. Control Systems and Devices for Electric Current. Soc. Anon des Etablissements L. Bleriot. July 6th. (July 7th, 1913.)

20,176. Method of and Apparatus for Electric Welding, and article produced thereby. O. C. Knipe & R. H. Read. September 25th.

20,238. Electric Current Relays. J. Schiessler. September 26th. (April 16th, 1914. Patent of addition not granted.)

20,254. Attachment of Electrical Conduit Tubes to Junction Pieces. T. A. Smith & W. H. Owen. September 28th.

20,295. Electric Switches for simultaneously Operating Electric Light and Camera Shutters. C. H. T. Schmidt. September 29th.

20,458. Prepayment Electricity Meters. Landis & Gyr, Ltd., S.A. October 2nd. (October 1st, 1913. Addition to 18,464/14.)

20,595. Rontgen-ray Apparatus for Localising Bullets and for like purposes. T. Clark. October 6th.

20,920. Junction Boxes, Ceiling Roses, and the like. W. Williams, E. Warbrick, & Anchor Cable Co., Ltd.. October 13th.

21,822. Electric Arc Soldering. E. H. Jones. October 31st.

21,824. Electro-magnetically-operated Valves. A. H. Curtis & Igranic Electric Co., Ltd. October 31st.

22,937. Repeaters for use in Telephone Lines. A. H. Olsson & H. B. M. Pleijel. November 23rd. (December 2nd, 1913.)

23,368. Automatic Regulating Apparatus for Dynamo-electric Machines. V. A. Trier. December 1st.

1915.

771. Arrangement of Transmission Dynamo-meter for Direct Observation. K. Suyehiro. January 18th. (Addition to 9,068/13.)

3,676. Synchronisers. G. T. Van Swaay & H. J. Keus. March 8th. (March 12th, 1914.)

4,987. Hot-wire Alternating-current Limiters. P. Wessel. March 31st.

8,941. Electric Coupling Transformers. J. Schiessler. June 17th. (April 16th, 1914. Divided application on 20,238/14. September 26th.)

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Vol. LXXVII.] CONTENTS: November 5, 1915. [No. 1,980.

Page
The War and British Industry ... 577
Copper ... 579
Decimal Coinage and the Metric System (*continued*) ... 580
Institution of Electrical Engineers (Birmingham Local Section) ... 582
New Electrical Devices, Fittings and Plant (*illus.*) ... 583
Correspondence—
The A.E.G. Meeting ... 585
The Institution and Alien Enemy Members ... 585
Decimal Coinage and the Metric System ... 585
Legal... ... 585
War Items ... 586
Business Notes ... 587
Shanghai Electricity Works (*illus.*) ... 591
Notes ... 596
City Notes ... 599
Stocks and Shares ... 601
Share List of Electrical Companies ... 602
Metal Market.—Fluctuations in October ... 603
Half-Watt Lamps from the Central Station Standpoint, by "Lux," (*illus.*) ... 603
The Electrification of the Chicago, Milwaukee and St. Paul Railway (*illus.*) ... 605
Electricity Supply in China ... 607
Foreign and Colonial Tariffs on Electrical Goods ... 608
New Patents Applied for, 1915 ... 608
Abstracts of Published Specifications ... 608
Contractors' Column ... Advertisement page xx

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THE WAR AND BRITISH INDUSTRY.

A FAIRLY extensive library could be made of all the literature that has been produced on the war and its present and future effects upon British trade, since Prince Lichnowsky and the staff of the German Embassy left Harwich in August, 1914, on their return to Berlin.

Much that has been written and said has dealt with particular points that possessed a special interest at the time of its expression. At the time it served its purpose, and, perhaps, was soon forgotten; yet we may venture to hope that it has all contributed its share to the formation of public opinion. It is an old controversy whether the Press leads public opinion or is led by it, and latterly we have been advised by those who ought to know that Governments—or, at any rate, the Governments of these days—act in certain vital matters only after the weight of public opinion has been brought to bear upon them. We believe that the Press and the Government both lead and follow, but perhaps it would be a little outside our immediate province to indulge in a statement of the arguments in favour of that view. What we are more concerned about now is to know how far the leading which has been given by the public as represented both by industrial authorities, and by the Press, which is the vehicle for the conveyance of their views, is going to be followed by the Government in respect of our national industries. If the "wait and see what the public think" policy is to be followed by this Government, then there is no need to wait any longer, for there is already plenty to "see." But we cannot imagine that in such a serious matter the Government has no mind of its own, for it has had so much information brought home to it in practical experience during these fifteen months of war that it ought to need no other leadership in regard to its handling of trade policy to ensure, as far as possible, that the German advantage in competitive trade shall be absolutely broken beyond repair. We consistently and determinedly hold, our statesmen say, to the resolution that there can be no other issue of the conflict save the crushing of Prussian militarism. We are all, we trust, working hard to that end, but are we to believe that the crushing of Prussian militarism by the victory of the Allies, however long deferred, is going *per se* to mean the crushing also of German international trading machination and domination? That is a question in regard to which we have many unhappy doubts, and we may reasonably be required to look both within ourselves and to the Government for guidance. It concerns both parties, for the Government will not help those who do not help themselves any more than Heaven will do so. Manufacturers have been doing their part up to a point, but now they are largely occupied making war requirements, and only in part can they devote attention to the questions concerning future trade connections. They are engaged in the national service, helping to win the war. It will be for the Government to render them a definite measure of assistance in days to come, not only to enable them to regain any ground which they are now compelled, by national needs, to somewhat neglect, but to strengthen them in those great efforts which must inevitably follow the war if they are to combat the onslaught of Teutonic industrial forces.

What will the Government do? What should the manufacturers do?

It is around these two questions that much has been, and much more will yet be, written. Month by month more and more is being revealed to us regarding the deeply-laid schemes that the industrial and financial leaders of Germany are employing even now to retain or regain their foreign connections. Trading operations, which ought not to be possible, are undoubtedly in progress at the present time, and on everybody's lips there are suggestions and suspicions just as there were in the early months of the war, though, perhaps, with more foundation or justification than then appeared to be the case. If underhand and unfair artifices are being resorted to, and neutral countries are being availed of in such connections, they must be exposed and, as far as possible, prevented. There is a Government Department looking after such matters, and it may be trusted to take suitable action when facts, and not mere opinions, suspicions, or personal bias, are produced. It is against the wish of every true-hearted Englishman in the electrical industry that the way shall be kept open for German electrical activities to be renewed in these Islands and our Colonies immediately after the cessation of actual fighting. Our resolution in this connection becomes keener, stronger, after every new diabolical piece of outrage that the Huns commit. Really the blindness of our Enemy to its own interests is remarkable—it is a peculiarity of the Teutonic attitude. We belaud to the skies German powers of organisation and German unity or solidarity, yet what do we see?—a strange want of uniformity between the policy of the military and the industrial authorities. German military and industrial policy has been supposed to be consistently co-ordinated so that the entire nation moves as one vast machine. Yet while the manufacturers and the bankers, the industrial magnates and the financiers, devise their schemes for international trade revival and make plans for conquering in that way whether they lose in the other or not, the Military and Naval authorities do more to shock the civilized world and to strengthen its anti-German trading sentiment than all the normal and recognized practices of warfare might have done. Every German in future will bear the mark of Cain, will have the murderer's brand upon his forehead, printed there by the cruel hand of his own German militarism. The industrial and financial magnates of Germany, the export houses of Berlin and the shippers of Hamburg—these are welcome to whatever encouragement they are able to derive from the horrifying outrages of those with whom they have been endeavouring to obtain world dominion.

But the shocked susceptibilities of the people will not alone suffice to prevent the return of the German trader. We may all hate ourselves for even thinking of the possibility of our ever stooping to buy German articles again, steeped as they will seem to be in blood and lust, in outrage and barbarity. But we must do more than that, and the Government, as well as the public, know that such is the case. What will the Government do? What will the public do?

We are not imagining that we can have from the Government in such anxious days as these a full statement of policy in regard to trade. Such is, of course, impossible. The Prime Minister and others in the Cabinet have truly stated that the time is not yet ripe for that. If manufacturers are too busy making munitions to energetically develop their export trade just now, so also is the Government of necessity busy with a thousand important matters. Furthermore, the Peace terms may greatly affect trade policy. But we must keep the trade matter well to the fore so that it shall not lose its proper place among the deliberations of the Government and of the country. Something has got to be done whether this Government is in power when the right time comes or whether another set of men hold the reins of office. These suspicions of trading through neutral countries are well founded, and the manufacture in Germany of labels bearing the words "British made," and the branding of packing cases with a Union Jack, betray both an intention for the future as well as a fairly accurate estimation of the regard in which German-made goods will be held after the war.

It will require some of the best industrial minds in the Kingdom, and not merely the minds of lawyers, to devise very thorough-going measures for safeguarding all our interests in the future days. These interests are taking a good deal of safeguarding today, and efforts, even under existing favourable conditions, are not always as successful as might be wished. A good deal has been written with reference to a Trade Entente between ourselves and our Allies after the war, and undoubtedly much may be looked for in that direction, but one of the most direct ways in which British manufacturers may be advantaged will be the adoption of a national policy of spending British public money on British manufactures wherever this is at all possible. During the war, though, as we have suggested, not all neutral countries are above suspicion, it may be in our public interests to keep our electric supply and other like undertakings up to load requirements by ordering from abroad, but whatever we do in the case of neutrals after the war there should be no hesitation whatever in excluding enemy-made manufactures from Government and other public undertakings. For such a principle to be generally adopted requires, no doubt, a strong Government decision on the point, and nobody knows what shade of government we may have when that matter calls for settlement. Even this Coalition Government would, we believe, by a fair majority, favour the idea if it considered the time ripe for making a pronouncement; but while the Government does not see fit to act it rests with the authorities that have the ordering of plant and other requirements to exercise their local discretion as purchasers. Several of them have already struck a very clear note on the matter—Birmingham, Brighton, and Manchester occur to us, and there may be others as well.

The Manchester Corporation only last week unanimously resolved to add the following clauses to one of its Standing Orders. May the A.E.G., at Berlin, as it listens for the humming of its own machinery installed years ago in one of the Manchester stations, note the terms:—

"*No contract shall be entered into with any person of German or Austrian nationality. No contract shall be entered into with any firm or company whose subscribed capital (whether by way of shares or otherwise) is held or controlled to the extent of one-third or upwards by persons of German or Austrian nationality.*"

It may be noted that there is no time-limit to this policy, and we venture to believe that the personnel or the feelings of the Manchester City Council will have to undergo very material alteration before it will be persuaded so to alter its standing orders as to revert to the former policy. It does not mention the case of nominees of enemy shareholders, but probably the clauses are intended for application in such cases, when they can be discovered. Alderman Walker, who proposed the above resolution, said that it might be thought that the regulation was unnecessary because of the Trading with the Enemy Acts, but that was not the case, for Austrians and Germans trading in this country were protected by law. He referred to the activities of the British Engineers' Association in trying to secure that British public contracts should be placed with British firms, and we are convinced that, for obvious reasons, all efforts in that direction may be expected to receive more general support in municipal council chambers in the future than was the case before the war. Engineers who advise committees have a good deal of power in this connection, though their recommendations are not always adopted when there are party divisions in the chamber.

Of course, there are still difficulties in defining what is or what is not a British firm. In the Manchester discussion reference was made to a company, seven-eighths of whose capital is in German hands, but which is permitted by the Government to trade, and we believe it was on this point that it was stated in reply that the material was essential and could not be obtained from other firms, and that the whole of the labour employed was British; further, that the Government was itself ordering from the firm in question, and that the Local Government Board had given its authority. But even those who justified a particular contract were in favour of the terms of the new standing order. We are sure that nobody will quarrel with the Government for availing itself of any special facilities that are within these islands for successful conduct of the war, whatever the nationality of the firm or the holding of the capital. It is conceivable that some of the goods that have found their way into the country, more or less surreptitiously, have been useful to us in the course of our operations, just as it has happened in at least one of our own lands abroad. It is seeing that the money does not get to the enemy shareholders during the war that is the main point just now when our manufacturers are so busy. We see that one of the Manchester aldermen connected certain incendiary bomb outrages in London with methods of welding tram-rails; this was owing to the nature of one of the constituent parts of these bombs. Here we have a direct instance of the effect that outraged feelings may be expected to have upon the course of contracts. Yet we also see that even in that direction contracts are placed because the goods cannot be obtained anywhere else. Necessity will be the ultimate deciding factor in many such matters, and we must, as manufacturers, and as students of the problems of the day, bear that fact in mind. It is for those engaged in manufacturing to lay themselves out to the full limit of their power to meet the want; it is for those who require those necessities, when they are unmistakeably assured that they are enemy goods, to try and find substitutes.

In the House of Commons last week the Government was asked whether it was willing to adopt M. Sazonoff's suggestion for the complete removal of all the fiscal barriers that existed between the Powers now co-operating against Prussian militarism. In reply, Lord Robert Cecil said that there had not yet been time to consider schemes to take effect after a peace which was not yet in sight. A member suggested the unwisdom of being unprepared with some scheme of Customs Union, and asked Lord Cecil to consider the matter beforehand. His lordship succeeded in drawing ironical cheers and laughter by saying: "The Government always think out every question beforehand," but that response, seriously considered, can bring only cold comfort to those who, viewing the future trade outlook with apprehension, think that some steps should be taken at once.

It seems to us that the time has arrived for the representatives of all the great industries, scientific advisers, and buying authorities, to come together on such matters as we have alluded to above. It is a year since we made a detailed appeal along these lines for a Government policy. We repeat the appeal now after long months of watching the effects of the shutting out of German manufactures. The new Advisory Committee may be very busily engaged—we hope it is—but the position and outlook call for something more than that.

Copper. AFTER a period of hesitancy the copper market has again shown a renewal of vigour induced, as usual, by the buoyant reports coming to hand from the United States, and the renewed advance in the prices quoted by producers in America. The supplies of copper in this country have lately been drawn upon very considerably, and the total now stands at a dangerously low level, which has induced those with speculative commitments open on the "bear" side of the market, to cover. The fact that further quantities of rough copper have been shipped from this side to America for conversion is being sharply criticised by the English refiners, who seem to have good grounds for their belief that the Americans are now seeking to manipulate the market upwards by their process of fictitiously diminishing the European visible supply. It was all very well, and a perfectly legitimate transaction, to withdraw rough copper from here for conversion into refined in America, so long as American supplies of rough copper were deficient, but whatever may have been the case six months ago this is certainly not the position to-day, for America is accumulating rough copper at a considerable rate, and must now hold comparatively fair reserves of this class of material. It is likely that strong opposition will be forthcoming should this fictitious drain upon our supplies be persisted in, and the attention of the authorities might very well be called to transactions of this kind. There is, of course, a big consumption of copper going on, but it is practically centred now upon the provision of war supplies, while the execution of commercial orders becomes a more and more difficult matter owing to the contradictory attitude of the Government departments, one section of which will issue permits, which another department cancels or refuses. The history of the doings of our authorities in connection with the issuing of permits would read like a page from a fairy tale, but the business man is now getting hardened to such methods, while fully conscious of the deplorable results accruing therefrom in this and every other sphere of action.

The Australians are quite determined to retain the whole of their metal industries in their own hands, but the functions of the Australian Metal Exchange which has recently been formed appear to have been rather misunderstood on this side. This institution will have nothing to do with buying and selling as such, but will be merely a channel through which all transactions in Australian metal products must be registered for approval before deliveries or shipments can be made. The regulations which have been drawn up and approved, require that every contract entered into must be registered with the Attorney-General of the Australian Commonwealth, and that a copy of such contract, whether in the form of a letter, cable or formal agreement, together with a statutory declaration of accuracy, must be registered within 48 hours. The only exceptions made are with regard to business within the Commonwealth, for which registration is not obligatory when the transaction involves an individual payment of less than £500. Meantime, all metal and ore exports from Australia are forbidden, unless with the consent in writing of the Minister for Customs.

DECIMAL COINAGE AND THE METRIC SYSTEM.

(Continued from page 572.)

Let us now consider the metric system on its merits. This part of the subject is far more important than the question of adopting decimal coinage; the latter is in no way closely connected with the goods that we export, whereas the system of measurement in terms of which they were produced is inherently associated with them for ever. We are concerned chiefly with measures of length; to a less extent with measures of weight, and in the engineering industries, with measures of area and volume, except in connection with calculations and designing work. It is, however, of importance that these measures should all have a simple and rational relationship with one another, a feature which is almost wholly absent from our English weights and measures. The one instance of which we can boast in which such a relationship exists is the gallon of water, which weighs ten pounds (avoirdupois, not troy) at 62 deg. F., and therefore 70,000 grains, the pound having the convenient value of 7,000 grains! But the cubic foot of water, which is constantly in use, weighs 62.288 pounds or 996.6 ounces, and a cubic yard and inch of water have equally awkward weights—strictly we should say masses, but the point is here immaterial. If the gallon could be conveniently expressed in terms of cubic inches or feet, the difficulty would be diminished, but it cannot. Our English units, it cannot be denied, are utterly heterogeneous and unsystematic; there is no attempt at order or cohesion in either their magnitudes or their arrangement, and the multiples seem to have been chosen rather with a view to securing the utmost variety than to facilitating their use. It is customary and easy for the upholders of this chaos to argue that the multipliers used lend themselves readily to the processes of mental arithmetic; this may be the case—we are not concerned to dispute it, for in the system which we advocate arithmetical processes are reduced to the absolute minimum.

Before dealing in detail with some of the arguments for and against the compulsory adoption of the system in this country, it will be advisable to outline, as briefly as possible, the leading features of the system.*

The unit upon which the whole structure is founded is the metre, which is equal to 1.0936 yd. From this are derived multiples of which only the kilometre (1,000 m.) is of importance as a rule, though the other units are employed in certain arts and sciences (the dekametre by surveyors, for instance, equals about two rods, and the hectometre by artillerists, equals 1/16 mile or ½ furlong). The kilometre equals nearly ⅝ mile. Smaller units than the metre are decimal sub-multiples—the decimetre (=1/10 m.), centimetre (=1/100 m.), and millimetre (=1/1,000 m.)—of which the decimetre is not much used. The centimetre is 0.3937 in., or about two-fifths; the millimetre is about 1/25 in., or 4/100; and a half millimetre is about the smallest measure that can be conveniently used by eye, though under suitable conditions tenths of a millimetre can be estimated, as in using the slide-rule. The millimetre is the most convenient unit for use in engineering drawings in connection with manufactures.

The unit of surface is the square metre, equal to 1.196 or about 1 1/5 sq. yds. The square centimetre, 1/10,000 sq. metre, is the most used sub-multiple, and the square kilometre, 1,000,000 sq. metres, or 0.3861 sq. mile, the most important multiple; the are is 100 sq. metres, and the hectare (=100 ares=about 2½ acres, actually 2.471) is also a useful unit.

The unit of volume is the cubic metre, equal to 1.308 cubic yards, and the cubic centimetre, 1/1,000,000th of a cubic metre, is the sub-multiple in common use (=0.06113 cubic inch). For fluid measure, the cubic decimetre or litre is employed (=1,000 cubic cm. =1.761 pints, or about 1¾).

The unit of mass is the gramme, the mass of 1 cubic cm. of water at maximum density, with its multiple the kilogram, the mass of 1 litre of water (=1,000 gm., or 2.2046 lb.). Other multiples in common use are the tonne (=1,000 kg.), almost exactly equal to 1 British ton (0.984), and the quintal, or 100 kg. (= nearly 2 cwt.). Sub-multiples are the decigram (0.1 gm.), the centigram (0.01 gm.), and the milligram (0.001 gm.), used mainly in laboratory work.

The litre is commonly divided into halves and quarters, corresponding roughly to our pint and half-pint, and the kilogram is also divided into the half-kilogram, about 1 lb., and the quarter-kilogram, or ½ lb. The term kilo is very commonly applied to the kilogram, improperly, of course, but one cannot control the "vulgar tongue."

The simple relations between the various units and derived units render computations with the metric system a matter of the greatest ease. Where we would write, say, 7 tons, 6 cwt., 18 lb., the user of the metric system can, if he likes, write, say, 7 tonnes, 425.5 kg. When we want to calculate the value of the goods referred to, at so much per lb., or per cwt., we have first to reduce the total quantity to one denomination, multiplying or dividing by such an awkward number as 112 (20 happens to be less inconvenient, because it approaches the decimal system). But the metric computer escapes this process altogether. He simply writes down the figures 7,425.5 kg., or 7.4255 tonnes—whichever unit he requires. There is no calculation required for reduction. Let us take another example, say 5 miles, 3 furlongs, 27 poles, 4 yards; here the multipliers are 8, 40, 5½ (!). The metric man writes, say, 8 km. 423 m.; and if he wishes to carry out any computation with this quantity, he merely writes 8.423 km., or 8,423 m. What a saving of time and labour—and, not less important, of mistakes! As a matter of fact, it is quite superfluous to write down the figures in the extended metric form first quoted above; they are simply kept in the terms of one or other unit, and, therefore, often need not even be rewritten. What useful purpose is served by splitting up a quantity into acres, roods, rods, and yards? Why can it not be left in a single denomination? The answer may be that it is difficult to form a mental picture of, say 17,900 sq. yds., while it is easy to grasp the idea of 3.7 acres—but if so, why split up the 0.7 into a variety of smaller units? The metric user has no such difficulty; if he thinks in hectares, he says 9.13 hectares; but if he would rather deal with square metres, he says 91,300 sq. metres.

Again, the simple relation between the units of length, volume, and mass is of great value. Water is universally employed as the standard medium to which the densities of solid bodies are referred; hence the importance of the fact that a cubic decimetre of water weighs one kilogram, or one cubic centimetre weighs one gramme. Given a table of specific gravities, the user of the metric system simply multiplies the volume of a given substance by the specific gravity, and obtains the mass in one operation. We, on the other hand, have first to select the unit of volume, then to look up the density of the substance, and to multiply the volume by the density and the product by the mass of the unit volume of water. This involves twice the labour, with far greater liability to mistakes. To reduce the labour, we find in our so-called pocket-books numerous tables, giving not merely the specific gravity of substances—all that is required on the metric system—but the weight of a cubic foot as well. If our volume is in inches, we have to remember that there are 1,728 cubic inches in a cubic foot, and to divide by that awful number. More often than not the volume *is* in inches. But in many cases the weight per cubic foot is in pounds, when we want tons, or ounces, and *vice versâ*, and a further reduction becomes necessary. Again, many things are (in our notation) habitually expressed as regards one dimension in one unit, and as regards another, in another unit. So we find tables for sheet-iron, let us say, giving the weight of 1 sq. ft. by 1 in. thick, ⅛ in. thick, and 1/10 in. thick; also 1 ft. long by 1 in. square, and so on, *ad infinitum.* The metric man is independent of all these refinements; all dimensions are expressed in the same units or in decimal multiples of them, and he needs only one table—the specific gravity table. Even to remember that a cubic foot of water weighs 62.3 lb. requires an effort. It is perhaps easier to remember that a cubic foot of water weighs 1,000 oz., and to divide that number by 16 when we want pounds. Unfortunately it is not true; accurate determinations carried out by the International Bureau of Weights and Measures show that a cubic foot of water, as mentioned above, weighs 996.6 oz. The difference may not be material, but it exists. Now, in the case of the metric system, it has been proved by most arduous and protracted investigations that whether by good luck or good management, the difference between the mass of a cubic decimetre of water and that of one kilogram is infinitesimal.

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* We are indebted in what follows largely to a paper read before the Society of Engineers some years ago by Mr. A. H. Allen.

Having now discussed the characteristics of the metric system, it remains for us to consider whether, and why, we should adopt it for all purposes in this country, and what disadvantages are alleged in opposition to this course.

The difficulties, the loss of time, and useless labour entailed by the continued use of our existing caricature of a system of weights and measures, have already been incidentally touched upon. These difficulties are met with in almost every walk in life, and are first experienced in early youth, when we are taught to reduce all sorts of compound quantities in a variety of ways, at an immense cost in mental wear and tear, and a serious loss of time. There is so much to be learnt nowadays even to attain to the average level of information, that it is madness to waste valuable time at our most receptive age on hack-work of this kind. It has been argued that the mental training is good for the child, like the study of the dead languages, but are the German and French children less mentally alert than our own? If so, how is it that we are so hard pressed by foreign competition? The drudgery involved in this futile description of mental gymnastics, more akin to the treadmill than to the cricket-field, inspires the child with a distaste for anything in the shape of figures, which often persists throughout his life. He does not even remember the heterogeneous units that he has to juggle with. How many of us can form an idea of the area of a square rod? How many square yards are there in a square rod, pole, or perch (we even give it three names!), or how many in an acre? What is the length of side of a square acre? How many different kinds of gallon are there, or how many quarters? How many grains in an ounce? The British ton is not equivalent to the American ton, as many a trader has learnt to his cost. The only connection between the inch and the ounce is their common derivation, nominally, from the Latin *uncia*, meaning one-twelfth; but the ounce of commerce is one-sixteenth of a pound. The troy pound is lighter than the avoirdupois, but the troy ounce is heavier than the avoirdupois ounce. If this sort of thing, which could be extended indefinitely, affords good mental training for children, their minds must surely be constituted in a peculiar fashion; we never hear of adults taking up their table-books for a little mental exercise—the only sensation excited by such an occupation is profound disgust.

It may be objected that decimals are difficult; this, however, is not the case. Decimals are simpler than vulgar fractions, and almost as simple as whole numbers. They are not well taught in this country, partly because there is not the same inducement to teach them as in metric countries, or even in countries where decimal coinage is in vogue. This trouble would very quickly right itself when the metric system was adopted. The time saved in teaching compound arithmetic and complex units would be far more than sufficient to allow of teaching decimals properly—out of comparison, in fact.

It is not only in childhood, however, that the waste of time and mental effort is incurred; the amount of time and labour spent in office work, due to the use of our units, is enormous, and the opportunities for mistakes are unlimited. Obviously, this clerical work is costly, and unnecessarily increases the cost of our manufactures, thus helping to handicap us in the world's markets. It also increases the cost of goods to us that we purchase from abroad. Further, the openings for dishonest dealing afforded by existing methods of measurement are notorious and inevitable; inspectors of weights and measures have forcibly emphasised this unfortunate fact. There are no fewer than 200 weights in actual use for selling corn; the stone may mean almost anything, and every county has some local measure of its own, the diversity of units being almost incredible. Any attempt to standardise existing units would be a heart-breaking undertaking, and the inspectors confess that they make no attempt to suppress the numerous illegal measures of which they are aware—to do so would be to handicap an inspector's district in competition with others. The only way to secure uniformity is to introduce a system differing entirely from existing units; and this requirement is admirably fulfilled by the metric system. So well is this understood by business men, that as long ago as the year 1900, forty Chambers of Commerce, twenty-nine Town Councils, eighteen Trades Councils, and numerous other public bodies had passed resolutions in favour of the adoption of the metric system.

In 1903 the following questions were sent in the form of a circular letter to the headmasters of the principal public schools:—

1. Are you in favour of the adoption of the metric weights and measures in this country?

2. Should not decimals be taught concurrently with simple notation?

3. What, in your opinion, would be the time a scholar would save in learning arithmetic if the metric weights and measures were substituted for our present weights and measures, and if compound addition, subtraction, multiplication and division were dispensed with?

Out of 221 who replied, 212 expressed unreserved support of metric weights and measures; 197 stated that there would be a considerable saving of time if the metric system were substituted for the British. Of these, 161 estimated it at 1 year, 30 estimated it at 2 years, and 6 estimated it at 3 years.

In 1914 a circular was addressed to Chambers of Commerce asking their present attitude towards the adoption of the metric weights and measures. Of the 41 who replied, only one was opposed to it, and one expressed an opinion favourable to decimal coinage.

But it is not only in respect of our internal trade that we are at a disadvantage. Our enormous foreign trade, amounting in all to about 1,300 millions sterling annually, is carried on very largely with countries using the metric system, in spite of the disadvantages entailed by the use of British units. In this connection, there is serious risk in declaring value to foreign Custom Houses; a heavy fine is imposed if a mistake is made in converting from British to metric units, even if the error is in excess, and they will not accept statements in our units. It is not to be expected that foreigners, accustomed for years, or all their lives, to metric units, with their simplicity and convenience, will take the trouble to learn our complex "system." This applies not only to the Customs, but also to the purchasers, who naturally give the preference to goods measured in units which they understand. We cannot, as formerly, dictate to our foreign customers what they shall take; we must now provide what they will accept, and our units are to them a foreign language. For years our foreign consuls have been urging upon us the pressing need for the adoption of the metric system, if we wish to retain, let alone increase, our trade.

(*To be continued.*)

INSTITUTION OF ELECTRICAL ENGINEERS (BIRMINGHAM LOCAL SECTION).

ON Wednesday, October 27th, Lieutenant-Colonel J. F. LISTER delivered his address as Chairman, on the application of electricity to military communications. The following is an abstract of the address:—

If we look on an armed force in the field, such as the British Expeditionary Force in France, as bearing some sort of analogy to a living organism, then we may say that the Signal Service takes the place of the nervous system, and the General Officer Commanding in Chief that of the brain. Just as the nerves of the organism report to the brain the information about the outside world obtained by the senses, and flash back the decision of the brain which sets the whole organism in motion, so reports of the enemy's activities on every side are forwarded to general headquarters by the signal service and the orders to move transmitted outwards again to the units of the army.

The available means of communication may be given as under:—

(*a*) Dispatch riding is the time-honoured method of circulating orders to an army, and may be done by any available means. In practice, in a civilised country, the motor bicycle may be said to have superseded all other means of carrying messages.

(*b*) Visual signalling may be done in many ways, but can be practically neglected under the circumstances of the present campaign, as any movement is bound to draw artillery fire.

(*c*) The vibrator with light equipment is used for communications from the divisional to the brigade and battalion headquarters.

(*d*) The vibrator with heavy equipment (cable section) is used for communication between the corps and the divisions, and any other places where required. The cable is carried in two-mile drums—four drums on a wagon—and is paid out and picked up from the wagon. It can be laid at the rate of three miles an hour in ordinary country. When required to be used with ordinary D.C. telegraph sets, it is necessary to pole the cable or tie it up to trees to protect its insulation.

(*e*) Air-line is a light equipment which consists of bare wire, carried on insulators, supported by a portable pole. It can be erected at the rate of a mile an hour in ordinary country, and, by employing a suitable number of detachments, a long line can be erected in a very short time. It is eminently suitable for ordinary telegraph work, but cannot be employed in any area liable to be shelled by the enemy.

(*f*) Light permanent line equipment is provided for line-of-communication companies, by which means they can produce a good permanent line at the rate of about five miles per diem; but in a civilised country it is usually possible to utilise or repair the permanent lines of the country.

The whole art of a successful signal service is in ensuring that communications are preserved intact while the force is either advancing or retreating. The signal service exists for the use of the staff, and is practically a portion of the staff. The officer in charge of signals, therefore, lives with the staff, and should be absolutely conversant with all that is going on. This knowledge should enable him to forecast probable moves, and in some cases to make his arrangements in advance.

To enable the staff to do its work properly, it is necessary for it to work in comfort, and free from fear of interruption by the enemy, so that the normal position of the staff and the signal office is some distance behind the troops which they serve. When, however, the force is engaged with the enemy, it is essential that the general should move up to the troops he is directing, and he is accompanied by his general staff officers, the other branches of the staff, however, remaining behind. This entails the signal office throwing out an advance signal office (usually called a report centre), to which all messages dealing with the operations can be delivered, and where the general can always be found.

Omitting the divisional companies, where communication is very much subject to interruption by the enemy, the methods adopted depend on the circumstances under which the corps or army finds itself, and it is customary to run the first rapid connection by cable, using vibrator, subsequently to pole these cables, and, finally, to replace them by air-line if there appears to be any likelihood of their being required for more than a day or two. Permanent lines in a civilised country are used whenever available, but except in a country which has not been occupied by the enemy, the necessary repairs will probably be found to be too extensive to be undertaken by signal units attached to the fighting units, and will have to be left to communication companies in the rear.

Where permanent lines are used, very great care indeed is required to ensure that all circuits leading into the enemy's lines are disconnected from the communications of the army. In the case of a vibrator, it is not sufficient merely to cut the permanent lines, but a whole bay must be let down. Instances have occurred in this campaign of an instrument in a British signal office tapping out a German message, and during several weeks of last winter the Germans themselves lit a whole town in the British lines by high-pressure current from a neighbouring town in possession of the Germans.

Using ordinary direct current, the signals are produced at the other end by the attraction of the armature of an electro-magnet, the signals being read by the duration of time between the two clicks made by the armature on being attracted to the poles of the magnet, and on being released on the cessation of the current. A set made up in this way is known as a single-current set; but it is obvious that to work a set of this description over any distance would entail prohibitive battery power, and, therefore, a relay is introduced at the receiving station. It is possible to employ duplex working, but in practice quadruplex is usually impracticable in the field owing to the high standard of insulation required in the lines. Furthermore, military traffic differs from ordinary commercial working, in that periods of greatest pressure are usually in one direction only. To enable heavy traffic to be dealt with on the lines of communication, Wheatstone is the most suitable system that can be employed, and full advantage is taken of these instruments.

The vibrator is an instrument which was specially invented for military work. The signals, instead of being intervals of silence between sharp and distinct sounds, are given by long or short buzzes in a telephone receiver, separated by periods of silence. The advantages of this system are:—

1. The telephone receiver is extremely sensitive, and, consequently, a very small current is required.

2. Vibratory currents will pass through condensers, and, consequently, a circuit can be divided into two parts, so that ordinary direct currents will pass through one path only, and the vibrating currents through the other. This enables one line to be used for two independent telegraph circuits at the same time.

3. It is easy to produce very high momentary E.M.F.'s by means of induction coils, and this, combined with the small current required, enables the system to be used on lines of a very high resistance and poor insulation without very much battery power.

4. The telephone receiver requires no adjustment, and is always ready to receive either strong or weak signals.

5. The instruments required are light, and the battery power is small, consequently, the apparatus is very portable.

The following disadvantages of the vibrator system are obvious:—

1. A vibratory current induces similar currents in all neighbouring wires, so that two vibratory circuits cannot be run side by side for a short distance or even connected to the same earth, although it is wonderful how a trained operator can pick out the signals meant for him, even when the induction on the line is very bad. Further, vibrating currents induce similar currents on all telephone circuits in the neighbourhood, seriously interfering with the latter, and also enabling messages to be read by persons for whom they are not intended.

2. Every line has a certain capacity between itself and earth, and the capacity increases with the length of the line. Vibrating currents will pass through such a capacity and leak to earth on a long line, even if it is well insulated. The vibrating system is, therefore, not suited for working on long lines, and about 40 miles is found to be the limit for field cable.

3. For short vibrator lines it has been found necessary to provide single-current sets, which are used whenever cable line is down for some time, the cable itself being poled or raised from the ground by tying to trees. This is principally to avoid induction in the office, and for short distances excessive battery power is not required.

Besides vibrator sets, a portable telephone and vibrator is used for brigade signalling, and for lineman's work on the lines. The additional condenser which is carried in the body of the instrument enables the lineman to work an ordinary circuit without interfering with signals which are being sent. A vibrator line can also be tapped at any point, and the signals read. When a vibrator is super-imposed on an ordinary direct-current set, it is necessary that there should be a certain capacity and self-induction in the line between the direct-current and the vibrator sets; this is usually inserted specially by means of an apparatus known by the name of a "separator."

The instruments used in a signal office are generally carried made up, so that connections, upon opening an office, are reduced to a minimum. The incoming lines are usually laid either on to a commutator or terminal board, so that sets may be changed from one line to another without the necessity of re-connecting the whole office.

Lightning protectors are carried on the terminal board or baseboard of instrument sets.

Besides the main work of the signal service which has been slightly sketched above, it is usual when a staff is stationary for some period to provide a small telephone system between the various offices, which system very often grows to a considerable size. Telephones are not suitable for sending messages, nor can they be used where firing is going on.

Wireless forms a special branch of signal work, and it is not advisable at the present time to make any mention of the methods employed.

A very important matter remains to be dealt with, and that is the organisation of traffic through the various signal offices.

The details of the system adopted, naturally, vary according to the amount of traffic involved; whether the office consists of a vibrator set and an operator deposited by the roadside, or an army office where many lines come in and a large bulk of traffic has to be dealt with, the general principles are the same in all cases. As all offices work night and day, three reliefs are provided; two are capable of coping with the work when the office is stationary, but a third is necessary to enable moves to be carried out without interfering with communications. The instruments are duplicated, two reliefs being fully equipped, whilst the third is not; this enables the new office to be set up while the old one is still working, and when the change is made at the new office the old one is dismantled, and brought on. The technical side of the work is kept quite distinct in the offices from the traffic side. At large offices a superintendent is appointed to look after the circuits and instruments, whilst a supervisor is required for traffic only.

Messages are received by a counter clerk, as in an ordinary post office, but the signal service being used for the staff, the counter clerk may very often be advantageously placed in the staff office itself, where he sits next to the staff clerk, who registers all messages sent and received by the staff. The counter clerk dates, codes, and numbers, counts the number of words, and then passes the message on to the supervisor; the supervisor enters the number, adds the prefix, which denotes where the message is to be sent, and passes it to the operator. This arrangement is required, as in a military telegraph office the circuits may be continually altered, and a supervisor's duty is to keep in touch with this; he is often the only man who knows by what route a message to a given unit can be sent. When the message has been sent by the operator, it is passed to a clerk who completes the record of that message and files it.

The record-clerk also records received messages, files one copy, and sends out a copy to the addressee.

Dispatch riders are either worked practically as a separate office, or are considered as an alternative circuit, and noted accordingly.

At the conclusion of his lecture Colonel Lister described, with the aid of a highly interesting diagram, the telegraphic arrangements of a recent battle, giving a realistic idea of the complicated and elaborate nature of the telegraphic service employed in the field.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electric Contact Strips.

In order to enable the wording of electric signs to be frequently changed, and to enable one to use lamps, appliances, &c., at various places in a room without the use of long flexible conductors, a novel form of continuous contact strip has been developed by the CHASE ELECTRIC CO., of Chicago, Ill. These strips are made in various forms for mounting on the fronts of buildings, attached to the framework for roof advertising signs, &c. They can also be used to form slotted contact mouldings embedded in interior walls of buildings. They are made in unit sections, which can be joined together by means of jointed steel sections. Special contact hooks enable one to place sign letters or to attach lamps, fans, &c., at any point on the strips. Letters for use with electric signs made with these strips are provided with contact hooks, and the strips can also be furnished with a background for the letters made of enamelled steel.—*Electrical World.*

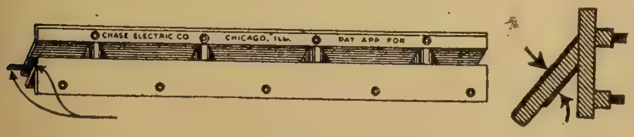


FIG. 1.—ELECTRIC CONTACT STRIP.

Half-watt Lanterns.

It is fortunate that the nature of the half-watt lamp enables the fitting to be made more attractive in appearance than was possible with the arc lamp, which it is largely replacing.

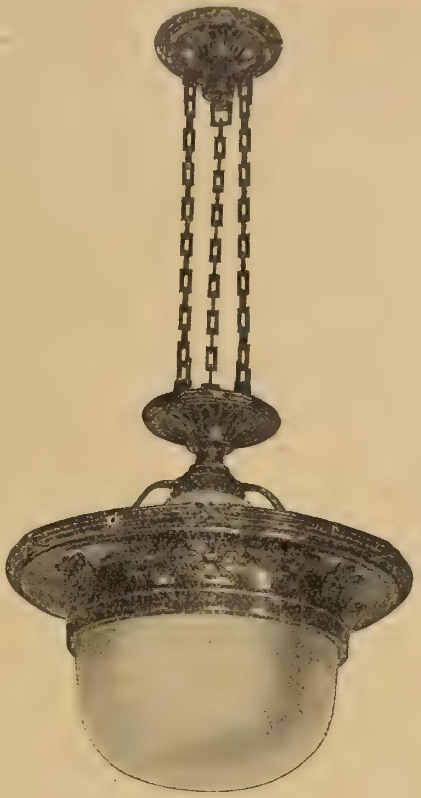


FIG. 2.—INTERNAL FITTING FOR HALF-WATT LAMP.

In the designs shown in figs. 2 and 3, while due consideration has been given to appearance, much thought has also been given to mechanical suitability. For outside use the enamelling is of good quality and finish, the ventilation is ample, and the lanterns are weatherproof, while the special glass used in the more elaborate designs is the result of considerable experiment, and is designed to secure the maximum of light with the minimum of glare.

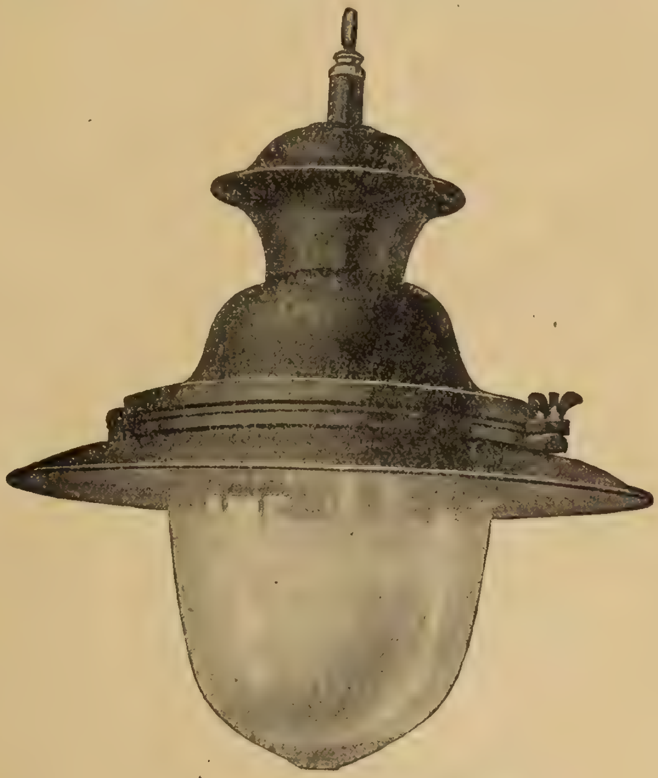


FIG. 3.—SIMPLEX HALF-WATT LANTERN.

MESSRS. SIMPLEX CONDUITS, LTD., of Garrison Lane, Birmingham, have a considerable number of standard designs of fittings suitable for use with the new lamp, including those shown.

Picture Lighting Fitting.

A neat device for illuminating pictures, desks, &c., to the best advantage has been introduced by the EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., of Ponder's End, Middlesex. It is

18 in. in length, and takes a Tubolite lamp. As shown in the accompanying illustrations, exceptional provision is made for adjustments to suit the requirements of each case, consisting of :—A, Main tube with serrations free to turn upon the supports E, so adjusting the light as required ; B, Revolving screen to cut off the light at the top of the frame ; C, Hinged screen to cut off the light at the bottom of the frame and from the wall below ; D, End plates to cut off the light at the sides. We are informed that fittings of this type have been installed in the choir stalls at Westminster Abbey.

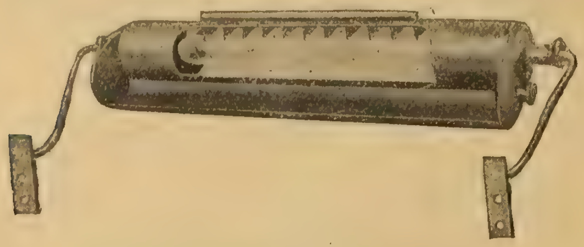
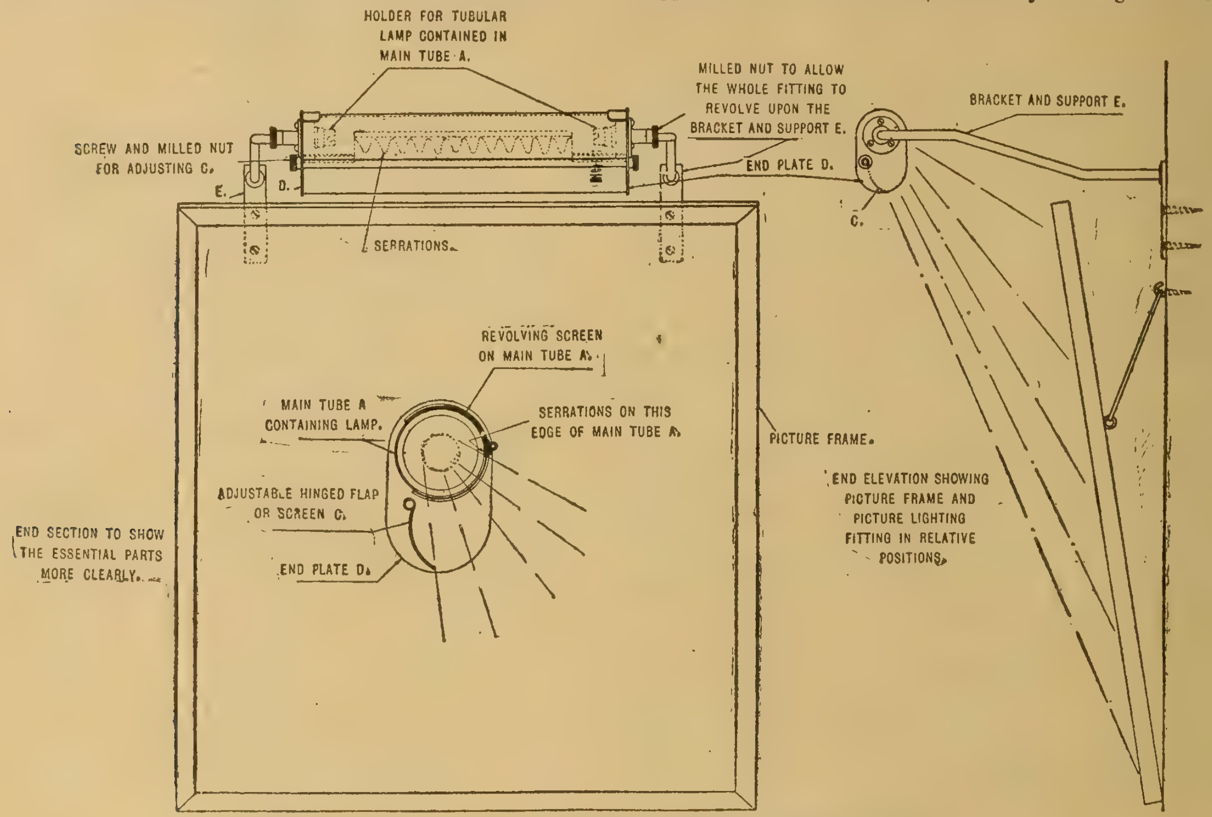


Fig. 4.—Ediswan Picture Lighting.


HOLDER FOR TUBULAR LAMP CONTAINED IN MAIN TUBE A.
SCREW AND MILLED NUT FOR ADJUSTING C.
E.
D.
SERRATIONS.
MILLED NUT TO ALLOW THE WHOLE FITTING TO REVOLVE UPON THE BRACKET AND SUPPORT E.
END PLATE D.
BRACKET AND SUPPORT E.
C.
REVOLVING SCREEN ON MAIN TUBE A.
MAIN TUBE A CONTAINING LAMP.
SERRATIONS ON THIS EDGE OF MAIN TUBE A.
PICTURE FRAME.
ADJUSTABLE HINGED FLAP OR SCREEN C.
END ELEVATION SHOWING PICTURE FRAME AND PICTURE LIGHTING FITTING IN RELATIVE POSITIONS.
END SECTION TO SHOW THE ESSENTIAL PARTS MORE CLEARLY.
END PLATE D.

Figs. 5 and 6.—Detail Diagrams of Picture Lighting Fitting.

Underfeed Travelling Grate Stoker.

In our last issue we mentioned that the new boilers installed at the Limehouse generating station of the Stepney Borough Council were of the travelling grate pattern, manufactured by the Underfeed Stoker Co, Ltd., of South Place, E.C. The grates are built in two ways, which differ only in the resulting method of dealing with the ash carried over the back of the grate. They consist of a number of specially-shaped fire-bars placed across the grate and mounted on endless chains which are moved along by sprocket wheels. Air is delivered through the slotted caps of the fire-bars ; the air supply enters the furnace through the duct D, and the air chambers E E, the sloping upper surfaces of which are provided with openings A for the delivery of air into the open ends of the box-shaped fire bars.

The supply of air is controlled by hinged triangular-shaped dampers (shown at A) which adjust the opening into the ends of fire-bars ; the shape of the opening is such that the maximum air is admitted at the front where fresh coal is being fed, and resistance to air admission is greatest, while at the back where the the fire is thin, minimum air supply is given.

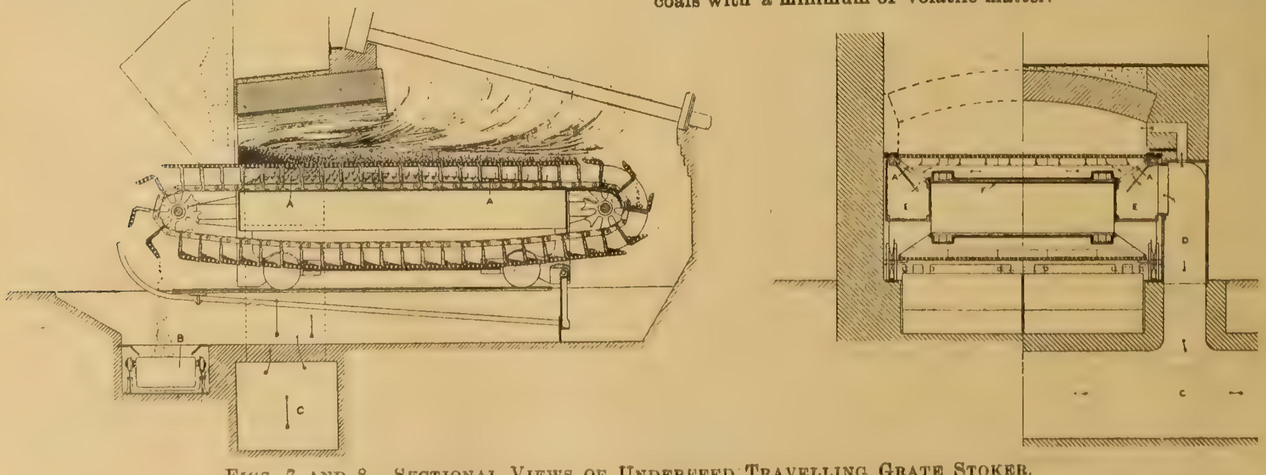
This arrangement gives exact regulation of the air supply at any time.

The fuel is delivered to the grate from a hopper in the ordinary way, and the whole machine, being mounted on wheels, can be withdrawn if required.

It will be noted that the box-shaped fire-bars gradually open as they pass over the rear sprocket wheels, close again at the bottom, and open again in passing up round the front sprocket wheels. Thus, with the bars mounted one way, the ash and clinker will be trapped at the back in the bars, and finally discharged at the front of the grate, while, with the bars turned in the opposite direction, the ash is discharged at the back in the usual way.

No dumping bars, such as are necessary to seal the end of the chain-grate stoker are required, and there is no tendency for the clinker to agglomorate in masses.

At the back end, the stoker is sealed from the passage of air from the boiler house by the plate F ; the sides of the stoker are also air-sealed. These grates burn not only bituminous coals, usual in chain-grate practice, but also coke breeze, anthracites, and other coals with a minimum of volatile matter.



Figs. 7 and 8.—Sectional Views of Underfeed Travelling Grate Stoker.

The advantages at the present time of burning coke breeze were recently referred to by Mr. Bowden when referring to the economies effected by his company (the South Metropolitan E.L. and Power Co.) by its use, the grates employed being of the type described above.

CORRESPONDENCE.

etters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The A.E.G. Meeting.

It is astonishing at the present time to note the apparent uncon-ern with which English manufacturers of electrical goods view e heavy importations of finished electrical machinery from eutral countries.

A few days ago I purchased some half-watt lamps, and was surrised to find "Made in Holland" indistinctly stamped on them. t the same time I was offered a motor made by a firm who trade nder a very English-sounding name, but whose birthplace I found as a Swedish works.

Ample confirmation of the statement of "Union Jack," in his st week's letter, can be found by carefully studying the *ersonnel* of a firm who are at the present time opening several ranches in England.

Previously to the war, almost without exception, their branch anagers occupied similar positions on the staff of a large German-wned electrical company in this country.

I have noticed that up to the present time the firm in question ave refrained from any extensive advertising, which is somewhat range, seeing that their circular-letters state exceptional oppor-unities for quick deliveries, a matter of great importance to power sers at the present time.

It would be extremely interesting to know if the B.E.A.M.A. ave satisfied themselves as to the real origin of this company, pecially with regard to its financial support.

Tariff.

October 18*th*, 1915.

Allow us to thank "Anti-Humbug" for his patriotic letter hich appeared in your last issue. We hope, with him, that this orrespondence will not fizzle out, but will grow—with or without e help of a leading article—so insistent, that all your readers ill awake to the fact that to trade with these firms is an act of eachery to their country.

Perhaps it is not generally known that grenades have been icked up in our trenches in Flanders with the letters A.E.G. cast n the cases. We have seen a photograph of these grenades and ave been hoping to see it reproduced in your columns. We do not now if it is possible to obtain one of the spent bombs from the ont, but we are trying, and if successful, we will send it to the E.A.M.A., as an exhibit at one of their meetings.

In the meantime, we wonder if the "British" staff of these erman concerns, whom "Anti-Humbug" so rightly chastises, ally like the idea of working for, and taking money from, a firm ho are helping to kill our brave soldiers.

With regard to "Anti-Humbug's" strictures regarding the ant of patriotism of electrical contractors, we think he is tirely mistaken. It is true a few of the smallest firms may be the Teutonic clutches, for it is, or was, one of their tricks to low a small firm to run up a large credit account, and then, ce in the toils, they were allowed to continue to exist, on the ndition of being bound hand and foot to their German aster.

We cannot speak of the E.C.A. We believe, however, the dividual contractor is as patriotic as the average Britisher, and the contractor has grown into a habit of buying German-made ods, it is chiefly the fault of the British manufacturer who has lowed the agents for the foreign-made article to have a monopoly push and go.

Our own position was clearly set out in a letter you were good ough to publish in your issue of October 22nd, and Anti-Humbug" may be interested to learn that we have the tisfaction of knowing that this letter was the means of rsuading at least one firm to discontinue supplying the Electrical . with their goods.

The electrical manufacturers and contractors could, in a few ort weeks, close the doors of every German electrical firm now ading in this country. Let us not only shut the doors but *ep* them shut.

E. P. Allam & Co.

London, W.C., *October* 30*th*, 1915.

With reference to the correspondence in your columns respect-g the A.E.G. Co. and its subsidiary companies trading in this untry as the Electrical Co., Ltd., and the Electrical Co. of South frica, Ltd., it may perhaps interest your readers to know that a ember of our staff has in his possession a German shell nose cked up on the battlefield, with the identification mark "A.E.G., 14." Apart from the fact that we permit enemy concerns to rn in this country the money to pay for munitions to be used ainst us, the date (on the shell) is significant.

The Wilson-Wolf Engineering Co., Ltd.

Bradford, *November* 1st, 1915.

The Institution and Alien Enemy Members.

With reference to the communication from "Station Engineer," obably naturalised alien enemy members of our Institutions and bs who have duly paid their subscriptions cannot legally be excluded, though there is no reason why it should not be brought home to them that their presence is not desired. Some of these people seem to be exceedingly thick-skinned; but persons of German birth should remember that they come of what has proved to be a criminal and brutal breed, and should be sufficiently ashamed of their origin to stay home for the present.

John E. Gray.

London, S.W., *October* 31*st*, 1915.

While it is impossible not to sympathise with a "Station Engineer's" desire to eliminate the unwelcome attendance of Germans at the meetings of the Institution, "A.M.I.E.E." is, no doubt, right in his contention that naturalisation must not be treated as a "scrap of paper," and that naturalised Teutons must, therefore, be allowed to attend if they so desire. Here, however, is the crux, for it is impossible to imagine that any one of German origin possessing ordinary gentlemanly instincts would desire to force his unwelcome personality upon a British gathering under present circumstances. Indeed, only recently one of the most prominent and popular members of the electrical industry, a man of German birth but acquired British nationality, wrote saying that till the war was over he intended to abstain from appearing in public, and from attending any gathering where his presence might offend British susceptibilities. Such considerate feeling does this individual credit, and the unfortunate attitude of other electrical personages of German origin, in appearing in public, apparently on every possible occasion at the present time, is only proof that no amount of naturalisation is sufficient by itself to convert a pachydermatous Teuton into an English gentleman.

M.Insts. C. and E.E.

October 30*th*, 1915.

With reference to "Station Engineer's" letters on this subject, may I commend to the Council of the Institution the following notice that has recently been put up in this club by order of the Committee:—"Owing to the natural anxiety of the members of this club in the present crisis, it is suggested that members who have been subjects of any country which is at war with this country, would exercise a wise discretion by abstaining from the use of this club during the period of the war, in the interests alike of their own comfort, and that of others."

A Member.

Junior Carlton Club, Pall Mall, S.W.,
November 1st, 1915.

Decimal Coinage and the Metric System.

Following our communication which you were good enough to publish in your last issue, we ought to have made a more clear statement regarding decimal coinage. We had in our minds the adoption of the franc. We are not in favour of adopting any other basis value than the English £ sterling, but, subject to this, we see little or no objection, and a most decided advantage and convenience, in decimalising this, especially as the florin is already the tenth, and the smaller amounts could easily be fitted in. Such modification might, in our opinion, form the matter of early legislative action. In regard to the metric weights and measures, however, we submit that the process of evolution which is now taking place should be allowed to go on, and that those who, like ourselves, are constantly dealing with clients who use the metric system, should be careful to interpret our British weights and measurements in metric weights and measurements.

W. Sisson & Co., Ltd.

W. Sisson, *Chairman.*

Gloucester, *November* 1*st*, 1915.

[As regards decimal coinage, we quite agree with Mr. Sisson, but we believe it to be important, under the conditions created by the war, to speed up the process of evolution.—Eds. Elec. Rev.]

LEGAL.

Workmen's Compensation.

In the City of London Court, on Monday, before his Honour Judge Atherley-Jones, K.C., Arthur Motley, electrician, of Woolwich, brought an action under the Workmen's Compensation Act against the Ocean Accident and Guarantee Corporation, to recover damages for the loss of a portion of one of his legs.

Mr. J. P. Morle appeared for the plaintiff, and Mr. Herbert Smith for the defendants.

It seemed that the plaintiff had been employed by George Driver and Son, High Road, Willesden Junction, but as they were insured, and had gone bankrupt, the proceedings were brought against their insurance company. The injury of which the plaintiff complained occurred on February 27th, 1911, when he knocked his knee upon a stool on which he was working. His left shin was severely injured, and plaintiff had been paid £1 a week as compensation. The shin caused him trouble, and the doctors had scraped it, but three years' afterwards the leg was amputated below the knee to get rid of the periostitis which had formed. In October, 1914, the insurance company provided him with a wooden leg, at a cost of 18 guineas, and they had hoped that that would have ended matters. The plaintiff was still unable to do any work, and he could not wear the wooden leg. He was a skilled electrician. Some of the nerves went wrong, and he was of opinion that he could not work, although the doctors thought he could. The present application was on behalf of the insurance company to reduce the £1 a week to 10s. a week. It was in the interests of the plaintiff, it was urged, that the Court should put pressure on plaintiff to get back to his work, and the parties had decided that the defendants would pay £340, and £60 for costs. Plaintiff was willing to accept that, and an order was made accordingly.

Wells, Rayner & Co., Ltd., *v.* Bovis, Ltd.

This matter was, by consent of the parties, referred to Mr. Albion T. Snell, who was appointed Special Referee under an Order of the High Court of Justice, dated April 28th, 1915. Plaintiffs claimed £254, balance due in respect of various installation work carried out in different parts of London, and for goods supplied, between July, 1911, and May, 1914. Defendants counterclaimed for £33 special discounts which, they said, had been orally agreed upon and for £298 in respect of alleged overcharges. Plaintiffs said that the cash discount was never agreed to, and denied the overcharges.

Mr. Snell, after hearing the evidence and examining the various documents and accounts put in, also surveying the principal installations, gave judgment to the following effect:—Defendants were not entitled to the sum of £33 or any sum as special rebate or discount; plaintiffs were entitled to £187 from defendants in full settlement of the matters in dispute; defendants to pay Arbitrator's fees and expenses of the reference; defendants to pay their own costs, and to pay the plaintiffs their costs of the counterclaim and three-fourths of their costs of the action and reference.

Messrs. Swann, Hardmann & Co. acted for the plaintiffs.

Aublett Harry & Co., Ltd., *v.* Dresdens.

In the Lord Mayor's Court last week, before the Recorder and a jury, a claim was made by Aublett Harry & Co., Ltd., general and electrical engineers, 53-55, Curtain Road, against Messrs. Dresdens, Army clothing manufacturers, of Sandy's Row, for £38 16s. 8d., the price of an A.H. electric cutting machine supplied. Mr. R. J. Willis appeared for the plaintiffs, and Mr. S. Duncan for the defendants. The plaintiffs in May last supplied the defendants with an A.H. electrical cutting machine at £38 16s. 8d. It was to be on trial for a period of seven days. Some time after delivery of the machine a telephone message was received stating that it was not in working order. Upon the plaintiffs' engineer calling at the defendants' place the machine was found to be working and too busy to be spared for examination. Mr. Vincent, the defendants' representative, had said that the machine did not quite suit their work, and asked the plaintiffs to quote for the supply of a Crescent band knife cutting machine. This was done at £78 odd. The terms for the supplying of the more expensive machine were under discussion for some time. The plaintiffs agreed, in the event of an order being placed for the band knife machine, to allow the full value for the electrical cutter provided it was returned at once in good condition. The defendants, however, never gave the order for the new machine nor paid for the one supplied. Several applications were made for payment without success. Finally the matter was placed in the hands of the solicitors for collection, and then the defendants, through their solicitors, wrote stating that no order was given nor was the machine purchased, that it was sent in on appro., and was unsatisfactory from the commencement. The defendants had requested the removal of the machine, which had not been done. The plaintiffs' contention was that although the machine had been delivered on appro., under the Sale of Goods Act, a reasonable time had elapsed in which the defendants could have returned the machine if not approved. For the defence, it was said that the electrical cutter which the plaintiffs had supplied was not satisfactory. It would not do the work it was represented to do. It was supposed to take a 3-in. lay of material, and would only take 1½ in. Negotiations for a more expensive machine had broken down. The plaintiffs were informed that the machine they had supplied was of no use for their purpose, and it had been returned to them but brought back by the plaintiffs' mechanic.

The jury, after hearing the evidence, returned a verdict for the plaintiffs, for whom judgment was entered, with costs.

Brown *v.* Mayor, &c., of Lambeth.

In the King's Bench Division, before Mr. Justice Avory and Mr. Justice Lush, on October 27th, an appeal was heard in which the plaintiff complained that the County Court Judge was wrong in holding that there was no evidence of negligence on the part of defendants, and that the onus of proving negligence was on the plaintiff. Plaintiff also submitted that the Judge was wrong in law in refusing to let him give evidence that the electric lamp which was extinguished at the time of the accident (a collision of a taxicab with it) was defective. The Court dismissed the appeal. A full report of the hearing will be found in the *Times* for October 28th.

WAR ITEMS.

Russia after the War.—Speaking as chairman of the Russian Corporation, Ltd., in London last week, Mr. A. W. Tait referred to the need of immediate British action in order to prepare to take advantage of the new atmosphere in Russia, as under. We reproduce the extract from the "Times":—"There was no doubt that the feeling which existed before the war for closer union and relations between the two countries had been, and would be, more strongly cemented during the present period of trial. Russia was a country of vast resources and enormous capabilities for rapid development provided it was supplied with the necessary financial facilities and expert advice and assistance. The enormous hold which Germany had obtained on the industry of Russia through the assistance and co-operation of its large industrial banks and financial syndicates, backed up with the necessary technical and financial experience in developing and managing enterprises of all classes, particularly railways and public utility and public service corporations, was only too well known. If this country was to render the assistance to Russia after the war which it expected and required, it would be necessary for the financial interests of this country to proceed immediately to put their house in order, so that they could provide that financial and expert assistance for the development of Russian industry; otherwise, it would surely slip back into the hands of the Germans, who previously largely controlled the commercial development of Russia. By a proper association of the financial interests of this country, backed by the technical and commercial experience which they could readily obtain and enlist in their service, this country would be able to forestall the approaches which would undoubtedly be made by the enemy in their own self-interest after the war, and enable Great Britain to obtain the concessions for, and to assist in the development of, large enterprises of a thoroughly sound and public nature. If the financial institutions of this country could only be got together in the manner which he had indicated, and which he strongly advocated that they should do without delay, they would be enabled to establish their position and influence in time for the large amount of economic development which was waiting for them in Russia after the war." Lord Ffrench is also reported to have testified from personal experience to the control exercised by Germany before the war over Russian industry, and he remarked that if this country did not at once proceed to "put its foot down," the Germans would, after the war, get back into their predominant position in Russia.

Australian Government and its Contractors.—The "Melbourne Age" for September 17th states:—"A week or two since the Federal Attorney-General requested the Victorian Government, the Postal Department, the Municipality of Sydney, and other public bodies who have entered into extensive contracts with Messrs. Siemens Bros., which has contracts amounting to considerably over £1,000,000 with these bodies, to make out a case why the importation of these goods should not be prohibited. Letters have been received from the Town Clerk of Sydney and the Postal Department, but none from the Victorian Government. As the latter is the biggest contractor, it having entered into a contract for the electrification of the railways with Messrs. Siemens Bros., Mr. Hughes stated yesterday that he was unable to arrive at any decision in the matter until he heard from the State Government. 'The position in regard to Falk, Stadelmann is also receiving very careful attention,' added Mr. Hughes. 'It would appear that this firm, which is one of the principal suppliers, if not the principal supplier, of incandescent mantles, chimneys, globes and other lighting sundries, is, though registered in England, almost entirely owned by Germans. According to the representations made by those in the trade, it is asserted that unless importations are permitted from this firm a most serious position will arise.' Mr. Hughes went on to say that while desirous of discouraging German firms, whether masquerading under the guise of British registration or not, he was anxious that the convenience of the public should be consulted. According to his information, it was impossible to obtain incandescent mantles in sufficient quantity from sources not dominated by German influence."

Manchester Corporation and Enemy Contractors.—The Manchester City Council, on Wednesday last week, unanimously adopted a resolution to the effect that no contract should be entered into by the Corporation with any person of German or Austrian nationality, and no contract should be made with any firm or company whose subscribed capital (whether by shares or otherwise) was held or controlled to the extent of one-third or upwards by persons of German or Austrian nationality. Alderman Walker moved the resolution, and Councillor West, who seconded, said the time had arrived when a municipality like Manchester should give a lead. Alderman Bowes, chairman of the Tramways Committee, said that certain commodities were entirely in the hands of firms whose capital was to a large extent German. His Committee had made purchases from one such firm, and the Board of Trade had offered no objection.—Alderman Walker said the resolution would not, of course, have any effect on the international situation. It simply meant that the Manchester Corporation declined in future to place any ntracts with persons or firms of German or Austrian tionality.—The resolution was carried, as stated.

Electrical Men Wanted.—It is stated in the "Times" at motor mechanics, boiler makers, mechanical and elecical fitters and telephone linesmen, between 19 and 40 ars of age, are wanted at 3s. 2d. per day, and all found, ith the usual separation allowances, for service in the w Corps of the Royal Engineers which is being raised r transportation purposes on the canals of France and elgium. Recruits are being selected by the Mercantile arine Service Association, of Liverpool, for the War Office, d applications should be made to the Association at Tower uildings, Water Street, Liverpool.

What is a "British" Firm? Australian Definition.—In nnection with the establishment of a Melbourne Metal xchange, the "Australian Statesman and Mining Stanrd" says that, although the formal opening had to be stponed, the Federal-Attorney General, Mr. W. M. ughes, announced early in September that on and after ptember 6th, and until the Exchange was formed, all les of metals and of certain specified minerals must be ade as through the Exchange and must be registered with e Attorney-General. A copy of the contract, whether letters, bles, or formal agreements, together with a declaration of curacy, to be registered within 48 hours in Victoria, and the case of other States 48 hours after providing for the dinary course of postage. Three sub-committees have en, and still are, engaged in drafting rules and regulans; these represent respectively producers, buyers and llers, and consumers, and their object is to create such a heme as is likely to work smoothly and not require speedy nendment. Our contemporary states that the Attorneyeneral has approved of the following definitions of British Firm" and "British Company":—A "British irm" is defined as one all the partners of which are British bjects; and a majority of the partners of which are natural rn British subjects and approved by the Federal Attorneyeneral. A "British Company" is defined as a company corporated in the British Dominions, all the directors of hich are natural born British subjects, and at least fourths of the shareholders of which are British subjects resint in the British Dominions. At least four-fifths of the pital of such company must be owned by British subjects, d the company must not be mainly controlled directly or directly by the subjects of any foreign country. The torney-General has also approved of the following recomendations made by the sub-committees:—All export busiss to be registered. Unsold parcels to be declared, and dertakings to be given to register within 48 hours of ceipt of advice of sale of any portion of the parcel. With gard to business within the Commonwealth, it should not obligatory for transactions which involve an individual yment of less than £500 to be registered. In the case of stoms' smelters, chemical works, and similar general orks, registration may be made monthly. A formal dearation to be made by the Attorney-General throughout e Commonwealth, so that all concerned may be acquainted ith requirements of registration. A proclamation was sued in September prohibiting the export from Australia of etals, alloys, and minerals unless the consent in writing the Minister is first obtained.

New Zealand and Inter-Imperial Trade.—A New Zealand change states that in September a large meeting was ld in Wellington Town Hall in furtherance of a campaign arted by the New Zealand Federation of Chambers of mmerce to develop inter-Imperial Trade. The Mayor said at the object of the meeting was to prevent, in future, itish countries helping to provide Germany with the ews of war. Trade relations with Germany should cease r all time. Sir Joseph Ward said that New Zealanders ould determine not to trade again with the enemy counes. Their policy should be preference to the Mother untry, to the Sister Dominions, and to the Empire's lies, and he was inclined to say, also to America, which d supported Britain and her Allies with 175 millions rling of munitions. Resolutions were carried urging the version of all the import and export trade formerly carried with Germany to countries within the Empire or to the lied countries, and urging the Government to impose a rtax after the war on goods from the present enemy untries.

BUSINESS NOTES.

Consular Notes.—GREECE.—In his report on the trade the Piræus and district for 1914, Mr. Consul Norcop says that year 1914 opened with all indications of a prosperous conclun. With the acquisition of new territory there arose an inclinan on the part of private individuals having a certain amount capital at their disposal to establish industries; and there was ensible increase in the number of inquiries for British-made chinery of various kinds, including small turbine plants and mping machinery in general. The trade in motor cars, both for vate and commercial purposes, increased considerably, and eral agencies carrying stocks of motor tires and other accessories were established at Athens, with branches at the various large centres.

"It was impossible to foresee the paralysis that would overtake the trade of the country in the shape of a European war. Possibly paralysis is too strong a word to use, for up till the date of writing the demand for many articles still exists. The difficulty lies in the supply, at least from the United Kingdom. Imports into Greece from Germany and Austria-Hungary have certainly diminished, though they have by no means ceased; manufacturers in the latter countries guarantee to fill promptly 60 per cent. of all orders placed with them. The advantage of even this proportion of the regular trade is, to the Greek importer, of great importance: for not only are freights within the Mediterranean much nearer the normal rate than they are from British ports, but German shippers continue to extend the same terms of credit that they gave before the war. On the other hand, British manufacturers who formerly gave credit, or who accepted cash against bills of lading on presentation in Greece, now demand either cash with order, or a confirmed banker's credit in London to guarantee cash before shipment. To the further detriment of British trade with Greek ports, freights are now so high and uncertain that business has become practically impossible. The result is that Greek merchants are being driven into the arms of American exporters for such articles as they can no longer obtain from Germany and Austria-Hungary. Strange as it may appear, it is nevertheless true that merchants here have found it easier to obtain goods from Germany than from the United Kingdom, orders which have been sent there having been executed with great promptitude and without any change of terms, the long credits which have always been allowed by German firms being still allowed without difficulty or question. Thus a good opportunity has been lost by British manufacturers of securing the German trade.

"Trade continues as usual, and the Athens and the Piræus markets are both remarkably strong and brisk; money is plentiful and gold cheap, and the retail trade in particular is doing very well owing to the large increase in the population of the two towns due to the large number of Greeks and others who have come here from Turkey since the outbreak of the war."

The reasons why German and Austro-Hungarian firms have done so well in Greece are, first, because they have always been willing to suit the requirements of the market in many ways which British manufacturers in general have not appeared willing to do. Other factors are the cheapness of their goods, the long credit they give (60 to 120 days), prices, including packing c.i.f. Greek port, discounts, quick delivery of goods, metric system of weights and measures, and smart travellers who gauge how much credit can be given to firms. And with all this, Greek firms would prefer British goods if they could only obtain the same terms as given by our rivals. The Greek buyer wants credit because the Customs duties in Greece are very high, and as he has to pay these duties before he can get delivery of the goods, he wants time before he pays the bill of the exporter. Catalogues should be in French.

The commission usually paid to agents in this district for the sale of goods, such as yarns and piece-goods (of cotton, wool, flax, &c.), is as follows:—

Manchester and Bradford goods, 1 to 1½ per cent.: machinery, motor cars, 5 to 10 per cent. The commission is due only on goods actually paid for, and applies to all orders whether placed through the agent or direct. A local agent has no responsibility unless he acts contrary to instructions. The credit usually given by foreign firms through agents is four to six months, and a discount of 2½ per cent. is usually allowed for cash payments. Prompt and punctual delivery of orders is very essential, as local merchants have the habit of waiting to the last moment to give orders, and should there be any delay in delivery acceptance is often refused. Commission business is in the hands of persons who are energetic, but some do not present the necessary guarantees of solvency. For this reason the following measures should be taken:—

1. Agents should be entrusted with the collection of sums of money in special instances only, and when they can furnish sufficient guarantees.

2. When orders are dispatched, the firm should ask that the orders be signed by the merchant who orders the goods, as otherwise it is easy for disputes to arise as to quality, &c.

3. Bills of lading should be sent through a bank, to be delivered on payment of the goods, or in exchange for a draft, signed by the merchant.

In the latter instance, and in case of non-payment, proceedings could be taken, and also application could be made to the court to make the merchant bankrupt.

As a general rule the above steps should be taken; there are, however, several commission agents in whom full confidence can be placed.

Commercial travellers are not required to go through any formalities in order to be able legally to exercise their calling in Greece, nor are they required to take out a licence, provided they come and go merely as bearers and receivers of orders. Agents of British firms resident and trading in Greece are, however, required to take out trade licences.

The present is a propitious moment to push trade which has been in the hands of our rivals, namely, in textile machinery, aërated water machinery and accessories, agricultural machinery, ploughs, engines for steam, gas or oil, pumping and irrigating machinery, flour mills, oil mill plant and olive oil presses, water wheels, turbines, steam and oil tractors, brick and tile machinery, and other machinery for industrial and other purposes, electric motors and tools of different descriptions. Germany and Austria-Hungary were also doing very good business in cast-iron water pipes, iron bars, black and galvanised sheets, wire, iron joists and girders, iron bars, angles tees, roller shutters, corrugated iron, &c.

Austria-Hungary has been supplying Greece with more than double in value of the following, compared to British imports :—Electro-technical appliances, electric conduction apparatus in boxes, electric motors, transformers, switch and contact devices, mounted fuses, &c., and also imported dynamos, motors, electrical fittings, electric lamps, high-pressure cable and transmission lines, electrolytic copper. Switzerland is a contributor for high-pressure wire. Electrical instruments have generally been supplied by the United Kingdom, low-pressure wire by Sweden, and transmission lines by Belgium. It is reported that the Minister of Communications in Greece has laid a Bill before the Chamber for the extension of the lines in Old Greece and the new territories, and the adoption of the newest system and secrecy in communication. This change is expected to cost about £90,000. It is further stated that tenders will be invited later on.

The reason of the success of our rivals has been, to a great extent, their sending very capable representatives with a practical knowledge of their duties, explaining to the buyers all they want to know about machines, &c., and ready to agree to any alterations to meet local requirements. Representatives of British firms are seldom seen in Greece. There have been many complaints at the slackness of delivery on the part of British firms which has deflected much business from them, and has enabled our rivals to step in and secure trade by prompt deliveries. Buyers in this country take time to decide before giving orders, and give the order at the latest moment which will allow of delivery, and the buyer expects and relies on prompt delivery, otherwise he is often subjected to serious losses.

With the exception of steam boilers, which are principally imported from the United Kingdom, all the machinery in the factories came from Germany. The reason, according to a Greek manager is : "German agents visit us daily ; they study our requirements and give exactly what we want. They inundate us with catalogues in French or German—in not a few cases even in Greek. The prices are invariably quoted with delivery in Athens. Weights and prices are given in the metric system, so that we can judge to a lepta how much we have to pay and, best of all, goods are delivered on easy terms, payable at 3, 6, 9 and even 12 months."

Catalogues and Lists.—Messrs. Pass & Seymour Inc., Syracuse, N.Y.—Illustrated leaflet and priced folder, giving particulars of the Mogul or Goliath lampholders.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Illustrated and priced folder relating to "Magnet" electric heating and cooking apparatus—rod type electric fires, panel type ditto, portable cookers and range type cookers ; also an illustrated folder, giving prices, &c., of "Magnet" electric hotplates, toasters, electric irons and kettles.

British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.—The company has just issued a set of six gummed and perforated poster stamps, advertising in many-coloured designs, the virtues of Mazda lamps. The stamps are intended for use on letters, envelopes, &c., and supplies will be forwarded to factors or contractors on application.

Edison & Swan United Electric Light Co. Ltd., Ponder's End.—Illustrated circular describing and pricing the "Ediswan" picture lighting fitting, which is also equally useful for pulpit, desk, or orchestra lighting.

Messrs. Siemens Bros. Dynamo Works, Ltd., of 38 and 39, Upper Thames Street, London, E.C., have sent us a very handy "Wotan" desk pad. A block of memoranda slips, held by a spring clip allowing of removal or replacement of slips as required, rests on a neat art metal base.

Messrs. Heathman & Co., Parson's Green, Fulham, London, S.W.—Illustrated circulars giving particulars and prices of various patent ladders, fire ladders and ladder carts, fire extinguishing appliances, telescopic ladders and ladder towers, &c.

Messrs. Falk, Stadelmann & Co., Ltd., 83/87, Farringdon Road, London, E.C.—Twenty-page illustrated and priced pamphlet giving particulars of "Efesca" British-made wire lamps. In addition to the usual lines, types of traction, street lighting and train lighting lamps are included, also "Electra" carbon lamps, auto-transformers, and "Efesca" lanterns.

The Electrical Supplies Co., 53, Victoria Street, London, S.W.—Leaflet announcing that they have arranged to stock in their London warehouse a complete range of all sizes and types of arc lamp carbons at more favourable prices than those prevailing last season.

Board of Trade Inquiries.—The latest weekly list of the B. of T. Commercial Intelligence Branch shows that inquiries have been received from home firms for the makers of the following :—

Electric batteries for pocket lamps.
Electro cautery apparatus for superfluous hairs.
Enamelled iron shades for electrical purposes.
Yarns, cotton, for covering electric bell-wire, flexible cords and cables.

The Commercial Intelligence Branch is prepared to give certain information respecting the following inquiries :—

Russia (Finland).—A firm in Wiborg wishes to get into touch with United Kingdom manufacturers and exporters of electrical plant, fittings, and machinery.

An agent in Helsingfors wishes to represent United Kingdom manufacturers of technical and machinery lines.

Canada.—A firm of agents in Montreal wishes to obtain agencies of United Kingdom manufacturers of mechanical equipment, electrical equipment, and articles for the mining industry.

Book Notices.—"Technical Papers of the Bureau of Mines." No. 101.—"Permissible Explosion-Proof Electric Motors for Mines ; Conditions and Requirements for Test and Approval." No. 88.—"The Radium-Uranium Ratio in Carnotites." Washington : Government Printing Office.

"Science Abstracts." A and B. Vol. XVIII, Part 10. October 25th, 1915. London : E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"Scientific Papers of the Bureau of Standards." No. 250.—"Characteristics of Radiation Pyrometers." Washington : Government Printing Office.

"Mechanical Technology." By G. F. Charnock. London : Constable & Co., Ltd. Price 7s. 6d. net.

"Overhead Transmission Lines and Distributing Circuits." By F. Kapper. Translated by P. R. Friedlaender. London : Constable & Co., Ltd. Price 16s. net.

Lantern Slides.—The British Westinghouse Electric and Manufacturing Co., Ltd., of Trafford Park, wish it to be remembered that they have a large and varied collection of lantern slides at their disposal. These slides they freely lend to responsible persons, and the lecture season having now commenced, they will welcome applications for the loan of them.

Bankruptcy Proceedings. — Joseph Swainson (J. Swainson & Co.), electrical contractor, C.-on-M., Lancs., and Manchester.—November 19th is the last day for the receipt of proofs for dividend by Mr. A. Yearsley, 27, Brazennose Street, Manchester, the trustee.

J. W. and T. W. Tattersall (Tattersall & Tattersall), electrical engineers, Highgate and Willesden Lane, N.W.—November 13th is the last day for receipt of proofs for dividend. Trustee, Mr. E. S. Grey, Official Receiver, Carey Street, W.C.

For Sale.—Particulars will be found amongst our advertisements to-day of a number of Diesel engines and a considerable amount of other engineering and electrical plant and material, at the late works at Ipswich of the Consolidated Diesel Engine Manufacturers, Ltd., which is for sale by private treaty.

Fire.—A fire occurred on the premises of Messrs. Johnson & Phillips, Ltd., Victoria Road, Charlton, last week.

Liquidation.—Consolidated Diesel Engine Manufacturers, Ltd.—On Tuesday last an application by petition of the majority of the committee of inspection was heard before Mr. Justice Astbury, asking for the appointment of an additional liquidator, or in the alternative for the removal of Sir W. B. Peat, the present liquidator, from his office. The summons was adjourned.

LIGHTING AND POWER NOTES.

Aberdeen.—The electrical engineer's monthly statement showed that for September the output of the Corporation electricity undertaking was 1,061,210 units, compared with 957,650 for the corresponding period last year, an increase of 103,350 units.

Atherton. — Increased Charges. — The electrical engineer has advised that charges for current purchased in bulk be increased at the end of the year, and he has been instructed to report further on the matter at a future meeting of the Electricity Committee.

Australia.—Annual Report.—The report of the Electric Supply Committee of the Melbourne City Council for the year ended December 31st last, mentions that the sales of current for the year 1914 showed the largest increase of any year in the history of the undertaking. The number of units sold was 17,163,000, an increase of 2,950,387 over 1913. The revenue for the year amounted to £164,788, an increase of £14,433 over the previous year, the general expenditure was £79,991, while the gross profit was £84,797, and after providing for capital and other charges there was a net profit of £21,050.

The capital expenditure for the year amounted to £105,234. The city engineer, in a series of tables illustrating the results of the working of the department, shows that the most marked feature of the sales for last year was the great increase in those for power and heating in comparison with those for light, being 32·28 per cent. and 2·46 respectively.

The number of consumers has been increased by 807. The motors connected during the year show an increase of 3,260 H.P., or 32·7 per cent.—*Melbourne Age.*

Aylesbury.—Loan Application. — The U.D.C. has applied to the L.G.B. for sanction to a loan of £362 for a new cable needed for Government work, and to a loan of £1,600 spent in connection with the carrying-out of the E.L. scheme and in excess of the loan already granted.

Bo'ness.—The proposal of the National Electric Construction Co. to make temporary extensions at the electricity works, at an estimated cost of £6,000 to £7,000, under which the Council would pay 6 per cent. per annum until it obtains borrowing powers, and the two Diesel oil engines to be provided would be returned to the company and full credit be allowed, has been submitted to the Secretary for Scotland, who has asked for further particulars. A ratepayers' petition against the proposition, and asking that sanction be not given, has been forwarded to the secretary, who has asked for the Council's observations on the matter. The T.C. has decided, before replying, to ask the National

Electric Construction Co. to state specifically whether loss arising through temporary expenditure would be charged to capital account, and not to the T.C., and whether the company would be prepared to pay, if need be, a higher rate of interest than 6 per cent. (the amount stipulated in the agreement with the town) to cover interest and sinking fund on the future sum to be borrowed by the Council for the permanent extensions.

Bradford.—Plant Inauguration.—On Friday, last week, a new 5,000-KW. turbo-alternator and two 1,500-KW. rotary converters were officially started up, in the presence of the Lord Mayor and many members of the Council and visitors. The new plant has been supplied by the British Westinghouse Co., and a third rotary of the same size and make is being installed. Subsequently the company were entertained to luncheon at the Town Hall, where, in the course of speech-making, it transpired that during the next 12 months the Committee will have to consider further extensions of plant, owing to the growing demand, and that an arrangement had been come to for giving a supply having a maximum demand of at least 1,000 KW. for the operation of electric furnaces, which it was anticipated would be used for 24 hours a day the year round. At the Dumb Mills, which is to be electrically operated from the Corporation mains, over 26,000 spindles will be installed. The only direction, according to the chairman of the Electricity Department, in which progress was not being made, was in connection with electric vehicles for heavy haulage, which, he said, was the fault of Bradford, not of the machine.

The Electricity Committee has agreed to give bulk supplies to Messrs. Croft & Perkins, and Thwaites Bros., large engineering firms in the city; negotiations are also on foot for a temporary supply of energy to the Yorkshire Electric Power Co.

Broadstairs.—Price Increase.—The Tramway Co. has intimated that the Council ought to bear the 10 per cent. increase in the price of electricity, as the company had not received any revenue for 12 months in respect of the lighting contract; the matter was referred to the Lighting Committee.

Canada.—B.C. Water-Powers.—Surveys of the available water-power throughout British Columbia show that 3,000,000 H.P. can be developed from the streams of this Province, and that only about 8 per cent., or approximately 240,000 H.P., has been made use of up to the present.

The British Columbia Electric Railway Co. and its subsidiary companies has developed more water-power than any other individual corporation, having plants running which produce over 120,000 H.P., and a distributing system delivering power over an area of 1,600 sq. miles; on the north arm of Buzzard inlet, 16 miles from Vancouver, the Lake Buntzen power plants, of which there are two situate half a mile from each other, generate about 85,000 H.P. The original installation of the No. 1 plant was four 1,500-KW. generators driven by Pelton wheels; three 5,000-KW. generators have been added from time to time. The No. 2 power house is equipped with three generators of 8,900-KW. each, driven by 13,500-H.P. Doble-Pelton wheels. A three-phase 60-cycle current is generated at 2,200 volts in both plants, and at present is stepped up to 34,000 volts, at which pressure it is transmitted to the various sub-stations around Vancouver and district.

On Vancouver Island, at Jordan River, the B.C. Electric Railway Co. develops 2,500 H.P. for lighting, power, and the street railways in Victoria and district.

Another concern operating in the Vancouver district is the Western Canada Power Co., Ltd., which has developed power on the Stave River, the installation consists of two 13,000-H.P turbo-generators and two 500 H.P. exciter turbines; two 10,000-H.P. three-phase, 60-cycle, 4,400-volt generators, capable of delivering 12,500 H.P. each at a power factor of 85 per cent.; the four machines are direct-coupled to Escher-Wyss turbines, and a double transmission line 35 miles long, on steel towers, transmits the output of the power house at 60,000 volts to the receiving station near Vancouver, from whence it is distributed to the various sub-stations in Vancouver, New Westminster, North and South Vancouver, Burnaby, Port Moody and Coquitlam.

On Vancouver Island, the Canadian Collieries (Dunsmuir), Ltd., is in operation; this company impounds the waters of Lake Comox, diverted from Puntledge River, which is supplied to two 6,000-H.P. Escher-Wyss Francis turbines, direct-coupled to 4,000-KW. generators, developing a three-phase, 25-cycle current at 13,200 volts; the transmission system of about 50 miles in length supplies six step-down sub-stations at the various mines of the company.

On the Powell River, the Powell River Co. has developed 34,000 H.P., of which 24,000 H.P. is now being used, 14,400 H.P. for pulp grinders, and 9,600 H.P. for generating electricity.

The West Kootenay Power and Light Co., Rossland, has developed 30,000 H.P. at Bonnington Falls, on the Kootenay River, and 3,000 H.P. at Cascade, on the Kettle. A three-phase 60-cycle current is transmitted at 60,000 volts to the Trail Smelter, Rossland Mines, Grand Forks, and Greenwood, 78 miles from Bonnington. The city of Nelson has a 3,800-H.P. plant on the Kootenay River, which supplies the city with energy for light, power and the street railway. The city of Revelstoke has also its own hydro-electric plant of about 2,000 H.P. The Britannia Mining and Smelting Co., near Vancouver, has developed 3,000 H.P. for generating electricity for operating air compressors, mill and mine machinery; the Granby Con. Mining, Melting and Power Co. has a hydro-electric equipment at Anyox, of about 3,600 H.P., which supplies electricity for mining and smelting machinery, electric railway, &c., and many of the small cities throughout the province are supplied with electrical power developed from near-by streams. —*Mining World.*

Chelmsford.—Street Lighting.—With reference to the total abolition of public lighting, the Electricity Supply Corporation has suggested that while the order is in force the rebate on the contract should be at the rate of £700 per annum, leaving the amount payable by the Council at £951. The Council considers the rebate insufficient, and has decided to offer an annual payment of £330 only.

Chester.—Price Increase.—The Electricity Committee has decided that the charges for electricity shall be increased 15 per cent. from December 25th, 1915.

Continental.—Spain.—The use of water power in connection with generating stations continues to increase in Spain. According to statistics furnished by the engineering secretary of the Spanish Electrical Union, whilst the official records showed that only 50,000 H.P. was utilised in hydroelectric works in 1904, the power employed in this way had risen to 266,000 H.P. in 1914. Yet the watercourses in Spain are able to yield an enormous amount of power. The bulletin issued by the Union sets forth that the River Ebro and its affluents are able to provide 1,130,000 H.P., the Duero 900,000 H.P., the Guadalquivir 750,000 H.P., the Tajo 700,000 H.P., the Guadiana 370,000 H.P., the Mino 250,000 H.P., the Jucar 190,000 H.P., and the Segura and its affluents 100,000 H.P., and the remaining rivers are estimated to be able to furnish a further quantity of 600,000 H.P. The hopes of the Spaniards tend in the direction of further developing the water powers and rendering themselves less dependent upon foreign supplies of coal.

Crewe.—Year's Working.—For the year ended March 31st last there was a surplus on the working of the electricity undertaking of £848, of which £600 has been allocated towards the relief of the rates.

Faversham.—Loan Repayment.—The T.C. has received notice for repayment within six months of a loan made to the E.L. department, amounting at present with interest to £5,779, the request being made in view of a new War Loan and the consequent withdrawals by depositors. At the expiration of the notice the loan and interest will amount to £4,081, and the T.C. has decided to ask the bank to let the loan continue and for its terms.

Folkestone.—Street Lighting.—The manager of the Folkestone Electricity Supply Co. has informed the T.C. that he has recommended the company to make a further rebate on the contract for the public lighting at the rate of the £288 per annum for the period over which the further reduced lighting extends.—*Folkestone Express.*

Gwersyllt.—Prov. Order.—The P.C. has decided to offer no objection to the application by the Wrexham T.C. for a prov. order for E.L. to include the parish and other parts of the rural district in the area of supply.

Gloucester.—Loan Application.—The City Council has decided to apply for sanction to borrow a sum not exceeding £25,000 for providing the required H.T. generating plant, and also for defraying the cost of special mains recently laid down.

Harrington (Cumberland).—Overhead Cables.—The U.D.C. has granted permission for the Workington Iron and Steel Co. at Lowca, to erect an overhead line for the transmission of current at 500 volts pressure to the railway sidings, and also to provide power for water pumping.

Haslingden.—Annual Report.—The income from the electricity undertaking for the year ended March 31st last was £3,887 and the expenditure £3,695, leaving a surplus of £192.

A conference has been held at Accrington between representatives of the two Corporations, with regard to the question of the inadequate and intermittent supply of electricity in bulk to the Corporation.

Huddersfield.—Power Supply.—Some difficulty is being experienced by the Electricity Committee regarding the supply of electrical energy to new power consumers. New works have been established at Deighton, and an application has been made by Mr. L. B. Holliday for a supply of electricity to the place. The Tramways Committee has undertaken to forego for the present the supply of electricity for the tramways, and, in view of this, the Electricity Committee has resolved that the supply asked for, should be supplied on terms stated and subject to an agreement being entered into with the authorities.

Hythe.—Electrical Pumping.—The T.C. has arranged with the Folkestone E.L. Co. for current for water pumping purposes at Saltwood Wells, at 1½d. per unit, or 3d. per 1,000 gallons, pumped by the plant installed by the company.

Ilford.—The L.G.B. has informed the U.D.C. that at the present time it cannot entertain the Council's application for a loan of £870 for the erection of an engine room at the refuse destructor site, where the Council propose to establish a sub-station.

Ipswich.—L.G.B. Inquiry.—An inquiry was held on October 26th relative to the application of the T.C. for a loan of £3,100 for the provision of coal bunkers and coal-handling plant at the electricity works. There was no opposition.

Japan.—According to a report by the Electricity Bureau in the Communications Department at Tokyo, electrical enterprises in Japan at the end of May numbered 615, the combined capital amounting to $303.410,786 United States currency. In comparison with the end of 1914 there is an increase of 14 in the number of enterprises and $541,475 in their combined capital. Power suppliers made up the largest number of these, being 524 in all with a combined capital of $154,793,112, while tram companies number only 44, though their combined capital is $25,[illegible]20,010. Others number 47 with a combined capital of $123,147,463. The total volume of power generated by them is estimated at 727,783 KW., being an increase of 7,551 KW. over that at the end of last year.—*Eastern Engineering.*

Leicester.—Plant Extension.—The Tramways and Electricity Committee of the T.C. has recommended the provision of two additional boilers at the Borough Generating Station at an estimated cost of £11,526, to be met out of the reserve fund of the tramways undertaking.

London.—Shoreditch.—The Lighting Committee of the B.C. has agreed that the expenditure under the order of the L.C.C. sanctioning the borrowing of £1,500 for services to consumers, be limited from March, 1915, and until the termination of the war, to the provision of services to consumers employed on Government work.

Poplar.—For the quarter ended June 30th last, as compared with the same quarter of last year, the output of the Council's electricity undertaking has increased by 1,076,456 units, or 31 per cent., notwithstanding a falling off in lighting supply. The net income from the sale of current for the quarter has increased by £3,300, while working expenses increased by £2,300, of which £1,269 was due to increased cost of coal. The Electricity Committee has recommended an arrangement whereby the public lighting staff will in future share in the bonus scheme connected with the undertaking.—*E. London Advertiser.*

Newcastle-on-Tyne.—Electric Cooking.—We have received from the Newcastle-on-Tyne E.S. Co. a pamphlet which it has recently issued to its consumers on the subject of electric cooking and heating, in which particulars of the company's special tariffs and of the various apparatus on hire are given. This apparatus can be seen working at the "Electric Shop" in Northumberland Street, where cooking demonstrations are given daily. The company's "domestic tariff" to consumers using electricity exclusively for lighting is ¾d. per unit for all purposes, providing they install not less than 2 KW. of heating or cooking apparatus and pay a fixed charge of 6s. per lamp holder per annum on 75 per cent. of the holders installed. No meter rents are charged, and 5 per cent. discount is allowed. For office lighting a fixed charge of 30s. per annum, payable quarterly, plus ¾d. per unit, is offered. Meter rent is charged, but a 5 per cent. discount is allowed for prompt payment. Ordinary electric cooking stoves are hired out at 5s. and 6s. 6d. per quarter; electric fires at 3s. per quarter, and smaller apparatus at proportionate rates.

Merthyr Tydfil.—The Electric Traction and Lighting Co. announces that, owing to enlistments on the part of its staff, it is unable to guarantee immediate response to consumers' requirements and complaints. The shortage of men is felt particularly in the lighting and wiring department.

Mexborough.—The T.C. has referred back a minute of the Electricity Committee, regretting that it could not give the Mexborough and Swinton Tramways Co. a supply of current on account of the capital expenditure which would be incurred.

Middlesbrough.—Bulk Supply.—The Electricity Committee has decided to install an automatic regulator at the electricity works, and to carry out certain alterations to the cables, so that the entire supply may be taken from the Cleveland and Durham Electric Power Co. These alterations would cost £270, and would supersede the scheme for the installation of a booster, &c., at a cost of £1,000; they would effect a saving of £600 per annum, and a saving of labour of £500 per annum.

Ormskirk.—Price Increase.—The Ormskirk Electric Supply Co. has given notice that the price of electricity for lighting purposes is to be increased by 10 per cent.

Rugby.—Year's Working.—The accounts of the Council's electric light undertaking for the past year show expenditure amounting to £4,376, receipts to £6,409, and after allowing for discounts, a balance of £1,732, which had been carried to net revenue account, which, with £1,197, the balance from last year totalled £2 929; after providing for interest £413, and £680 for repayment of loans, the net balance carried forward to next year's account was £1,836. The net profit on the year's working was £639, as compared with £813 in the previous year.—*Rugby Advertiser.*

South Africa.—In connection with the electric power supply to the Salt River (Cape Town) workshops of the S.A. Railways, high and low-pressure switchgear has recently been installed at the sub-station, which is supplied by the Corporation with 11,000-volt, three-phase current. The new gear is in three sections, consisting of four panels for the 11,000-volt supply, seven panels for 2,200 volts, and 10 low-tension panels. All the H.T. switchgear is of cubicle construction, and the whole was erected by Messrs. E. A. Shaw & Co., of Cape Town, district agents for the makers.

Steeton.—At the last meeting of the District Council mention was made of the statement by the Keighley T.C. that it could not supply electric power to Steeton and Eastburn, and several members protested against this action of the Keighley authorities, seeing that powers had been sought and obtained and then were not used.

Stoke-on-Trent.—Loan Application.—Application has been made for sanction to a loan of £2,000 for distributing mains. Under the Prices of Coal (Limitation) Act, an advance of 4s. 3d. per ton on last year's prices has been accepted by the Council's contractors.

Straits Settlements.—A contract for the electric lighting of Johore Bahru township was concluded in 1914 with the Central Engine Works, Ltd. The scheme provides for the efficient lighting and supply of power to the public roads and Government buildings and institutions within the town as well as to His Highness the Sultan's residence at Pasir Planggi, some 2½ miles distant from the power station. A D.C. supply will be given from two 150-KW. Westinghouse generators coupled to two 225-H.P. Westinghouse vertical tandem gas engines Distribution will be on the three-wire system at 500-250 volts over, approximately, 15 miles of streets, with all necessary connections to Government buildings, shops, &c. The capital expenditure under the contract for installation is $204.100, and the contractors are further required to maintain the plant and supply power at fixed rates for a period of three years from the completion of the installation.—*Eastern Engineering.*

Sutton.—Street Lighting.—The U.D.C. has accepted the offer of the E L. Co. to reduce the candle-power of the public lamps during the war by 50 per cent., and the account by 25 per cent., on condition that after the lighting restrictions are removed the company have the same period on full and normal conditions added to its contract.

Tasmania.—The Hobart Gas Co. has confirmed an agreement for the sale to the hydroelectric department of the State, of all its electrical plant, machinery, and contracts, for £108,000.—*Tenders.*

Wimbledon.—The T.C. has decided not to extend the period of the agreement with the Fixed Price Light Co., whose operations have been curtailed during the period of the war. The agreement runs until the year 1922.

Wigan.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £6,700 for new boilers at the electricity works.

Wolverhampton.—The T.C. has been notified that the L.G.B. is not prepared to sanction a loan of £5,000 for expenditure on ordinary mains extensions, but has no objection to the proposed expenditure of £1,365 to afford a supply of electricity to certain firms engaged on Government work.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. System.—The Tramways Committee has decided not to reopen the question of the "pay-as-you-enter" system, and also that the present is not an appropriate time for incurring any expenditure in having the stairs and platforms on the P.A.Y.E cars restored to their original shape.

Blackburn.—Women Conductors.—The Corporation has decided to follow the lead of other towns and secure female conductors for the cars; up to Saturday last, nearly 200 applications had been received for these positions.

Blackpool.—Contract Tickets.—The T.C., after a long discussion, has referred back to the Tramway Committee the proposal to increase the price of tramway contract tickets, with a recommendation that sectional contracts be provided at a reasonable rate.—*Manchester Evening News.*

Dundee.—War Wages.—The Tramways Committee has considered an application for a 3s. advance from the motormen and conductors. It was decided to defer the question for two months, until after the recruiting canvass. It was stated that there were still a large number of men of military age in the service, and in view of probable enlistments it might be necessary to introduce women conductors.

Edinburgh.—War Wages.—The whole of the employés of the Edinburgh and District Tramway Co. have received an addition to their wages of 2s. per week. Over 1,000 men and women will benefit by this increase. Certain concessions in reference to holidays have also been made. The increases represent an addition to the yearly expenditure of the company of about £5,500.

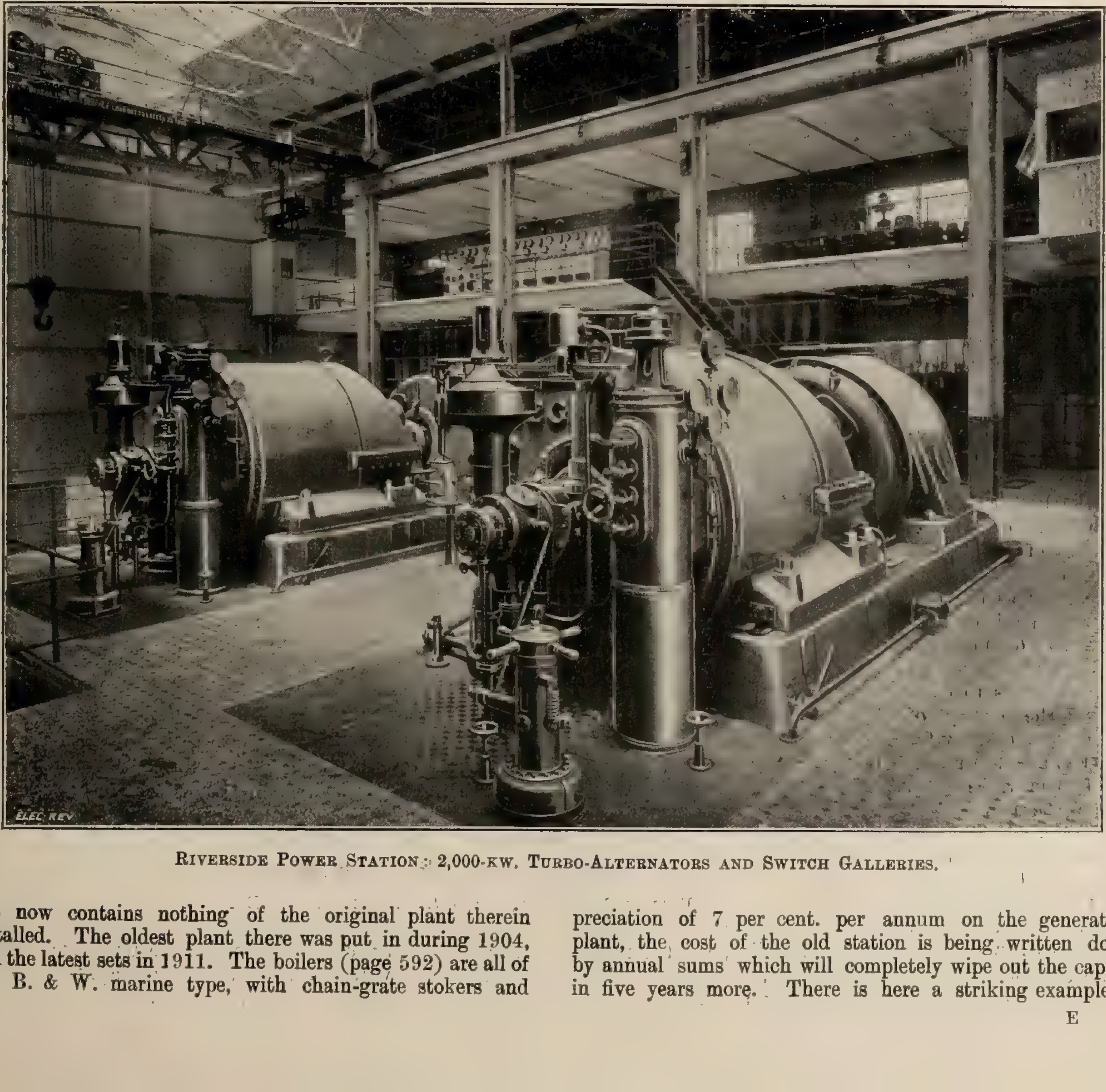
(*Continued on page 595.*)

SHANGHAI ELECTRICITY WORKS.

Riverside Power Station

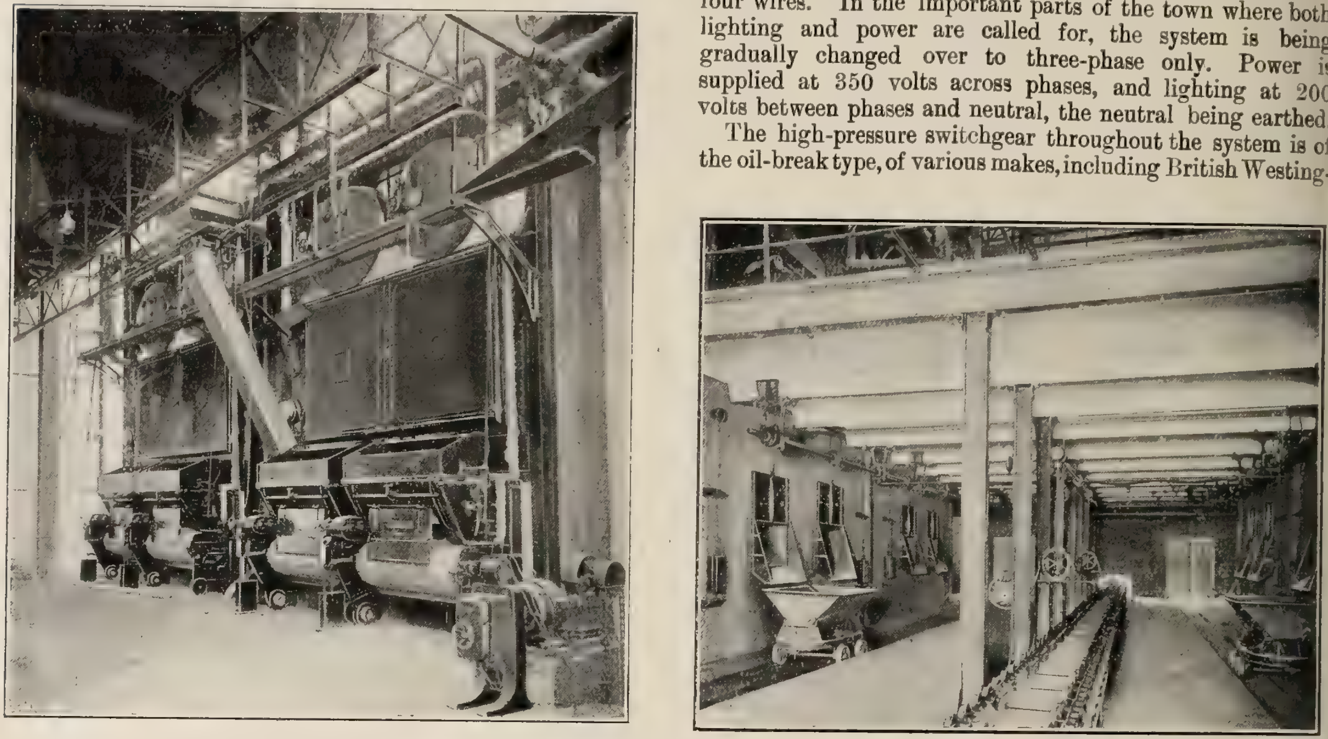
One of the most prosperous and progressive electricity supply undertakings in the Far East is that of the city of Shanghai. The municipality of this famous port is of International composition, with a predominating British element, and the business men who conduct its affairs are fully alive to the advantages of a cheap supply of electrical energy; they are also aware that the business is of a highly technical character, and therefore they wisely give a free hand to their electrical engineer, Mr. T. H. U. Aldridge, M.I.E.E., M.I.Mech.E., to carry on the undertaking on sound and progressive lines, with a keen eye to the future requirements of the district and to the never-ending improvements in generating plant. Hence it is that the works and mains have been planned and installed on the most up-to-date principles, and constant progress is being made in the direction of economy and low prices.

The "old" power station is situated in Fearon Road, but supply was commenced as far back as 1882 in a still older station. Fearon Road station was completed in 1897, but now contains nothing of the original plant therein installed. The oldest plant there was put in during 1904, and the latest sets in 1911. The boilers (page 592) are all of the B. & W. marine type, with chain-grate stokers and induced-draught fans. The reciprocating engines are of the Brush and Ferranti types, coupled to single-phase alternators, and Belliss-Peebles D.C. traction dynamos. Parsons and Willans turbines, coupled to Peebles alternators, and two Howden-Siemens mixed-pressure turbo-generators form the later additions to the generating plant, which has an aggregate capacity of 6,000 KW. (see fig. on page 593). There is also a Chloride storage battery. Motor-generators provide a link between the A.C. and D.C. systems. The "new" station, at Riverside, was completed and opened in April, 1913. It now contains generating plant of 14,000 KW. capacity, consisting of two 2,000-KW. turbo-alternators and two of 5,000 KW., the former running at 1,500 R.P.M. and the latter at 3,000. Both stations are at present used as generating stations, but eventually—in three or four years' time—the old station will be shut down, so far as generating plant is concerned, and will be converted into a distributing station fed from the new main station. With this end in view, in addition to the ordinary depreciation of 7 per cent. per annum on the generating plant, the cost of the old station is being written down by annual sums which will completely wipe out the capital in five years more. There is here a striking example of



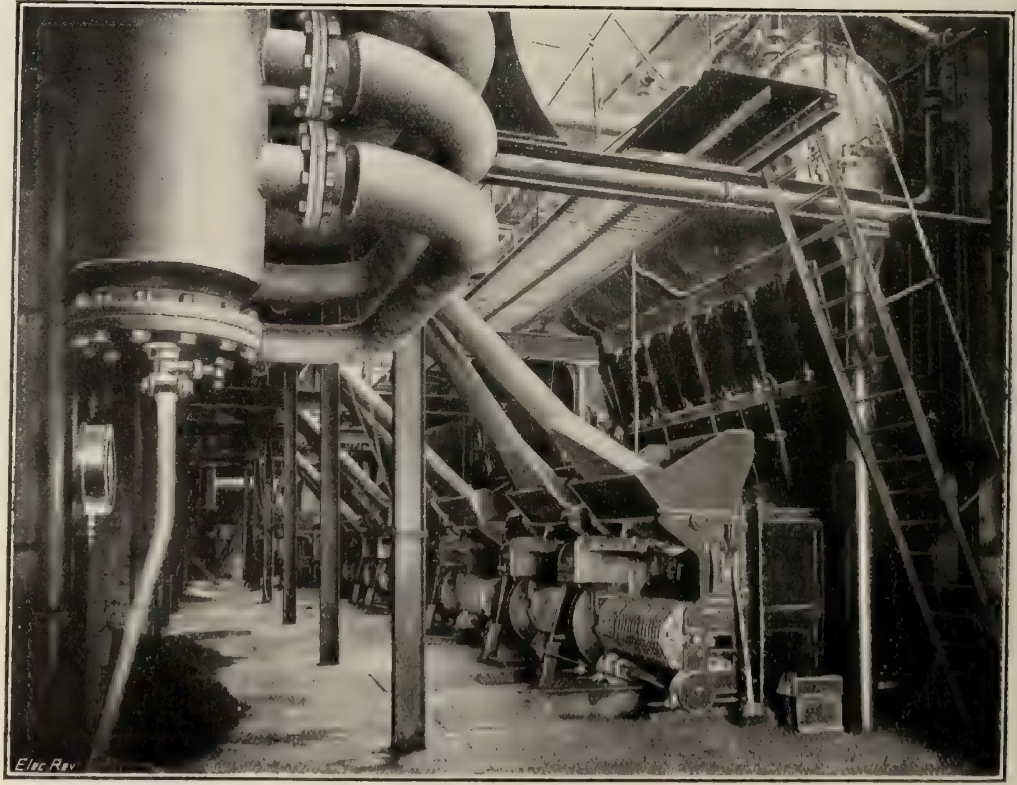
Riverside Power Station: 2,000-KW. Turbo-Alternators and Switch Galleries.

wise financial policy, which ought to receive the close attention of municipal authorities at home, though we fear that some of them are too prone to relieving the rates of to-day to give due thought to the pressing needs of the immediate future.



Riverside Power Station: B. & W. Boilers, and Coal Conveyer and Ash Chutes in Basement.

The system was originally entirely single-phase, the supply being given at 2,100 volts; the growing demand for power, however, rendered it necessary to adopt the three-phase system, and for this purpose two of the turbo-alternators were re-wound as two-phase machines, and two additional mixed-pressure turbo-generators of the two-phase type were installed at the Fearon Road station. The reason for adopting the two-phase system was that the existing switchgear could thus be utilised at a low cost. Three pairs of Scott-connected transformers were put down, converting the supply from two-phase at 2,100 volts to three-phase at 6,000 volts. The necessity for adopting the higher pressure arose from the fact that the area of supply was being considerably extended, and as the new Riverside station was to work at 6,600 volts, this arrangement enabled the authorities to commence the supply of three-phase current for power at the proper voltage two or three years before the new station was ready. It also provided a convenient interconnecting link between the two stations during the transition period. Eventually new switchgear will be installed, and the 2,100-volt service will be abolished altogether.



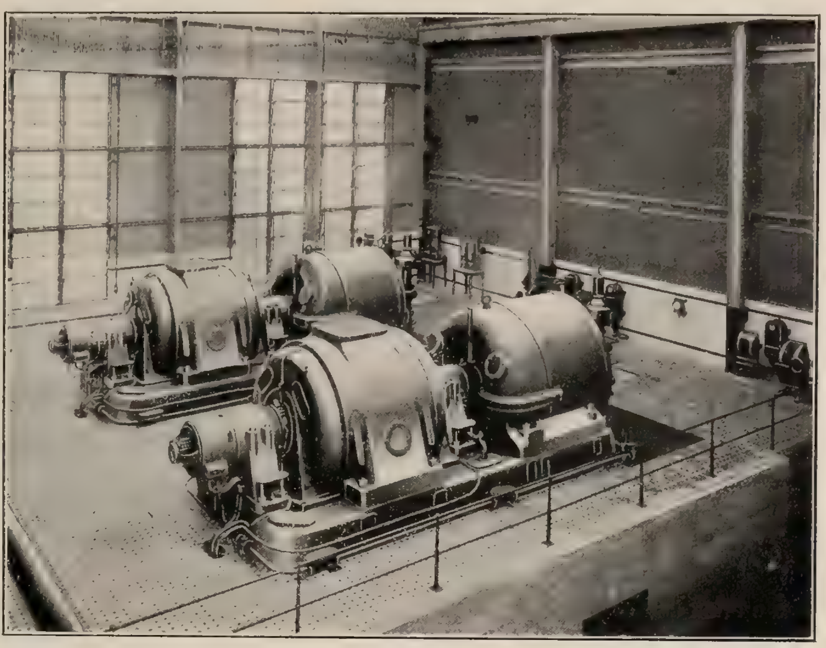
Fearon Road Station: B. & W. Marine-type Boilers.

Although a variety of reciprocating and turbine-driven plant had to be run in parallel under these conditions, no instance ever occurred of a machine falling out of step, nor was there any trouble from heavy circulating currents between the generators, the plant running remarkably well. The two-phase system of generation at the old station was adopted merely as a means to an end; no consumers were ever supplied with two-phase current, the system beyond the switchgear being either single-phase, or three-phase with four wires. In the important parts of the town where both lighting and power are called for, the system is being gradually changed over to three-phase only. Power is supplied at 350 volts across phases, and lighting at 200 volts between phases and neutral, the neutral being earthed.

The high-pressure switchgear throughout the system is of the oil-break type, of various makes, including British Westinghouse, British Thomson-Houston and Ferranti; remote control has been adopted, and some of the switchgear thus operated has been in use for ten years. Automatic circuit-breakers are used, to the total exclusion of fuses. When running, the generators are coupled directly to the bus-bars; reverse-current relays were installed, but they are apt to act at the wrong time, and are, therefore, not used.

The Chloride storage battery, of 1,000 ampere-hours capacity, is installed in connection with the traction supply, floating on the bus-bars. Direct-current overhead mains are run through the central district for operating lifts, of which there are over 100 connected with the mains, there being many high buildings. Direct current is supplied for no other purpose, except traction, all other requirements being met with alternating current.

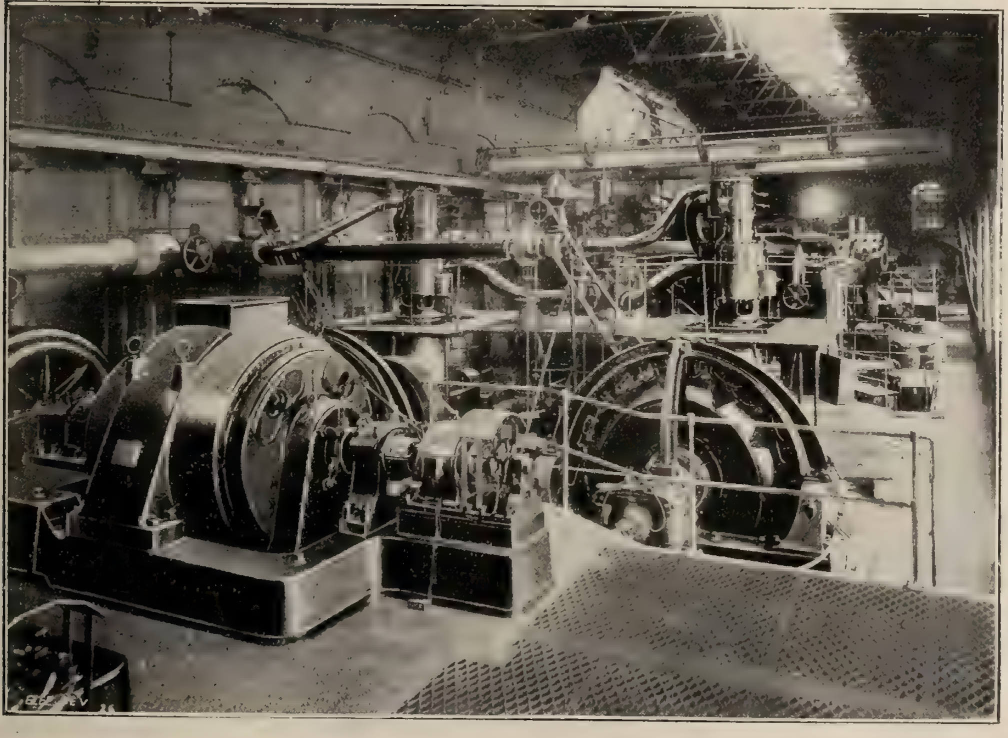
In designing the new Riverside station, no attempt has been made to create an ornamental monument to municipal trading; the building is regarded merely as a covering for the plant, and consists of a steel framework with corrugated iron roofs and side walls, the brickwork being carried up only 6 ft. above the level of the turbine floor. Here, again, we may draw the attention of municipal authorities to the dictates of common sense, as exemplified in Shanghai. The floors are of steel and reinforced concrete throughout, and the whole of the foundations were built up on a reinforced concrete raft, not more than 2 ft. deep. The raft is divided across the centre to provide against uneven settlement. The chimneys are of steel, and are provided with the Prat system of induced draught.



Turbo-Alternators in Riverside Power Station.

There are eight Babcock & Wilcox boilers, four capable of evaporating 22,000 lb. per hour, and the other four 28,000 lb. each; these are fitted with inclined chain-grate stokers, with which a low grade of fuel can be burnt. A Green economiser is provided for each pair of boilers. Feed water is dealt with by a Clarke-Chapman steam-driven reciprocating pump, and two motor-driven Rees-Roturbo pumps. The boilers are fitted with internal superheaters; the normal steam pressure is 200 lb. per sq. in., and the steam is superheated about 150° F.

Coal is stored over the boilers in bunkers capable of holding 900 tons, and provided with shoots to the stokehole. The coal is weighed with an Avery automatic weigher as it comes out of the barges on the river, a jib crane and grab being used to lift it into the hopper of the weigher; thence it passes into the filler, and is carried by conveyors into the bunkers in the usual way. An auxiliary storage bunker outside the station has a capacity of 1,000 tons. Japanese and Chinese dust coal is used—mostly the former.



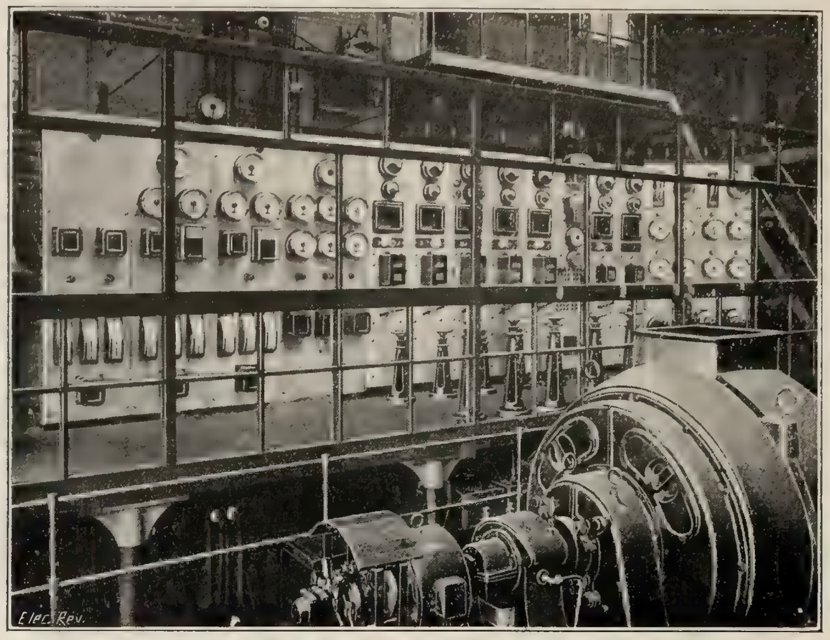
Interior of Fearon Road Station.

The hot well is fixed overhead in the boiler house, so that the pumps are always flooded; an additional storage tank is provided inside the station.

The circulating water for the condensers is taken from pumps installed in a special pump house built on the river's edge. The pump house is built entirely of reinforced concrete, the bottom of the building being at a level about 20 ft. below the basement of the turbine room. The circulating pumps, three in number, are of the vertical shaft centrifugal type, made by Messrs. W. H. Allen, Sons & Co., Ltd., of Bedford, and are below water level, so that they are always primed. Each of the pumps is driven by a vertical motor at the top of the pump house of 120 h.p., made by the Lancashire Dynamo and Motor Co., Ltd. Two smaller pumps are used to supply water to the feed-water tank and for general use in the station. The river water is pure, but very muddy, and therefore a Boby filter is provided for dealing with it before it enters the storage tank. Lea recorders are installed for measuring the water passed through each turbine, and also the combined consumption of the whole station.

The generating plant in the Riverside station at present consists of two three-phase turbo-alternators, each rated at 2,000 kw., or 2,500 k.v.a., and two 5,000-kw. or 6,250-k.v.a. sets of the same make; the steam consumption at full load is 14·9 lb. per kw.-hour for the smaller and 13 lb. for the larger machines. The air pumps are of the reciprocating type, motor-driven on the smaller sets, and of the rotary type, steam-turbine-driven, on the larger sets.

A Tirrill regulator is used to control the voltage of the whole of the generators.



Remote-control Operating Switchboard at Fearon Road Station.

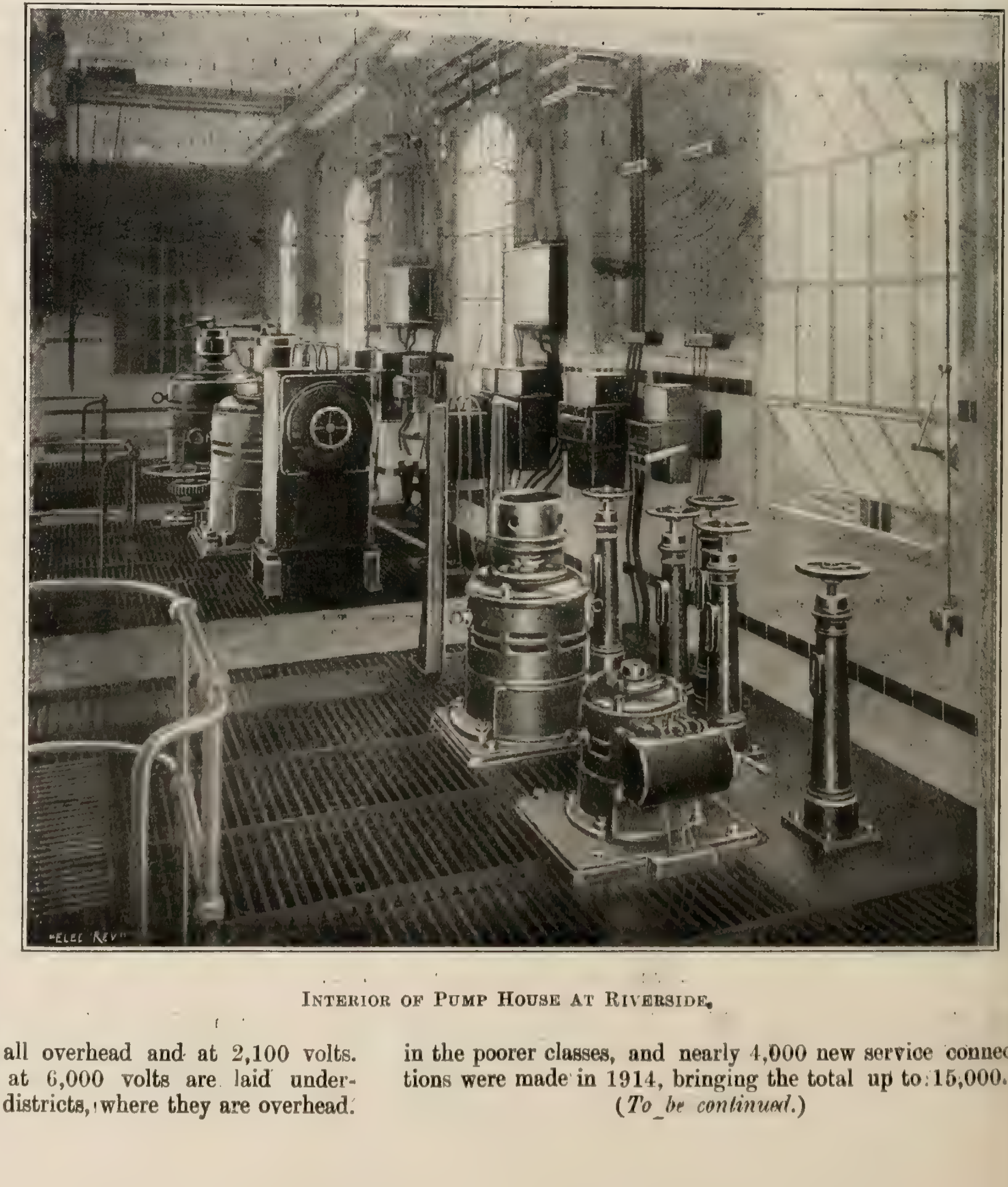
The extra-high-pressure switchgear is of the British Westinghouse Co.'s make, each switch being contained in a separate brick and concrete cubicle. Duplicate sets of busbars are provided, on either side of an alley-way about 4 ft. wide. All the switchgear is installed in a separate switch gallery on the same level as the floor of the turbine room. The two 5,000-KW. machines are controlled by electrically-operated remote-control Reyrolle ironclad switchgear. On the same floor are two 500-KW. transformers, which supply low-pressure current for use in the station. The remote-control board is mounted on the second floor of the switch gallery; from this board all the high-pressure switches are controlled, as well as the governors of the turbines. The low-pressure switches for all the station auxiliaries are also mounted on this floor; they are of the British Westinghouse Co.'s mining type, with automatic overload and no-volt releases.

The distribution districts are normally divided, connecting links being used only during repair work or when any special reason arises for interconnection. All low-pressure distribution, both single and three-phase, is on the overhead system—three-wire for the single-phase and four-wire for the three-phase. The single-phase high-tension feeders are all overhead and at 2,100 volts. The three-phase feeders at 6,000 volts are laid underground except in country districts, where they are overhead.

The first 19 miles of 6,600-volt underground cable was three-core paper-insulated and lead-covered, laid in earthenware troughing filled in solid with bitumen. These cables were laid in 1912, but since then all underground cables have been steel armoured and laid direct in the ground, with lengths of wooden planking as a guard against mechanical injury from picks, &c.

Practically all the high-pressure mains, with the exception of those noted, are underground. It is interesting to remark that Mr. Aldridge's experience during 12 years with overhead cables in Shanghai has hardly made him acquainted with a single fallen wire. Even his 6,000-volt mains are of bare copper run alongside of the highways, and no cradles or guard wires are used. Where telephone wires cross the high-pressure lines the former are provided with a continuous insulating cover, and where the feeders cross the tramways the former are similarly insulated; this is much simpler than to use guard wires, and is, moreover, considered safer. Power is supplied to the tramways, but these are under a separate management.

Incidentally we may point out that whereas the cost of house services in this country averages some £3 or £4, in Shanghai it works out at 10s. to 12s. from the overhead mains—a most important consideration in the case of small consumers, of whom there are many. Electricity is very largely used by the native Chinese, even in the poorer classes, and nearly 4,000 new service connections were made in 1914, bringing the total up to 15,000.



Interior of Pump House at Riverside.

(*To be continued.*)

TRAMWAY and RAILWAY NOTES.

(*Continued from page* 590.)

Continental. — SWITZERLAND. — THE ST. GOTHARD RAILWAY.—The principal question which was discussed at the recent meeting of the Standing Committee of the Administrative Council of the Swiss State Railways related to the estimates for construction and working in 1916. Included in the estimates was a sum of £120,000, which is projected expenditure for the introduction of electric traction on the Erstfeld-Bellinzona section. If this amount is not large in comparison with the total estimated expenditure of £1,540,000, it yet shows that the works are to be continued without interruption. The programme provides for the allocation of still larger sums for electrical construction in future years, so that the completion of the entire length is expected to be effected by 1920.

Eccles.—With the prospect of a further decrease in the staff of the tramways and the necessity for economising in the use of electrical energy, the advisability of a further reduction in the service, particularly late at night, is under consideration.

Halifax.—FEMALE LABOUR.—The Tramways Committee has been empowered to employ female labour on the tramways, to replace the 30 men who have joined the Forces, and also to assist in filling vacancies which it is expected will arise during the coming winter. Up to the present over 120 women have asked to be instructed in the duties, and from these vacancies will be filled as and when required.

Huddersfield.—HALF-YEARLY REPORT.—The Tramways Managers' Report on the working of the tramways during the past half year shows that the income amounted to £75,086 (12·8d. per car mile), as against £64,784 (11·33d. per car mile) in the corresponding period of 1914, whilst the expenditure totalled to £41,448, as against £34,371 in 1914, leaving a gross surplus of £33,638, as compared with the 1914 figure of £30,413. The net surplus was £10,428, as against £10,677 for the six months ended September 30th, 1914.

Ilford.—FEMALE LABOUR.—The Council, on the recommendation of the Tramways Committee, has decided to employ women conductors, who are to receive the same pay as men.

Japan.—The final plans for the construction of a Government railway line from Tokyo to Kobé, cutting off the haul over the Hakone Mountains by boring a tunnel through the mountains near Atomi, were adopted during 1914. It is intended to use electric power for hauling through the tunnel. The year 1914 witnessed the completion of the long-expected electric line between Yokohama and Tokyo. Unfortunately, the engineer having the work in charge decided to alter the plans submitted by the foreign experts called into consultation, hoping to effect a saving in the cost of the line. The overhead contact wire for carrying the current was, in the original plan, to have been welded to the supporting carriers. The plan adopted provided for the support of the wire by means of a hook not closed. As a result, when the line was opened, the passage of a train would elevate the wires so that they slipped off the hooks. The consequent confusion tied up the line for more than four months. The line is now (July, 1915) in operation, and is proving very successful.—*Eastern Engineering.*

Leeds.—WOMEN CONDUCTORS.—After having undergone special training, 26 women conductors began their service on the cars last week. Between 500 and 600 applications have been made by women for employment, and 75 of them are at present receiving instruction preparatory to filling the vacancies.

Stalybridge.—FEMALE LABOUR.—The Joint Board has authorised the appointment of women car conductors and women shed workers.

The Board has decided to grant all men of military age permission to enlist, on the understanding that no financial grant is made to them. Employés who were in the service of the Board prior to the war will have their places kept open.

Stoke-on-Trent. — TRAMWAY LEASE. — The Special Committee of the Council appointed to deal with the question of the suggested agreement with the Potteries Electric Traction Co., regarding a new lease by the Corporation to the company, proposed certain modifications, the most important being that the new lease should expire in 1932 instead of 1940; that a clause be inserted reserving to the Corporation the power to require the company to put into operation ½d. stages over the whole or part of the tramway system; and that if during the continuance of the agreement it became necessary to install plant for the generation of any further electrical energy for the purpose of the undertaking, the electrical energy should be taken from the Corporation upon terms to be agreed. The company state that the amendments to the agreement were so many and so serious that it was impossible to carry out the proposals for improving the system, and suggested a conference between representatives of the Corporation and company. The Council has therefore decided to defer the matter, the question of a conference being in abeyance.—*Birmingham Daily Post.*

Wharfedale.—RAILLESS TRACTION.—A further stage in the opening up of Wharfedale by railless trolley vehicles has been reached by the completion of the Guiseley and Burley-in-Wharfedale section, over which a trial run has been made. The route is now open to the public.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—A concession has been granted to Mr. C. Eldridge, representing the Federal Holding Co., of New York, for the erection near Buenos Ayres of a high-power wireless station, to communicate with a corresponding station to be erected near New York, on the Poulsen system. The work is to be completed within 21 months.

Recording Wireless Signals.—According to the *Electrical Experimenter*, of New York, the reason why the Government took possession of the German wireless station at Sayville was that a continuous record of the signals sent out from Sayville was made by Mr. C. E. Apgar, of Westfield, New Jersey, and was regularly forwarded to the Chief of the Secret Service Bureau. It is stated that Mr. Apgar had developed amplifying apparatus which enabled him to secure absolutely faithful records of the wireless signals on phonographic wax cylinders; it was found that secret messages, in code and otherwise, were sent along with regular messages which had been duly censored. Details of the method of amplification are lacking, beyond the statement that the Audion detector is used "in conjunction with the perfected Armstrong circuits."

Spain.—A telephonic network is projected for the province of Biscaya, by an arrangement between the Provincial Deputation and the State, the local municipal authorities being invited to co-operate. The Deputation is prepared to advance 250,000 pesetas towards the cost, if the installation is made with copper and iron wire. The principal station of the network is to be located at Bilbao, with sub-exchanges at Guernica, Durango, Plencia, Miravalles, &c., to serve the rural populations.

Wireless on Board Ship.—It is reported that the Standard Oil Co., of New Jersey, has placed a contract with the American Marconi Co. for the substitution of the Marconi system for the Telefunken system on 22 of its ships.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—November 25th. G N. of Scotland Railway Co. Six or twelve months' supply of telegraph material. Forms of tender from the Stores Superintendent 80 Guildford Street.

Australia. — December 7th. P.M.G.'s Department (various States). Non-encrusting zincs, carbon and manganese powder, manganese chloride, chloride of ammonia porous pots (2 in.), outer jars for cells, carbon blocks, resistance boxes of 5,000 ohms, &c. See "Official Notices" October 15th.

December 20th. P.M.G.'s Department, N.S.W. 4,250 telephones (Schedule 454).

January 5th, 1916. P.M.G.'s Department, Queensland. Copper wire and accessories (Schedule 356). January 26th.—Telephone instruments (Schedule 344).

January 19th, 1916. P.M.G.'s Department, S. Australia. One common multiple switchboard, Telephone Exchange, Adelaide (Schedule 405).

GOULBURN. — December 15th. Council. One 200-KW. direct-coupled generating set, gas or steam driven. Specification, 10s., from the Local Government Association, 103-4 Queen Victoria Markets, Sydney, or the Town Clerk.

SYDNEY.—December 6th. Municipal Council. 33,000-volt outdoor transformers and switchgear. Specifications (10s. 6d.) from Electric Light Department, Town Hall.

November 22nd. City Council. Cable-testing outfit. Electric Lighting Department, Town Hall (10s. 6d.).

December 20th. Metropolitan Board of Water Supply and Sewerage. Three centrifugal pumps and electric motors, each to pump 6,300 gallons per minute, and one to pump 15,100 gallons per minute, together with switchboards, starters, &c., for the pumping station at Marrickville, N.S.W. Deposit £10. Tenders to the Board, at 341 Pitt Street, Sydney, N.S.W.*

January 12th, 1916. N.S.W. Railway and Tramway Department. Two water-tube boilers &c., for the Zara Street power house, Newcastle. See issue of October 8th for further particulars.

January 31st, 1916. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

MELBOURNE.—December 14th. Deputy P.M.G. Eleven sections of a lamp-signalling trunk-line switchboard, and other material necessary for increasing the equipment of Melbourne trunk exchange from 108 to 240 lines. Schedule 1,207.*

December 14th. P.M.G. For delivery in all States, 18,670 common-battery wall pattern telephones, manufactured in Australia. Sched. No. 1 264. Tenders will also be considered for instruments manufactured in countries other than Australia.

January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

PERTH.—December 8th. 294 accumulators, and power board complete, for P.M.G.'s Dept. See "Official Notices" October 8th.

Barrow-in-Furness. — November 8th. Corporation. Installation of electric light at the Victoria Schools, Oxford Street. Specifications from the Borough Electrical Engineer.

Bradford.—November 13th. Corporation. Twelve months' supply of lamp fittings, insulating material and tramway stores for the Tramways Committee. Specifications from the Tramway Offices, 7, Hall Ings.

Chatham.—November 24th. T.C. Twelve months' supply of incandescent electric lamps. Specifications from the Borough Surveyor's office, Town Hall.

Dublin.—November 15th. Twelve months' supply of stores for Dublin United Tramways Co. See "Official Notices" October 29th.

Enniskillen.—December 1st. Sligo, Leitrim and Northern Counties Railway Co. Twelve months' supply of telegraph materials. Forms of tender from Mr. J. Duff, Secretary's office.

London.—November 8th. H.M. Commissioners of Works. Cord-grip electric lampholders. Controller of Supplies, 18, Queen Anne's Gate, S.W.

Manchester.—November 16th. Tramways Committee. (*a*) steel girder tramway rails; (*b*) permanent way special track work; (*c*) permanent-way points, tongues and crossings. Specifications, &c. (one guinea each, returnable), from Mr. J. M. McElroy, General Manager.

New Zealand.—Napier.—November 9th. Borough Council. Two gas engines, two D.C. electric generators, two switchboard panels, cables, spares, and other apparatus. Deposit £100; local representation.*

Spain.—November 15th. The municipal authorities of Casinos (Province of Valencia) are inviting tenders for the concession for the electric lighting of the town during a period of four and a half years.

St. Helens.—November 17th. Erection of engine house and other works at Cropper's Hill power station. Particulars from Mr. E. M. Hollingsworth, Borough Electrical Engineer (£1 1s. returnable).

Warrington.—November 16th. Supply of E.H.T. cable, for the Tramways Committee. See "Official Notices" to-day.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The following contracts have been accepted:

Commonwealth Department of Defence.

Electric lift, Catherine Hayes Hospital, Randwick, £880.—Standard Waygood Hercules, Ltd.

Commonwealth Department of the Navy.

15-ton cantilever electric crane, for Commonwealth Dockyard, Cockatoo Island, £4,381.—Fyvie & Stewart, Ltd.

Victorian Railways Department.

Electric lighting material for the Jolimont car-repair shop, two-pole ironclad switches, 30 amperes, £2 3s. 6d. each; ditto, 15 amperes, £2 1s. 3d. each; ditto, 50 amperes, £2 10s. 4d. each; three-pole ditto, 20 amperes, £3 3s. 6d. each; pull-in boxes, £2 17s. each.—Warburton, Franki, Ltd.

Prahran (Vic.) Council.

Carbon lamps, 6⅝d. each; metallic filament ditto, 1s. 2½d. and 1s 6d. each.—Edison & Swan United Electric Light Co., Ltd. —*Tenders.*

Hampshire.—The following is a list of the tenders received for the electrical installation required at the Park Prewett Asylum, near Basingstoke, to be executed under the direction of Messrs. G. T. Hine & Pegg, of Westminster, architects for the Hampshire Joint Asylums Visiting Committee:—

R. Alger & Sons, Newport, Mon.	£22,855
Rashleigh Phipps & Co., London	22,398
H. J. Galliers, Brighton	22,012
C. Cooper & Co., London	21,287
Nuneaton Electrical Contracting Co., Ltd., Nuneaton	21,093
Strode & Co., London	20,496
Crompton & Co., Ltd. London	20,422
Toy & Winslow, London	19,934
Foote & Milne, Ltd., London	19,065
Mann, Egerton & Co., Ltd., London	18,860
Rawlings Bros., London	18,[illegible]51
W. J. Furse & Co., Ltd.. Nottingham	18,419
Tyler & Freeman, London	18,253
Edmundson's Electricity Corporation, Ltd., London	17,660
J. Davis & Co., Ltd., Southampton	17,568
W. Coates & Sons, Belfast	17,446
Hancock & Rixon, London	17,124
Cox-Walkers, Ltd., Darlington	16 461
H. J. Cash & Co., Ltd., London	16,116
National Electric Construction Co., Ltd., London	15,835
Hill, Upton & Co., Oxford (accepted)	15,489

Wimbledon.—The Electricity Committee of the B.C. reported that the contractors for the supply of coal to the electricity works had been in communication with the various colliery companies respecting an adjustment of the prices in accordance with the Price of Coal (Limitation) Act, 1915, and have received the following replies:—

"Nailston Colliery Co. are unable to make any reduction, as their present contract prices conform with the Act."

"S. Leicester Co. are prepared to remit a sum of 5d. per ton on the present contract price at the pit."

"Kingsbury Colliery are prepared to reduce the contract price of their coal by 4d. per ton on the nutty slack, and 1s. per ton on the small nuts."

"Ibstock Colliery, Ltd., are prepared to reduce the price of their coals by 1s. 10½d. per ton."

FORTHCOMING EVENTS.

University College, London.—Friday, November 5th. At 5 p.m. Second Lecture on "Electric Heating and Electric Furnaces," by Prof. J. A. Fleming, F.R.S.

Salford Technical and Engineering Association.—Saturday, November 6th. At 6.30 p.m. At Royal Technical Institute, Peel Park. Members' Short Papers.

Institution of Electrical Engineers (Scottish Local Section).—Tuesday, November 9th. At 207, Bath Street, Glasgow. Chairman's Inaugural Address.

(Yorkshire Local Section).—Wednesday, November 10th. At 7p.m. At Hotel Metropole, Leeds. Chairman's Address and Smoking Concert.

Greenock Electrical Society.—Friday, November 12th. At 7.45 p.m. At Temperance Institute, 19, West Stewart Street. Paper on "Kinematograph and Kinemacolor," by Mr. P. C. Kerr.

Manchester Association of Engineers.—Saturday, November 13th. At Grand Hotel, Aytoun Street. Paper on "Science and Practice in Engineering," by Mr. C. E. Stromeyer.

NOTES.

Excess Profits Tax.—The following question and reply which appear in the Parliamentary Proceedings of the 28th ult. are of special interest to all electrical supply companies:—

Question put to the Chancellor of the Exchequer by Mr. Grant:—"If commercial companies, which exist under statutory limitations in regard to tenure or statutory charges and prices, will be permitted, under the Finance Bill, to submit their cases to the Commissioners for consideration in regard to excess profits?"

Answer:—"In the case of statutory companies, any question of the adequacy of the 6 per cent. rate of return, in view of statutory limitations as to period or conditions of tenure, would be matters for consideration of the Board of Referees under Clause 38."

We understand that the Chancellor of the Exchequer recently received a deputation representing an important and influential group of London and provincial electric supply undertakings on this question.

Engineering Labour Disputes.—The *Evening Standard* states that an important agreement for the purpose of avoiding disputes has been entered into between the Engineering Employers' National Federation and the National Amalgamated Union of Labour. Its provisions are:—

> When a question arises, an endeavour shall be made by the management and the workmen directly concerned to settle the same where the question has arisen. Failing settlement, deputations of workmen shall be received by the employers without unreasonable delay for the mutual discussion of any question in the settlement of which both parties are directly concerned. In the event of no settlement either party may bring the question before a local conference to be held between the local association and the local representatives of the Society.
>
> Local conferences shall be held within seven working days from the receipt of the application by the secretary of the local association or the local representative of the Society. Failing settlement at a local conference of any question brought before it either party can refer the matter to a central conference (to be held on the second Friday of each month) which, if thought desirable, may make a joint recommendation to the constituent bodies.

The agreement adds that until the above procedure has been carried through there shall be no stoppage of work either of a partial or a general character.

The War and British Industry.—With reference to our leading article to-day, we read in the *Times* of yesterday that the Parliamentary Committees of the Allies will meet in conference in Paris in January to consider important trade questions that will call for common action at the end of the war. The British Committee on Wednesday appointed a sub-committee to make the necessary arrangements on this side.

A Girl Electrician.—The *Edinburgh Evening Dispatch* records an instance of a girl, 20 years old, who is doing the work of an electrician. She is Miss May Traill, the daughter of Mr. W. A. Traill, an engineer who was the constructor of the Giant's Causeway and Portrush Electric Tramway, which was opened in 1883. Miss Traill, who studied horticulture at Studley College, Warwickshire, exhibited her gift for mechanics while still a student, and was made chauffeur of the College motor-lorry. When this was purchased by the Government, she drove it from Studley to London, a distance of over 100 miles. Subsequently she was placed on the staff of the College in charge of the electric light and power installation. This consists of a 50 H.P. gas engine and suction-gas plant driving two dynamos, with a set of accumulators, for the electric lighting, and power for running the dairy and laundry plants and the electric incubators for hatching chickens by electricity. She has the assistance of a young lady pupil and two boys, and has set free a man who is now engaged in making torpedoes.

Royal Assent.—The Royal Assent was last week given to the following Acts:—

Post Office and Telegraph Act, 1915.
L.C.C. (General Powers) Act, 1915.
L.C.C. (Tramways and Improvements) Act, 1915.

Accidents.—The *Times* states that through an electric cable fusing early on Sunday morning at the Grove Road Military Hospital, Richmond, one nurse received burns, and another was incapitated by shock.

Chas. Stevens, an employé of the Galway Electric Light Co., was severely burned while working on an electric main on October 26th.

Fatalities.—At Neath, on Thursday last week, an inquest was held touching the death of an Italian named Matteo Simeone, who was killed at the restaurant of Mr. Ullo, in Windsor Road, Neath, two evenings before. In the saloon of the restaurant a metal bar charged with electricity runs round the counter, and a person standing on a metal footplate set in the floor and touching the bar completes the circuit and receives an electric shock. The arrangement is regarded as a means of producing mirth at the expense of the uninitiated. Simeone had switched on the current from the main supply with the object of playing a practical joke upon a customer, but the latter received warning, and the joke miscarried. A few moments later Simeone himself caught hold of the bar, and in raising himself to the counter stepped on to the footplate. He was at once seen to swoon, and before medical aid could be summoned he died from heart failure. It was stated in evidence that Simeone had been rejected by the Italian Army authorities because of a weak heart. John Ullo, another assistant at the restaurant, said that when the deceased received the shock, he exclaimed, "John, turn the electric off." Nicholas Ullo, the proprietor of the establishment, said he had the brass rail connected to the electric wires 18 months ago in order to keep the boys away. Six months ago the plate was put in the floor. He himself knew nothing about electricity. Mr. J. Wesley, electrical engineer, of Skewen, stated that one of his men laid on the supply of electricity without his knowledge. He had made a test, and found 30 volts between the rail and the foot-plate. This was the maximum obtainable at the spot, although the voltage in the mains was 200. The Coroner characterised the device as a stupid one. The Jury returned a verdict of death from an electric shock, which accelerated the heart disease from which deceased suffered, and added a rider that the Neath Corporation be asked to do away with any similar contrivance which may be found existing in the town.

ISLINGTON.—An adjourned inquest was held on October 28th into the cause of death of Edgar M. Jackson, aged 36 years, an arc lamp trimmer, who was killed on October 21st. Deceased had been employed by the Islington Borough Council since May, and on the evening of October 21st he climbed to the top of a lamp standard by means of portable brackets. He was seen to fall, striking his head with great force. Life was found to be extinct. As a result of a post-mortem examination, Dr. Spilsbury, pathologist of St. Mary's Hospital, reported various injuries to the brain, the spine, &c., and he found blisters on both hands, which, he thought, were caused by an electric shock immediately before death. Evidence was given at length by Mr. A. McAllister, a member of the electricity department staff. Mr. Albert Gay, Borough Electrical Engineer, said that after hearing the evidence he thought that it was possible for the deceased to have received an electric shock. If he had had rubber gloves he would not have received it. He had never heard of a trimmer climbing the columns whilst the switch was on for the purpose of tapping the glass globe to make the carbons fall into position. It would be a dangerous thing to do. A juror said he knew it was done, for he had done it himself. A police-constable said that he found a pair of rubber gloves amongst deceased's effects. A verdict of "Accidental death owing to having received an electric shock" was returned.

A verdict of death from heart failure following heart disease was returned by a Belfast coroner's jury in the case of Robert John Lockie, aged 38, who had been employed as an electrician in the Corporation gasworks. Deceased was apparently in his usual health up to a moment before he expired, while at duty at the works.

Rifle Club Friendly.—A friendly match between teams representing the British Electric Transformer Co. and the Ediswan Rifle Club, took place on the range of the former club at their works at Hayes, Middlesex, last Saturday afternoon. The conditions were:—Two sighters and 10 shots on five bull targets, eight in each team and six to count. The result was a win for the British Electric Transformer Co. by 554 to 541 points, the teams averaging 92·3 and 90·2 respectively. On the winning side the highest scores were Harvey 99 and Whish (captain) 95, while for the losers Golding and Winterflood each scored 94. The visitors were entertained to tea, and Mr. J. Cooper for the visitors proposed a hearty vote of thanks to the hosts for their hospitality, to which Mr. Whish, captain of the B.E.T. Co.'s team, responded.

Municipal "Hustle" at Sheffield.—It is, of course, well known that the Sheffield manufacturers have rendered enormous services to the country during the emergencies of the past year, and that in so doing, they have called in the help of the Corporation electric supply department to a very large extent, necessitating quite unlooked-for extensions by the latter. At the present time big electricity extensions are in hand and the civic authorities, we are glad to note, have agreed on a course of action, of which even the American hustler may well be envious.

The urgency with which things are being accomplished, may be gathered from the fact that at a recent Electricity Committee meeting, Mr. Fedden, the general manager, obtained "absolution" for placing on his own responsibility orders to the extent of £120,000; apparently his action was at once approved by the Emergency Committee of three members, who had not had time to meet to discuss the subject. The chairman reported that he had authorised Mr. Fedden to accept a further £3 000 tender, and that a motor lorry had been purchased "at the price now mentioned" By now it is probable that a further £6,000 tender for coal-handling plant at Neepsend will have been accepted. We congratulate the City Council on a discrimination—rare in municipal management—of "things that matter."

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—*Company Orders.*—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week commencing November 8th, 1915:—

Drills, 6.15 to 7.15; 7.15 to 8.15 p.m.

Saturday, November 6th, 1915.—Company Parade, 2.30 p.m.
Monday, November 8th.—Section 1, Technical; Section 3, Squad or Working Party.
Tuesday, November 9th.—Section 2, Technical; Section 4, Shooting Working Party.
Thursday, November 11th.—Section 3, Technical; Section 1, Shooting Working Party.
Friday, November 12th.—Section 4, Technical; Section 2, Squad or Working Party.

Sections for Technical Drill will fall in at the Headquarters of London Electrical Engineers (T.F.), at 46, Regency Street, S.W.

Sections for Squad, Signalling, Shooting and Working Parties will fall in at the new Headquarters, Chester House, Eccleston Place, S.W.

Volunteers for trench work on Sunday, November 7th, are requested to give early notice to their Section Commanders. It is hoped that, as far as possible, the men who attended on the 31st ult. will attend again on the 7th inst.

E. G. FLEMING,
Company Commander and Acting Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, November 4th, 1915:—

Week-end Parades.—Saturday.—The Battalion will parade at Baker Street Station at 2.15 p.m., for Battalion Manœuvres, and will proceed by train as follows:—

North London Platoon, Blackheath Platoon, and No. 8 Platoon, "B" Company, under command of Mr. Marples, to Hendon, where they will detrain.

The remainder of the Battalion, under command of Mr. King, to Wembley Park.

Instructions will be issued to Officers concerned.

Sunday.—The Battalion will parade at Liverpool Street Station (Low Level entrance, G.E.R.) at 8.55 a.m., and proceed by train for Entrenching duties, returning at 4.59 p.m.

This order is subject to permission being granted for the Battalion to return by the 4.59 train.

Musketry.—Saturday next, the 6th inst. There will be shooting at both Acton and Bisley Ranges, as usual. Members proceeding to Acton must parade there at 2 p.m. punctually. Those shooting at Bisley must report themselves to Sergeant Cotter, at the barrier of No. 9 Platform, Waterloo Station, at 12.45 p.m.

Tuesday, November 9th. Shooting at Acton, as usual, at 2 p.m.

There will be no shooting at Bisley on Sunday next, the 7th inst.

A. G. JOINER, *Major and Adjutant*, O.B.C.

Institution and Lecture Notes.—The Institution of Electrical Engineers.—Since the publication of our forecast of meeting arrangements in our issue of October 15th, it has been found necessary to make several alterations in the programme, which, for London, now stands as follows:—

November 18th.—Charles P. Sparks (President). Inaugural Address. (The premiums awarded for papers read or published during the past Session will be presented at this meeting.)
November 25th.—Prof. A. B. Field. "Some Difficulties of Design of High-Speed Generators."
December 16th.—J. R. Beard. "The Design of High-Pressure Distribution Systems."
January 13th, 1916.—Prof. Miles-Walker. "The Predetermination of the Performance of Dynamo-Electric Machinery."
January 20th.—N. W. Storer. "The Possibilities in the Design of Continuous Current Traction Motors."

MANCHESTER LOCAL SECTION.—Mr. B. Welbourn will deliver his inaugural address at the opening meeting of the Section on Tuesday, November 16th, at 7.30 p.m. The following other arrangements are announced for the first half of the Session:—

November 30th.—Prof. A. B. Field on "Some Difficulties of Design of High-Speed Generators."
December 14th.—Mr. J. R. Beard on "The Design of High-Pressure Distribution Systems."
January 11th, 1916.—Prof. Miles-Walker on "The Predetermination of the Performance of Dynamo-Electric Machinery."
January 25th.—"Printing Telegraphs."

Other meetings will follow on February 8th and 22nd and March 8th and 21st. The Engineers' Club is electing members of the I.E.E. to be temporary members of the Club for the five meetings already arranged.

DUBLIN LOCAL SECTION.—On account of the war it has been decided to suspend the meetings of this Section for the present.

Royal Institution.—The Ninetieth Illustrated Christmas Course of Afternoon Juvenile Lectures will be delivered this year by Prof. H. H. Turner, D.Sc., D.C.L., F.R.S., his title being "Wireless Messages from the Stars." The subjects are as follows:—"How the Messages are Carried," Tuesday, December 28th; "How the Messages are Received," Thursday, December 30th; First Message: "We are very far away," Saturday, January 1st; Second Message: "Some of us are Giants and some are Dwarfs," Tuesday, January 4th; Third Message: "But we all behave much as you do," Thursday, January 6th; Fourth Message: "And in fact we are your Blood Relations," Saturday, January 8th.

University College, London.—In his first lecture on "Electric Heating and Electric Furnaces" last week, Prof. Fleming dealt with general considerations regarding the laws of heat and the measurement of temperature, accompanying his remarks with a series of interesting experimental demonstrations. The effectiveness of the method of obtaining the equivalent of a real "black body" by using an aperture in the wall of a hollow vessel was well illustrated with the aid of boxes coloured red, blue and yellow internally, all of which, when viewed through a hole in the lid, looked exactly alike and exceedingly black. The fact that for accurate thermometry under workshop conditions electrical methods were indispensable was clearly shown.

Appointments Vacant.—Station fitter (45s.-50s.), lineman jointer (40s.-50s.), wireman (40s.-50s.), fitter drivers (37s.-43s.), engine drivers (30s.-37s.), switchboard attendants (28s.-40s.), lineman or wireman's mate (25s.-30s.), for Military Camps, Southern Command; switchboard attendant (35s.), for Stockport Electricity Department; clerk, male or female (£70), for Barnes U.D.C. Electricity Department. Particulars are given in our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. Herbert Miller has secured appointment to the position of manager of the electricity works of the Holmfirth District Council. There were 65 applicants.

Mr. Boydell Shallis, who was an assistant engineer at the municipal electricity works at Canterbury, has been granted a commission in the Royal Engineers (Inland Water Transport Section).

Corporal Reginald Edwards, who was until enlistment, in September, 1914, on the staff of the Bristol Corporation electricity works, has received a commission in the Royal Engineers as second-lieutenant. He has been at the front in France for eight months.

Tramway Officials.—Mr. H. J. Smith, who has been resident engineer for the Worcester Electric Traction Co., Ltd., for the last twelve years, has been appointed manager of the Tynemouth and District Electric Traction Co., Ltd.

General.—Mr. Thos. Pratt, head of the firm of Christopher Pratt & Sons, Ltd., electrical contractors, of Bradford and Ilkley, president of the West Yorkshire Federated Chambers of Trade, has four sons with the Forces and two in the O.T.C.

The *London Gazette* of October 27th contained the following:—"Company Quartermaster Sergeant George Harbord Gyton to the 3/1st London Divisional Signal Company, R.E. (T.), as second-lieutenant." Mr. Gyton was the winner of the Christmas morning swimming race in the Serpentine in 1912 and carried off the Peter Pan Cup. He is also an inventor of counterweights for electric light pendants, particulars of which have appeared in our pages.

Mr. W. Trevor Roper, who has been appointed a lieutenant in the A.S.C., is an electrical engineer, and manager of Messrs. Veritys, Ltd., Dublin.

Second-Lieutenant R. B. Dunlop, 70th Field Company, R.E., who has been wounded in action on the western front, prior to the war held a position in the firm of Messrs. Siemens, at Glasgow.

Mr. D. W. McGuffie (now on active service), who had charge of the marine side of the business of Messrs. Stevenson and McGuffie, of Glasgow, has resigned his position as a partner in the firm. Mr. H. A. McGuffie and partners will carry on the business as consulting, mechanical, and electrical engineers under the same firm name.

Roll of Honour.—Lieutenant (temporary Captain) Henry Alexander Hammich, of Stretford, formerly employed at the British Westinghouse Works, Trafford Park, has been awarded the Military Cross for conspicuous gallantry at Helles, Gallipoli Peninsula.

Private Albert Jewsbury, 1/5th Duke of Wellington's Regiment, of Ravensthorpe, where he was with the Yorkshire Electric Power Co., Ltd., as an electric cable jointer, has been killed in action in France, having been shot in the forehead.

Gunner Walter Hudson, who was on the staff of the Keswick Electricity Co. prior to enlistment, has been wounded in action in France.

Gunner Archibald Wm. Homewood, of the Royal Horse Artillery, who has fallen in action in France, was prior to the war engaged at the Charlton works of Messrs. Siemens.

Private Harry Seed, of the 8th Battalion King's Own Scottish Borderers, who was engaged in electrical work at Stockton Heath, near Warrington, prior to the war, has been killed in action in France. He enlisted in September, 1914, and went to the front last June.

Private Geo. Sibley, who was on the electricity works staff of the Barking U.D.C., has been killed in action in France.

Private Percy Bird, of the 4th South Staffs. Regiment, attached to the 2nd Battalion, who was on the staff of the Walsall Corporation electricity works, is reported to have been killed in action.

Private G. W. R. Peek, 6th Battalion Duke of Cornwall's Light Infantry, who was wounded in France on October 9th, in the attack near Hulluch, and died of wounds in hospital on October 12th, was motor inspector in the mains department of the County of London Electric Supply Co., Ltd. Corporal Sydney D. Wood, Machine Gun Section, "B" Company, Norfolk Regiment, who was killed in action on October 9th in the attack near La Bassee, was in the service of the County of London Co.'s mains department. Private E. Gordon Morley, Queen's Westminsters, who was killed in action on October 12th, was also in the service of the County of London Co.'s mains department.

Obituary.—The death occurred on October 23rd of Mr. Geo. Patton, who had for many years been in business as an electrical engineer at Bath Lane, Newcastle-on-Tyne. He was 80 years of age. He had been assisted in the business for a long time by his son, Mr. Arthur Patton.

Mr. W. A. Luntley.—On Wednesday last week an inquiry was held at Wolverhampton respecting the death of Mr. William Aubrey Luntley (42), manager of the Corporation tramways. The deceased was a private in the Wolverhampton Volunteer Training Corps, and in March last he was out scouting with the corps at Perton when he slipped in a ditch, and in falling came in contact with his bayonet and was severely bruised. As a result abscesses formed, which necessitated several operations. The jury returned a verdict of "Accidental death." The funeral took place on the following day. A service, attended by the Mayor and many members of the Corporation and officials, was held at St. George's Church prior to the interment.

M. Eugene Ducretet.—The death is announced, in *La Lumière Electrique*, of M. Eugène Ducretet at the age of 71 years. As long ago as 1864 he founded the firm of instrument makers which bears his name, and which has always been in the first rank; he was one of the early workers with X-rays, a pioneer in wireless telegraphy, and a maker of loud-speaking telephones.

Sir A. W. Rucker.—We regret to record that Sir Arthur William Rucker, F.R.S., Principal of the University of London from 1901 until 1908, died at Newbury, Berks, on November 1st, at the age of 68 years. In the mathematical and physical sciences Sir Arthur was for many years pre-eminent, both as a scientific worker and as a professor. One of his greatest undertakings was his magnetic survey of the British Isles, which was spread over more than fourteen years. He was made an F.R.S. in 1889, and later was one of the secretaries of the Royal Society for five years. He received the Society's medal in 1891. He was president of the British Association in 1901, and was for seven years treasurer of that Association; he was also for two years president of the Physical Society. He was appointed Professor of Mathematics and Physics in the Yorkshire College, Leeds, in 1874, and in 1886 became Professor of Physics at the Royal College of Science, South Kensington. The honour of knighthood was conferred upon him in 1902.

NEW COMPANIES REGISTERED.

United Tube Corporation, Ltd. (141,902).—Registered October 18th, by G. H. Barber & Sons, 13, St. Swithin's Lane, E.C. Capital, £150,000 in £100 shares. Objects: To carry on the business of manufacturers of and dealers in munitions of war, and solid-drawn, lap-welded and other tubes of all kinds, wire drawers, iron and steel converters, ironmasters, founders, smelters, engineers, metallurgists, galvanisers, aluminium coaters, japanners, annealers, enamellers, stampers, tool makers, brassfounders, electrical and water supply engineers, etc. The Board of Trade authorises the acquisition by this company of a part of the undertaking of the British Mannesmann Tube Co., Ltd., the books and documents of which are liable to inspection under Section 2 of the Trading with the Enemy Act, 1914. The signatories (with one share each) are: J. R. Wright, Hindrefoilan, Sketty, Glam., steel manufacturer; J. C. Davies, The Mount, Gowerton, steel manufacturer; G. Hethey, 19, Chartfield Avenue, Putney, S.W., tube manufacturer; H. W. Dunn, 46, Queen Victoria Street, E.C., chartered accountant. Private company. The first directors (to number not less than three or more than eight) are Col. J. R. Wright, S. Baldwin, M.P., J. C. Davies, G. Hethey, H. W. Dunn, and A. Hethey. Qualification, £1,000. Remuneration, £200 each per annum (chairman £400).

Anglo-American Metals Syndicate, Ltd. (141,904).—This company was registered on October 19th, with a capital of £3,000 in £1 shares (2,750 "A" and 250 "B"), to carry on the business of metal merchants, steam and other engine manufacturers, brass, gunmetal, and iron founders and finishers, galvanisers, annealers, electroplaters, cable makers, electrical engineers, etc., and to adopt an agreement with S. A. Yorks and J. O. Lawson-Johnston. The subscribers (with one share each) are: J. O. Lawson-Johnston, Trafalgar House, Waterloo Place, S.W., stockbroker; S. A. Yorks, Trafalgar House, Waterloo Place, S.W., electrical engineer. Private company. The number of directors is not to be less than two or more than three; the first are J. O. Lawson-Johnston and S. A. Yorks (both permanent). Qualification, 500 shares. No remuneration until dividends amounting to 100 per cent. have been paid on "B" shares; thereafter as fixed by the company. Secretary: J. O. Lawson-Johnston. Registered office: Trafalgar House, Waterloo Place, S.W.

W. J. Addison, Ltd. (141,989).—This company was registered on October 29th, with a capital of £1,000 in £1 shares, to carry on the business of ironfounders, electrical and mechanical engineers, manufacturers of agricultural and other machinery and motors, tool makers, ironmasters, metal workers, etc. The subscribers (with one share each) are: W. J. Addison, 9, Broadway, Streatham, S.W., electrical engineer; H. G. Stimson, Salisbury House, London Wall, E.C., solicitor. Private company. Table "A" mainly applies. Registered office: 9, Broadway, Streatham, S.W.

Motor Engineering Co. (Nottingham), Ltd. (141,963).—This company was registered on October 26th, with a capital of £200 in £1 shares, to take over the business of a motor engineer and munition maker carried on by E. Burton, at Mayfield Grove, Nottingham, as Welton & Co. and the Electric Power Co. The subscribers (with 50 shares each) are: E. Burton, Maitland Road, Woodthorpe Drive, Sherwood, Notts., colliery agent; W. C. Hoffman, 2, Epperstone Road, West Bridgford, lace merchant; R. W. Ashley, 34, Wilford Road, Nottingham, engineer; A. A. Welton, 44, Turney Street, Nottingham, lace buyer. Private company. E. Burton is sole permanent director. Qualification, one share. Secretary: H. Harris. Registered Office: 2, King Street, Nottingham.

CITY NOTES.

Western Telegraph Co., Ltd.

The revenue for the year ended June 30th, 1915, amounted to £983,263, and the working expenses to £338,893. After providing £32,747 for debenture stock interest, and £33,349 for income-tax, there remains a balance of £578,273, plus £33,157 brought forward, making £611,431. Three interim dividends, amounting to £93,568 have been paid, £150,000 has been applied towards the reduction of the amount of capital expenditure in excess of the share capital and debenture stock issued, £150,000 transferred to the general reserve fund, £30,000 to the land and buildings depreciation fund, and £50,000 to the provision on account of investment fluctuations. The directors now recommend a final dividend of 3s. per share, making, with the interim dividends, a total dividend of 6 per cent. for the year, also a bonus of 2s. per share, both free of income-tax, which together will amount to £51,982, leaving £85,880 to be carried forward.

Holophane, Ltd., and Reduced.

The petition of Holophane, Ltd., of Westminster, to confirm a reduction of capital came before Mr. Justice Astbury, in the Chancery Division, on Tuesday. Mr. Hall, for the company, said it was formed for the purpose of manufacturing and selling electric globes and various kinds of lighting apparatus. The original capital was £200,000 in 100,000 £1 ordinary and 100,000 £1 preference shares. It was proposed to reduce the capital to £105,000 in 100,000 preference shares of £1 and 100,000 ordinary of 1s., the reduction to be effected by cancelling capital lost or unrepresented by available assets to the extent of £95,000, and reducing the ordinary shares from £1 to 1s., the ordinary shares in future to be 1s. per share.

His lordship confirmed the reduction, and directed the company to use the words "and reduced" in the name for another month.

National Telewriter Co., Ltd.

The report for the year ended June 30th, 1915, states that, notwithstanding loss of business in consequence of the war, after writing off the whole of the discount on the debentures issued, the costs thereof, and debenture interest, there remains a net profit of £757, as compared with a deficiency last year of £980.

Sir John G. Craggs presided on Monday, at the offices, 20, Bucklersbury, E.C., over the annual meeting. He said that the amount expended during the year on capital account was £1,020, as compared with £3,619 in the previous year. The revenue from rentals and other sources of income was £6,769, as compared with £6,883, which showed a slight falling off, while the apportionment of rentals carried forward was £2,098, as against £2,416 for the previous period. They had now reached a profit-earning stage, and, but for the adverse effect of the war upon business, he would have been able to report a larger net profit. New subscribers were being obtained in a satisfactory manner, and with their technical difficulties for the most part behind them, their future was becoming considerably brighter; but the outbreak of war immediately resulted in numbers of subscribers terminating their contracts, and since that time withdrawals had gone on until their total loss in annual subscriptions had reached about £2,000. Thus, the war had not only deprived them of a considerable amount of business already secured, but had stopped its development. The necessity at once arose for a reduction of expenditure. This had been accomplished, and was still having their constant attention. They hoped that they had now reached the worst of their troubles, and, although great difficulty was encountered in obtaining new business, they were still securing subscribers. They had reason to believe that they would be able to regain some of their old subscribers at the conclusion of the war, and as the success of their business depended largely upon trade conditions being normal (it being one of the first to be affected by commercial depression) he thought they might congratulate themselves on having turned the corner and made a profit during such abnormal times as the present.

Mr. E. B. Ellice-Clark seconded the motion, which was carried without discussion.

Fraser & Chalmers, Ltd.

Mr. A. W. Tait presided at the annual meeting, held at Winchester House, E.C., on October 28th. He said that the net profit for the year was £12,058, as compared with £8,377 in 1914 and £4,604 in 1913. The results were not good, but it was satisfactory that progress had been made during a particularly difficult time. The speaker referred to the difficulties experienced in obtaining raw materials and a sufficient labour force, difficulties common to all engineering concerns at present, but somewhat accentuated in their case. The progress recorded in the manufacture and sale of steam turbines and turbo-blowers last year had been fully maintained during the year under review; the results from this department showed an improvement, and there was every promise that it would continue to grow in importance. The company had now an established name in this class of manufacture, as was evidenced by the increasing number of inquiries and orders received. The orders taken in the coal conveying and coal handling department had been very satisfactory, and they were at the present moment in the process of carrying out certain substantial orders for the French Government, and also in South Africa and China. This department was growing in importance, and in the near future should be one of the principal departments of the company. A certain amount of business had been secured in Bettington boilers, and further inquiries were at present under consideration, although they might have to be deferred owing to the present regulations which existed for controlled establishments. During the year under review the business in South Africa had shown some improvement. The trading in Australia, and also in Canada, showed a falling off as compared with the previous year, but this was to be looked for in view of the financial conditions ruling in these Colonies. Certain new business had been secured in Australia, and the satisfactory crops in Canada should improve conditions there in the near future. It was, however, reasonable to assume that when conditions again became normal the volume of trade to be secured in these countries should be considerably augmented, especially if a certain measure of legislation was adopted whereby the manufactures of the United Kingdom obtained a substantial preference over those of alien enemy countries. The remaining departments did not call for any special comment, except that during the year the company appointed a representative to look after its interests in Russia. He had established himself in Petrograd, and had opened offices there. Although there was not much prospect of immediate business, largely due to the exchange problem with Russia, the ground was being prepared for future work. A new and larger power station had been erected at the works at Erith to meet special conditions which had arisen. The company had entered into a contract for a limited period for the supply of electric power to Vickers' works. This contract was a satisfactory one. In the event of it not being continued after the expiration of the existing agreement, the power station would supply all the needs of the company's own works at a considerably lower cost for power than in the past. The concentration at Erith of the sales departments and general accountancy with the manufacturing end of the business, had proved a great advantage to the work generally, and had largely contributed to more efficient and economic administration under the direction of Mr. Rogers, the general manager. The company was carrying out a large amount of work for the Government, or for its contractors, and for the supply of power units, which was classed as war work, but they had had perforce to turn down other orders and inquiries for the company's ordinary manufactures. The company's works were, however, at the present time fully occupied, and, provided there was no extraordinary change in the situation during the next few months, there was reason to hope that the results for the current year should be as favourable as those now submitted, if not more so.

Montevideo Telephone Co., Ltd.

Mr. Charles Lock presided at the annual meeting, held at Winchester House, E.C., on October 27th. He said that the item in the balance sheet of purchase price of property had been increased by £5,945 during the year, and now stood at £186,155. The increase was less than the corresponding figure of last year, and the explanation was simple—they had not had so much capital outlay in the shape of new connections. Stores at Montevideo were £6,789, against £11,400 last year. Last year he explained the reason for the large amount of stores then appearing in the balance sheet, viz., as being due to a certain portion of the cost of the new switchboard which had then been ordered, and part of which was then in Montevideo. Investments at cost were £49,289, as against £41,452. During the year they had considerable remittances from the other side, and had increased their investments by taking up some Treasury notes and £5,000 of War Loan. A question had been raised by a shareholder as to depreciation. This had not been referred to in the balance sheet because it was not of a serious character. Their investments were not in trustee securities, and perhaps for that reason were not so subject to fluctuations; but they were all of good class, with one small exception, and were thoroughly sound. Bills receivable and cash amounted to £21,798, against £20,600 in the previous year. Their investments of cash put them in the position of holding liquid assets, realisable at very short notice, to the amount of £71,000, whilst their capital was only £159,000. This, moreover, did not include the real estate and stores at Montevideo and sundry debtors, and taking these together they had solid assets of £104,000, probably every penny of which could be realised. On the debtor side, there was a small diminution in the item of sundry creditors. The reserve for renewal of plant, etc., stood at £40,130. They had charged the fund with a small portion of the cost of the new switchboard, but to the extent to which it was available for new connections in the future they had dealt with it as capital expenditure, which was sound finance. The profit and loss account showed a diminution in profit, but last year he foreshadowed that result, and they had 176 fewer subscribers on their books. He was glad to say, however, that business was looking up of late in the Republic, and their last reports were that subscribers were beginning to show an increase again. He was satisfied, however, that in view of the great depression on the other side, accentuated by difficulties with which they were all familiar, the result was not unsatisfactory. By the exercise of substantial economies they had been able to counteract the depressed business conditions, and the reduction in net revenue was only £2,748. The working expenses in Montevideo were substantially less than in the previous year, and they were able to show that result partly because there were not so many building operations going on necessitating the removal of their instruments and wires. Whilst they had not suffered from storms to any great extent in Montevideo, they had suffered materially in the Camp. However, the results of the whole year were that they lost £3,287 in receipts, but their net profit was only down by £2,748. The balance brought down was £25,776, which would enable them to pay the usual 6 per cent. on the ordinary shares and make substantial appropriations to depreciation and renewal of plant. Not, however, quite to the same extent, as they were putting £8,000 to depreciation as against £9,500 last year, and £9,000 for the renewal of plant, as against £9,500. The new switchboard had fulfilled all expectations, and justified the advice which Sir John Gavey gave them in recommending a particular kind of switchboard. For some years they had been endeavouring to get small sections of plant underground with a view to future developments, but during the year, owing to the troublesome times in which they lived, they had not proceeded so energetically with the question of obtaining the concession to put the whole of the plant underground. In March the old President went out of office, and the new President brought in a number of officials who, naturally, required a little time in which to study the conditions, and for the first few months, naturally, they did not wish to trouble them. Now, however, they had requested the local board to take the matter up at such time as they found convenient. He did not know what the views of the new Government might be in the matter, but the arguments the company would lay before them would be the same, viz., that they wished to give the public the best service, and would be prepared to do so when they got a concession. In conclusion, the Chairman expressed the indebtedness of the company to the local board, and also to Sir John Gavey for the constant advice he gave to them.

Mr. J. G. le Marchant seconded the motion, which was carried without discussion.

The meeting subsequently voted fifty guineas to the British Red Cross Society.

Barbados Electric Supply Corporation, Ltd.

The annual meeting was held on October 28th at Basildon House, Moorgate Street, E.C., Mr. A. W. Tait presiding. He said that the profit on operation for the year was £2,231, an increase of £850, or about 62 per cent. There was reason to be content with that progress in a year of adverse conditions, largely brought about by the world-war. While, perhaps, the community in Barbados could not be said to have suffered so much directly as a result of the war as people at home, the indirect effects of the war were, nevertheless, felt very seriously. It was, therefore, not surprising that the number of new consumers had not been quite so large as in the previous year, or that the number of units sold in proportion to the lamps connected was somewhat smaller. The winter season generally brought a large number of visitors to the Island, but owing to the lack of visitors last winter the company naturally suffered as a result of less current being used by the hotels and boarding-houses. There had also been less entertaining, and the lighting of the wharves had been restricted under Government orders. In view of those adverse factors, the directors regarded an increase of 2,321 lamps connected, and an increase of 27,369 units sold during the year, as entirely satisfactory. The trading profit had been arrived at after charging £504 for repairs and renewals, the principal item of expense in this connection being again the cost of replacing the original Norway pine poles by the more satisfactory Wallaba poles. More than half the original poles had now been replaced, and the remainder would have to be dealt with shortly, the cost being spread over the next two or three years. The number of consumers at the date of the report was 997, an increase of 260 in the past year, and the 25 c.p. equivalent connected to the mains stood at 15,036. The units sold during the year amounted to 166,585, an increase of nearly 20 per cent. over the previous year. Of the 260 new installations connected last year, 177 were carried out by their own wiring and fitting department, which had also carried out extensions to some of the previously existing installations. Electrical plant had also been installed by the company at three sugar factories on the Island, outside the radius of the company's system. The profit from installation work and the sale of electrical apparatus showed a decrease, but it was not the policy of the board to make substantial profits on this class of work. The department was a necessary adjunct to the company's business to enable them to obtain new consumers, and there was more attraction to intending consumers to have installations put in if they carried out the work at prices sufficient only to cover the working expenses of the department. With regard to the profit and loss account, the net profit for the year of £503, compared with a loss of £442 in the previous year, a difference of £945. The whole of the profit had been applied in reduction of the balance standing to the debit of profit and loss account to £2,752. The capital expenditure during the year had amounted to £1,103. As to their prospects for the current year, the conditions now prevailing were more or less the same as during the year under review, but the returns so far received showed a further slight, but quite satisfactory, increase over the corresponding period of last year. The sugar crop now growing, for reaping next February, was, he believed, a good one, and, if so, the company should ultimately get the advantage of the better conditions which were sure to prevail.

Mr. W. C. Kenny seconded the motion, and the report was adopted.

Ferranti, Ltd.

The annual meeting was held on Friday last at Central House, Kingsway, W.C., Mr. A. W. Tait in the chair.

In moving the adoption of the report, the Chairman said that the trading profit for the year was £37,230, as compared with £47,256 for the previous year, or a decrease of approximately £10,000. This decrease was in addition to the decrease which was shown last year from the profits which were made for the year to June 30th, 1913, which was the best year in the history of the company since its reconstruction. Last year he mentioned that the decrease was due principally to the discontinuance of large switchgear work and the building up of new business in switchgear details and power transformers; and he also mentioned that there might possibly be a further decrease due to the conditions arising out of the war. Unfortunately, this had been the case. The decrease could be accounted for to a very great extent by the decrease of the meter business, which was the principal part of the company's trade. The decrease had not occurred in any large measure in the home trade, but there had been a considerable falling off in the export trade, due to monetary conditions which had had the natural effect of retarding developments. There had also been some decline in the switch instrument and heater sections, but this had been compensated for in a large measure by the increase in the power transformer department. Improvements and developments had taken place in the company's design of transformers, and the progress which had been made was encouraging. Owing to the substantial reduction which had been made in general establishment charges, the net profit was £16,739, or only £3,036 less than the previous year. Proceeding to deal with the balance sheet, the Chairman said that a new item on the asset side was one of £11,856, expenditure on equipment of shell department. After considerable negotiation, the company were able to make a contract direct with the Government for the supply of a fairly large number of 3 in. and 6 in. shells, and also for the manufacture of fuses and gaines. Although the company had a considerable amount of plant suitable for this class of manufacture, they could not have undertaken the contract which had been placed with them without considerable addition to their available plant and also to their buildings. The matter was carefully gone into, and their probable requirements in this direction scheduled, and arrangements had been made under the contract with the Government for certain advances to meet this expenditure. Repayment had been arranged by means of equitable deductions from the invoiced value of the shells and fuses when the same was delivered. Arrangements were well forward, and the buildings had been completed and a certain amount of plant installed, although they were suffering, in common with other manufacturers, delays in delivery of various machines. The position had been put before the Ministry of Munitions, and pressure was being placed on the manufacturers to deliver the balance of their requirements as quickly as possible. They had already commenced the manufacture of the 3 in. shells, and of the fuses and gaines, and he hoped that before very long this department would be in full swing. In connection with this contract, they had had a very large amount of assistance from Mr. Ferranti, and the whole of this work was under his personal supervision. They had, in common with other manufacturers, experienced considerable difficulty in obtaining necessary supplies of materials, as well as having to meet continually increasing costs, both for material and labour. It was not always possible to provide for these increased costs in the prices which could be obtained for the finished article, particularly in standard articles such as meters. He was pleased to say that since the close of the financial year the orders which had been obtained showed an encouraging increase over those for the corresponding period of the previous year, and, if this could only be maintained, and no unforeseen expenditure arose in connection with the manufacture, the results which they would place before them next year should show some improvement. The works of the company were declared a controlled establishment under the Munitions of War Act, 1915, on September 6th, 1915. In order that they might be able to assist the country at the present time to the llest possible extent, they were making arrangements hereby practically the whole of their available male labour ould be employed on munitions work, and such other work they could carry on would be performed by female labour. conclusion, Mr. Tait referred with satisfaction to the loyal -operation, energy, and ability exhibited by the heads of e various departments and by the whole of the staff in sisting the company during a trying and difficult period.

Mr. ARTHUR WHITTAKER seconded the resolution, and the port was adopted.

Norwich Electric Tramways Co.

HE report for the year ended June 30th, 1915, gives the llowing comparative figures for 1914 and 1915:—

	1914.	1915.	
Total receipts	£39,121	£39,126	Inc. £ 5
Total expenditure	28,044	28,479	Inc. 435
Net profit	£11,077	£10,647	Dec. £430

The above amounts for expenditure include debenture iterest, donations, and London expenses. Adding £797 rought forward, there is a total of £11,444 to be dealt with. he directors recommend that £2,500 be placed to the reserve ind account, £7,920 to the payment of 3 per cent. dividend the shares of the company for the year, and £1,024 be irried forward.

	1914.	1915.
Car miles run	1,048,275	1,011,994
Passengers carried	9,431,890	9,471,883
Earnings per C.M.	8.96d.	9.27d.
Expenses per C.M.	5.82d.	6.13d.
Earnings per passenger	0.96d.	0.99d.

Mr. G. M. Chamberlin, who was appointed local director under Section 47 the Norwich Electric Tramways Act, 1897, retires, and under Section 45 of e Norwich Electric Tramways Act, 1914, the Corporation of Norwich will point a director, subject to the approval of the directors of the company, represent the city of Norwich on the board for the ensuing year.

Auckland Electric Tramways Co., Ltd.

URING the year ended June 30th, 1915, the total revenue as £272,242. The traffic receipts, which were adversely ffected by the war, amounted to £267,794, showing a decrease f £3,908. After providing for all expenses chargeable to evenue, including £20,510 for debenture and other interest, he rental and percentage of profits payable to the Auckland ity Council amounting to £5,382, and setting aside £22,500 the renewals and depreciation account, there is a surplus f £53,404, plus £5,876 brought forward, making £59,280. The reference dividend requires £9,000. An interim dividend on he ordinary shares for the half-year ended December 31st, 914, of 7d. per share, less income-tax, was paid in May, and he directors now recommend that £10,000 be transferred to eserve account (bringing the account to £122,500), and that a urther dividend be paid on the ordinary shares of 1s. per hare, less income-tax, making 1s. 7d. per share for the year. his will leave £4,655 to be carried forward. £5,851 first ortgage debenture stock was bought and cancelled, the verage cost to the company being slightly over par. The apital expenditure during the year aggregated £24,074, most f which was in respect of additions to the generating plant, ncluding the cost of a 1,050-KW. mixed-pressure turbo-set, which is now in course of installation and is expected to effect conomies in the working costs. Expenditure has also been ncurred on certain duplications of the track and in connection vith an extension of 1.14 miles. The new central repair vorks in the Mount Roskill district were in operation during he whole of the year, and have enabled the company to deal xpeditiously and economically with rolling stock and other epairs. Arrangements have been concluded with the Auckand City Council with regard to the extension in Upper Queen Street, and the work is now in course of being carried out. n view of the monetary conditions brought about by the war, apital expenditure in other directions is being restricted as nuch as possible. The passengers carried numbered 41,375,689, s compared with 42,133,345, and the average expenditure per assenger fell from 1.00d. to .99d.; the average receipts per assenger were unaltered at 1.55d.

Annual meeting: November 8th.

Drake & Gorham, Ltd.

HE directors' report for the year ended June 30th, 1915, states hat after payment of all charges, including bonuses due to staff, allowances to those who have joined the National Forces, and making provision for contingencies, there remains a net profit of £3,817, plus £1,931 brought forward, making a total of £5,748. After payment of a dividend at the rate of 2½ per cent. requiring £3,125, £1,000 is applied in writing down goodwill, and £1,623 is carried forward. As might be expected, country house lighting has been curtailed by the war, but the organisation of the company has been utilised in providing light and power for powder factories, chemical works, camps and hospitals, which has kept the staff fully employed. As, however, this work was undertaken at low rates, the profit on the installation department, as a whole, shows a reduction. The wholesale department has maintained its position and profits in spite of the prevailing conditions. The agency for commercial electric vehicles with Edison batteries has resulted in a number of sales, and development of this department during the current year has already taken place. Two directors and 60 members of the staff (two of whom have been killed and one wounded) volunteered for national service, and up to June 30th, £811 had been paid in allowances.

West India and Panama Telegraph Co., Ltd.

THE report states that the amount to credit of revenue is £36,454, against £41,482 for the corresponding half-year of 1914, and the expenses have been £27,225, against £26,900. The result is a profit of £9,229, plus £1,741 interest on investments and £6,348 brought forward, making an available total of £17,319. The directors propose that this amount be dealt with as follows: First preference shares, dividend, six months to June 30th, 6s. per share, £10,368; second preference shares, dividend, six months to June 30th, 6s. per share, £1,400; ordinary shares, dividend, six months to June 30th, 9d. per share (free of income-tax), £3,312; balance to current half-year's account, £2,237. The working profit for the half-year is £9,229, as compared with £14,582, a decrease of £5,353. The war conditions referred to in the last report have during the half-year involved an abnormal expenditure of over £7,000. The cost of repairs to cables is £3,263 less, partly owing to receipts for the hire of the *Henry Holmes* and to a smaller quantity of cable having been used in repairs. The traffic receipts during the current half-year, to which are added the special subsidies granted in respect of a reduction of rates, so far show a considerable falling off in comparison with those of the corresponding half-year of 1914.—*Financier*.

Western Telegraph Co., Ltd.—The directors, after transferring £150,000 towards the reduction of the amount of capital expenditure in excess of the share capital and debenture stock issued, £150,000 to the general reserve fund, £30,000 to the land and buildings depreciation fund, and £50,000 to the provision on account of investment fluctuations, recommend a final dividend of 3s. per share, making a total dividend of 6 per cent. for the year ended June 30th, 1915, also a bonus of 2s. per share, both free of income-tax.

South Metropolitan Electric Light & Power Co., Ltd.—At the meeting of debenture stockholders on October 27th, the resolution mentioned on page 568 of our last issue reducing the amount to be set aside to reserves and depreciation was carried by 11 votes to 6, but as a three-fourths majority was necessary, the resolution was declared lost.

Capital Reduction.—A petition for the reduction of capital in the County of Durham Electrical Power Distribution Co., Ltd. and Reduced, from £500,000 to £300,000, is to be heard in London on November 16th. A notice regarding the matter appears in our advertisement pages to-day.

Bordeaux Electric Tramways Co.—The following dividends are to be paid in London, on November 15th, on the shares of the Compagnie Francaise des Tramways Electriques et Omnibus de Bordeaux:—Fcs. 4.45 on bearer shares against coupon No. 27 and Fcs. 4.80 on registered shares by endorsement on certificate.

Shropshire, Worcestershire, and Staffordshire Electric Power Co.—The *Times* states that this company will hold an extraordinary general meeting on November 19th to sanction the creation and issue of £100,000 of 5½ per cent. debenture stock.

City of Buenos Aires Tramways Co. (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share, being at the rate of 5 per cent. per annum, less income-tax, for the three months to September 30th.

STOCKS AND SHARES.

TUESDAY EVENING.

It is surprising how little the Stock Exchange markets are being influenced by politics of any kind. The investor seems to be indifferent to the war influences so far as the active markets are concerned. His attitude must cause disappointment to the puling pessimist who makes a gospel of national depreciation, because such steadiness in markets augurs a calm confidence on the part of the general public that must be galling to the sensation-seller and his ready victim. Not even the greatly-deplored accident to His Majesty brought about a tremor in markets, and the talk about a new War Loan has not led to any sales of gilt-edged stocks in consequence.

Once more, it is Brazil, Canada, and Mexico which lead the markets all round. Mexico is hardly such a favourite as she was a fortnight back. Rumours as to assassination of Carranza turned out to be ill-founded, but they were unpleasantly remindful of possibilities in a country where revolution has been dormant for less than a month. After a reaction, however, prices of various Mexican issues hardened up.

The Canadian and American munition-making companies are known to be overwhelmed with work, and the electrical undertakings are fast and furiously busy with orders from this country and the Allies. Canadian General Electrics fell back to 124 after their Fifth of November rise, but the demand sprang up again, and the price rose to 129 with it. Shawinigan Water and Power Common shares are strong at 145, and Consolidated Gas, Electric Light and Power of Baltimore went up to 116½. Shawinigan's August earnings of 150,000 dollars showed an increase of 8,000 dollars on the month.

In view of the big price advances of late, it is useful to compare a few yields, because while some stocks are still cheap, there are others which look expensive enough, bearing in mind that the War Loan can be bought to pay nearly 4¾ per cent. on the money. Representative fixed-interest securities are:—

Bond or Stock.	Price.	Yield.	Interest due.
Baltimore Gas., Elec. Power Con. Deb. Stock	91 c.d.	£5 10 0	May, Nov.
General Elec. Gold. debs.	102½	4 17 6	Mar., Sep.
Mississippi Power	83	6 0 0	Jan., July.
Pennsylvania Water & Power	97	5 3 0	Jan., July.
Rio Trams 1st	93	5 7 6	Jan., July.
Rio Trams 2nd	76	6 11 6	Apl., Oct.
Sao Paulo Tram 1st	92	5 8 0	June, Dec.
Toronto Power Deb. Stk.	88 c.d.	5 2 0	May, Nov.
United Elec. Montevideo Trams 1st. deb.	89 c.d.	5 12 6	May, Nov.
Winnipeg Elec. Rly. perp. deb. stk.	86¾	5 1 0	Apl., Oct.

In all the above cases the interest is 5 per cent., with the exception of the Toronto and the Winnipeg debentures, which are 4½ per cent. stocks. The latter is obtainable free of stamp and fee.

The electricity supply market is so quiet that there is not an alteration to record in our lists this week. There is a little business doing in County of London shares, the yield on the ordinary attracting buyers, while, at the same time, there are a fair number of shares on offer. For South Metropolitan ordinary there has been some inquiry, on the basis of 15s. 6d. City of London ordinary are changing hands about 12, but in Charing Cross issues there is nothing going on. Edmundson's Ordinary changed hands the other day at 5s., and the £5 preference shares at 3, these carrying 6 per cent. cumulative preference dividends. The non-cumulative preference (also £5 shares) are about a sovereign. London Electric preference attracted a little attention at about 4⅜, and Metropolitans last changed hands at 45s.

Another feverish outbreak of buying of American Rails has helped prices of shares of all the companies operating in the States. New York Telephones at 100, ex dividend, are very steady, American Marconis hardened to 18s. 3d., and Anglo-American Telegraph preferred at 101 x.d. is a little better, allowing for the deduction. Western Telegraphs are good, on the declaration of the usual 3s. final dividend and 2s. bonus. West India and Panama are unchanged, the dividend of 9d. a share, free of tax, comparing with 1s. 3d. a year ago. In the Eastern group, Eastern ordinary has gained 2 points. Both the Globe Telegraph shares are better, further improving upon their rise of last week, and the market as a whole shows considerable strength.

This cannot be said of Home Railway stocks. Districts hardened a trifle, but the Underground Electric "A" shares are dull at 4s. 9d. Most of the Steam stocks show a sickly tendency. So long as the war continues, the Government guarantee to the railways protects dividends to a material extent, but the outlook for the industry after the war is over is too obscure for the investor to be tempted to buy the stocks. Should trade turn out to be good, there will be labour difficulties. If there are none of the latter, it will mean that trade is sluggish; and the investor is not a little puzzled to know what to make of the situation as it will develop when peace breaks out.

Brazil Tractions recovered their dividend of ½, deducted last account-day, and there is still a considerable amount of activity in the shares. Indeed, Argentine and Brazilian issues of all kinds are in demand just now.

The manufacturing shares are somewhat unsteady. Babcocks eased off a trifle, and falls of ¼ took place in British Insulated and in India-rubber shares. On the other hand, Henleys are up on the week, and Telegraph Constructions followed up their previous rise with an advance of another 10s. Prices in the rubber share market keep very firm. There is a good deal of business doing in them, most of it small, but fairly constant. The latest speech of the Chancellor of the Exchequer on the Budget encouraged the idea that the younger rubber-producing companies would receive reasonable treatment in the matter of the Excess Profits Tax: Mr. McKenna said that such cases must be left to be decided by the referees

A substantial recovery in copper shares is worth noticing. The metal has started to improve, and heavy purchases of shares from the other side of the Atlantic has brought about a complete change in the complexion of the market for copper shares on this side. There is not much doing in Armament shares, but supply and demand keep level enough to hold prices steady.

SHARE LIST OF ELECTRICAL COMPANIES

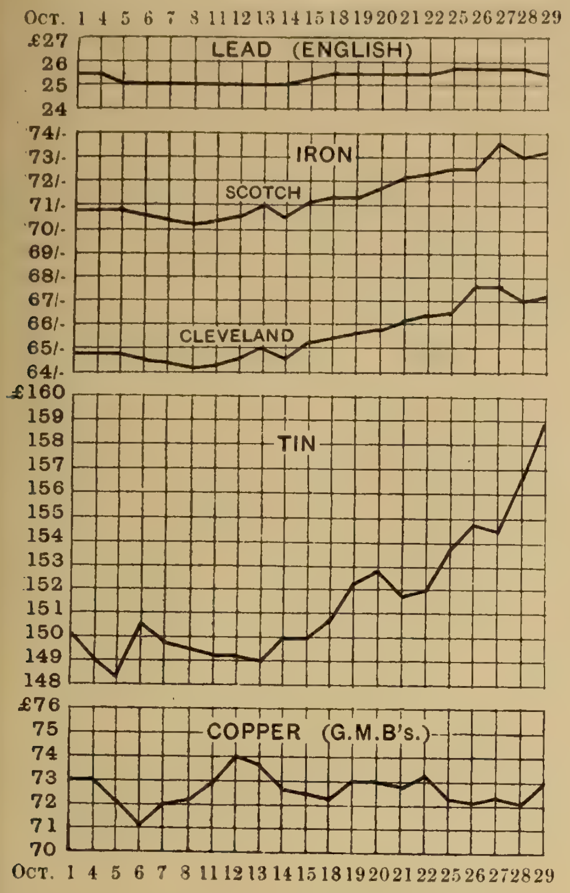
	Dividend, 1914.	Price Nov. 2, 1915.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.				
Brompton Ordinary	10	7¼	—	£6 18
do. 7 per cent. Pref.	7	7	—	5 0
Charing Cross Ordinary	5	3½	—	7 2
do. do. do. 4½ Pref.	4½	3¾	—	6 0
do. do. City Pref.	4½	3½	—	6 8
do. 4 Deb.	4	80	—	5 0
Chelsea	5	4¼	—	5 17
do. 4½ Deb.	4½	87	—	5 3
City of London	9	12¼	—	7 7
do. do. 6 per cent. Pref.	6	10¾	—	5 11
do. do. 5 Deb.		100	—	5 0
do. do. 4½ Deb.	4½	85	—	5 6
County of London	7	10	—	7 0
do. do. 6 per cent. Pref.	6	10¼	—	5 17
do. do. 1st Deb.	4½	90	—	5 0
do. do. 2nd Deb.	4½	85	—	5 6
Kensington Ordinary	9	6¼	—	7 4
London Electric	4	1⅜	—	8 8
do. do. 6 per cent. Pref.	6	4½	—	6 13
do. do. 4 Deb.	4	80	—	5 0
Metropolitan	3½	2¼	—	7 15
do. 4½ per cent. Pref.	4½	3¾	—	6 0
do. 4½ Deb.	4½	85	—	5 6
do. 3½ Deb.	3½	70	—	5 0
St. James' and Pall Mall	10	6¾	—	7 8
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12
do. do. do. 3½ Deb.	3½	70	—	5 0
South London	5	2⅞	—	6 19
South Metropolitan Pref.	7	1 1/16	—	6 14
Westminster Ordinary	9	6¾	—	6 13
do. 4½ Pref.	4½	4⅛	—	5 9
TELEGRAPHS AND TELEPHONES.				
Anglo-Am. Tel. Pref.	6	101 xd	—	5 18
do. Def.	1½	22¾	—	6 11
Chile Telephone	8	6½	—	6 3
Cuba Sub. Ord.	5	8	—	6 5
do. Pref.	10	15	—	6 13
Eastern Extension	7	11¾	—	*6 16
do. 4 Deb.	4	80	—	5 0
Eastern Tel. Ord.	7	122	+2	*6 14
do. 3½ Pref.	3½	66	—	5 6
do. 4 Deb.	4	82	—	4 18
Globe Tel. and T. Ord.	6	10⅛	+ ⅛	*6 15
do. Pref.	6	10⅛	+ ⅛	5 18
Gt. Northern Tel.	22	33½	—	6 11
Indo-European	13	46 xd	—	6 18
Marconi	10	1⅞	—	6 8
New York Tel. 4½	4½	100 xd	—	4 10
Oriental Telephone Ord.	10	1 13/16	—	5 8
do. Pref.	6	⅞	—	6 17
Tel. Egypt Deb.	4½	80	—	5 0
United R. Plate Tel.	8	[illegible]⅝ xd	—	*8 2
do. Pref.	6	4⅞	—	5 2
West India and Pan.	1	1⅛	—	8 17
Western Telegraph	7	12¼	—	*6 11
do. 4 Deb.	4	80	—	5 0
HOME RAILS.				
Central London, Ord. Assented	4	68	—	5 16
Metropolitan	1¼	22¼	—	5 8
do. District	Nil	13¼	+ ¼	Nil
Underground Electric Ordinary	Nil	1¼	—	Nil
do. do. "A"	Nil	4/9	−9d.	Nil
do. do. Income	6	70½	—	*9 12
FOREIGN TRAMS, &c.				
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0
do 5 Deb.	5	97	—	6 8
Anglo-Arg. Trams, First Pref.	5½	3½	—	7 17
do. 2nd Pref.	5½	3	—	9 3
do. 4 Deb.	4	74	—	5 8
do. 4½ Deb.	4½	74	—	6 1
do. 5 Deb.	5	75	—	6 13
Brazil Tractions	3½	57½ xd	+ ½	6 1
Bombay Electric Pref.	6	10¼	—	5 17
do. 4½ Deb.	4½	87	—	5 3
Mexico Trams	Nil	34	—	Nil
do. 5 per cent. Bonds	—	50	—	Nil
do. 6 per cent Bonds	—	44	—	Nil
Mexican Light Common	Nil	30	—	Nil
do. Pref.	Nil	40	—	Nil
do. 1st Bonds	—	10	—	—
MANUFACTURING COMPANIES.				
Babcock & Wilcox	14	2⅛	— 1/16	6 15
British Aluminium Ord.	5	1 1/16	—	4 14
do. Pref.	6	18/8	—	6 9
British Insulated Ord.	15	10⅛	— ¼	7 8
do. Pref.	6	5⅞	—	5 2
British Westinghouse Pref.	7½	34/-	—	8 10
do. 4 Deb.	4	72	—	5 11
do. 6 p. lien	6	101	—	5 19
Callenders	15	11	—	6 16
do. 5 Pref.	5	4½	—	5 11
do. 4½ Deb.	4½	92	—	4 17
Castner-Kellner	15	61/-	—	4 18
Edison & Swan, £3 pd.	Nil	10/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	57	—	7 0
do. do. 5 % Deb.	5	60	—	8 6
Electric Construction	6	18/-	—	9 4
do. do. Pref.	7	19/9	—	7 1
Gen. Elec. Pref.	6	9½	—	6 6
Henley	20	12⅝	+ ⅛	*9 1
do. 4½ Pref.	4½	4½	—	5 0
do. 4½ Deb.	4½	92	—	4 17
India-Rubber	5	7¾	— ¼	6 5
Telegraph Con.	20	33	+ ½	*7 6

* Allowance made for dividends being paid free of income-tax.

Delabole Electric Lighting and Supply Co.—The annual meeting was held on October 27th, Mr. Maurice J. Wells presiding. The report for the year ended June 30th showed that the income had been considerably affected by the war, street lighting being prohibited by the authorities. There had been a profit for the year of £119.

METAL MARKET.

Fluctuations in October.



Detection of Blowholes in Castings by X-Rays.—In a note read before the Institute of Metals at the recent autumn meeting, Mr. C. H. Tonamy, of Kobe, Japan, described experiments made for the purpose of detecting internal blowholes by external examination with X-rays.

Such defects being, in the ordinary way, only discovered when the material is subjected to machining, the application of X-rays for this purpose seemed likely to be of great service, particularly with copper castings, since pure copper, when at a high temperature, absorbs gases from the air, thereby rendering likely the formation of blowholes. When making these castings a small quantity of phosphorus, tin, or zinc is usually added as a deoxidiser. Blowholes, however, are always to be guarded against, and in order to study their occurrence the author made some experiments upon a thin casting of pure copper.

By varying the distance between the centre of the tube and the X-ray plate, the time of exposure, and the strength of current, the following results were obtained :—

Vertical distance. Centimetres.	Time of exposure.		Strength of current. Milliamperes.	Remarks.
	Min.	Sec.		
50	2	5	0·8	Very faint spots obtained, which indicated the positions of blowholes.
30	2	30	0·8	More distinct spots obtained.
15	5	0	2·0	Much more distinct spots obtained.

In order to verify the results so obtained, the plate was sawn across through the indicated positions of the blowholes, and these were found to be continuous.

In this experiment an X-ray source of ordinary strength was used, but had there been employed a much more powerful source, such as the Coolidge tube used by Dr. Wheeler, the radiographs would certainly have been sufficiently distinct to determine the exact position of the blowholes. Moreover, by taking radiographs in two directions at right angles to one another, the depth of the blowholes beneath the surface of the plate could be determined.

There is little doubt that useless work in the machine shop might be saved by testing metals by means of X-rays as described above.

HALF-WATT LAMPS FROM THE CENTRAL STATION STANDPOINT.

By "LUX," B.Sc. (Hons.)

There is not the least doubt that but for the invention of the tungsten filament incandescent lamp, incandescent electric lighting would be in an economically serious position by this time. Carbon filament lamps might have remained in use for a little longer, but incandescent electric lighting would to-day have been an extravagance, and the lighting load on central station mains would rapidly have dwindled to negligible proportions. Fortunately, the actual state of affairs is very different. The tungsten filament (*in vacuo*) provides a brilliant light by the expenditure of one watt per candle-power, and, by so doing, has placed electric lighting within the reach of all, and in a position to compete effectively with all other illuminants. Gloomy as were the forebodings of central station engineers at the time when the first metal filament lamps were introduced, none can deny that these lamps were literally the salvation of the domestic electric lighting industry, and of unqualified advantage to all parties concerned. From the very first, consumers recognised that, although the new lamps permitted them to effect material economies in lighting at given "points," an even more important advantage was the natural corollary that more and better lighting could be obtained for a given outlay. Consciously and unconsciously this important principle was applied, and is still being extended. Hence, while innumerable consumers now use electric light who could never have entertained the idea of using it with carbon lamps, the tendency of all established consumers, and of fresh consumers as they arrive, is to use electric lighting ever more freely—to install electric lamps in every room and passage, and to make full use of them when installed.

There was, however, a chink in the armour of electric lighting even after the introduction of the metal filament lamp, this zone of weakness lying between the domestic lighting field and that field in which the most powerful flame arcs could appropriately be employed. In other words, there was a need for something yet better than the metal filament vacuum lamp to meet the competition of high-pressure gas lamps, "gas arcs," and the like in shop lighting, in the lighting of average streets, and in other similar applications. This need has been supplied by the gas-filled or "Half-Watt" lamp, and, just as the first metal filament lamps saved the domestic lighting load to central station engineers, so the half-watt lamp has furnished central stations with a means of retaining and vastly extending their lighting connections in shops, factories, streets, open spaces, and other places—wherever, in fact, lighting units of from 3,000 down to several hundred candle-power are required.

All that these new lamps mean to central stations has not yet been adequately realised. A 2,000-c.p. half-watt lamp, as suitable for use in lighting open spaces or large interiors, consumes 1 kw. Its demand is operative continuously for hours at a stretch and is supplied at lighting rates. Once consider these facts, and the immense advantage conferred upon central station interests by the advent of the half-watt lamp is obvious. Nor is the central station benefit gained at the consumer's expense. Such a state of affairs would be quite unstable, could it, by any means, be brought about. Actually, of course, the half-watt lamp is of as great and permanent advantage to consumers as to central station engineers in that it provides all the advantages of the simple incandescent lamp combined with economy hitherto unavailable.

In the lighting field, where competition between various illuminants is still so keen, one realises with exceptional force that suspended progress is tantamount to immediate retrogression. Further than this, retrogression in efficiency of electric as compared with other lamps would involve immediate slackening in the rate of development of electric lighting loads, followed soon by actual reduction in the latter. While, on the other hand, the perfecting of more efficient lamps might seem to produce a reduction in lighting load, this is obviated by the fact that the new lamps are introduced in the larger sizes—giving increased candle-power. Furthermore, the rate of development of the lighting load, so far from being checked, is immensely accelerated. The actual reduction in load is thus quite temporary, and as there is necessarily a considerable diversity factor in the adoption of new types of lamp by various consumers, the actual effect on the lighting load curve need not be an adverse one; in many cases it will prove to be a beneficial one, and in the worst case much less pronounced than might be expected. The fundamental fact is that the whole course of lighting development is healthy and stable so long as lamps of the highest efficiency available are employed, but becomes artificial and unstable directly one neglects to take full advantage of lamp improvements. These statements are no mere hypothesis, but have been justified completely by the history of electric lighting since the introduction of the first metal filament lamps, which represented anything from 50 per cent. to 70 per cent. advance in efficiency on any previously obtainable incandescent lamps.

History will undoubtedly repeat itself in the case of half-watt lamps. The large sizes open out to incandescent electric lighting an entirely new field of development, of immediate advantage to both consumer and central station, and corresponding to the new field opened out by the first metal filament lamps. The smaller sizes, including those already available and those becoming available as the technology of manufacture advances, may be likened in their effect on consumers and central stations to the effect of the first metal filament lamps on previous users of carbon lamps. But the analogy is not complete, for, as compared with the metal-carbon position, the smaller half-watt lamps offer more advantage to consumers and less prospect of even temporary depression to central station engineers. Paradoxical as this statement may appear, it can be justified. In the first place, the absolute advance in efficiency between metal filament (vacuum) and half-watt (gas-filled) lamps in their smaller sizes is less than between carbon lamps and metal filament lamps—say, a reduction of energy for equal light of about half for the half-watt over metal vacuum lamps as compared to a reduction of about three-quarters for ordinary metal vacuum lamps over carbon lamps. On the other hand, the gain in brilliancy by the half-watt lamp is eight-fold over the ordinary metal vacuum lamps. The attractiveness and quality of the light—its advertising effect—is thus increased eight-fold at the cost to the central station of a 50 per cent. saving in current. The balance is, therefore, in favour of the central station and electric lighting growth. Furthermore, where the smaller lighting units are concerned, the advance in efficiency realised by the half-watt lamp is more important to the consumer in providing more and better lighting at the same cost than in actually reducing lighting costs.

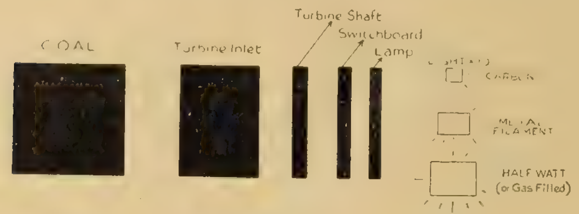


Fig. 1.—Losses from Coal Pile to Lamp.

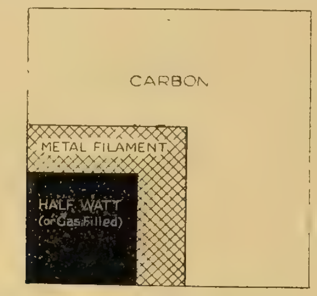


Fig. 2.—Reduction in Plant required for Equal Lighting Capacity.

The first metal filament lamps could be simply inserted into existing fittings in place of carbon lamps. This was not always done, and certainly was not always the best thing to do; but it could be done, and the important point was that it immediately reduced the cost of electric lighting to a level at which it could compete with any other domestic illuminant. As a result, reduction in lighting cost is now a matter of secondary importance. The first tungsten lamps educated the public to the need for more light, and popularised electric lighting by reducing its cost. The half-watt lamp, on the other hand, compels the use of suitable fittings. It cheapens electric lighting immensely in shop lighting, street lighting, and a number of other applications wherein the ordinary tungsten lamp found it difficult to compete with certain other illuminants. In the domestic field it compels abandonment of the many inefficient and injurious lighting schemes hitherto tolerated, and provides the best possible illumination without any increase in cost. The objections ordinarily raised to indirect lighting are completely overcome by the advent of the half-watt lamp, which combines the lowest cost of direct tungsten lighting with the unique excellence of indirect and semi-indirect illumination.

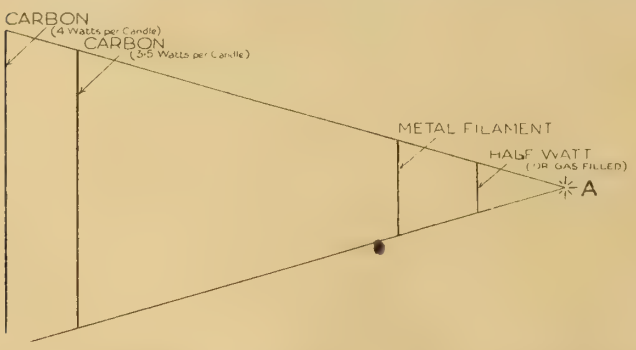

CARBON (4 Watts per Candle)
CARBON (3·5 Watts per Candle)
METAL FILAMENT
HALF WATT (OR GAS FILLED)
A

Fig. 3.—Reduction in Plant Capacity and Coal Consumption with Improvements in Electric Lamps.

High efficiency, as applied to any system of artificial lighting, is, of course, a purely relative term. The best incandescent lamp available—which is nearly the best incandescent lamp conceivable—can convert but a very small fraction of the energy of a coal pile into light. At the same time, the lamp is responsible only for part of the loss occurring in the series of conversions from coal to light, and the fact that its efficiency has been so much improved during recent years is rendered none the less important by the fact that the overall efficiency remains low.

The series of rectangles in fig. 1 show diagrammatically how the energy stored in a coal pile dwindles in the course of the conversions necessary to produce incandescent electric light on the consumer's premises. Of the full energy equivalent of the coal pile represented by the left-hand rectangle, only about 70 per cent. reaches the inlet valve of the turbine in the form of steam. About 80 per cent. of this energy is lost in converting it to mechanical power, so that we are left with about 14 per cent. of the energy of our coal pile available at the turbine shaft. The efficiency of converting mechanical to electrical energy and distributing the latter is very high, so that we still have 10 per cent. of the energy of the coal pile available at the lamp terminals. Of this, carbon filament lamps convert only 2 per cent. into light, while metal (vacuum) lamps convert 6 per cent. into light, and the half-watt lamp converts some 10 per cent. of the energy delivered into light. The relative efficiencies from coal pile to lamp are clearly shown in the accompanying figure. (For the sake of clearness, the areas of the rectangles representing light in the accompanying diagrams are made ten times their true value in each case.)

The superimposed rectangles in fig. 2 show yet more clearly the reduction in plant required; the cross-hatched area, for instance, represents to scale the additional plant capacity rendered available for fresh lighting and power connections without any additional capital outlay or delay in erection, by substitution of half-watt (gas-filled) for ordinary metal filament (vacuum) lamps in any particular lighting service. This has, naturally, a very favourable effect on the standing charges of the station, as the more pronounced the lighting peak (*i.e.*, the heavier the capital burden incurred in respect of plant for lighting supply) the greater is the advantage to be gained by the introduction of the newest and most efficient lamp from the central station standpoint.

An alternative method of representing the reduction in coal consumption and plant required for given light production is shown in fig. 3, in which the vertical lines are proportionate to coal consumption and plant capacity, and distances horizontally are, therefore, indicative to scale of progress attained. Were anything like 100 per cent. conversion of energy possible from coal to light, the vertical line representing coal consumption and plant capacity would be extremely short, for the energy equivalent of light is very small. The point A in fig. 3 represents this ideal, but quite unattainable, performance, and the relative positions of the several vertical lines in the diagram show the remarkable progress effected by the two types of metal filament lamps.

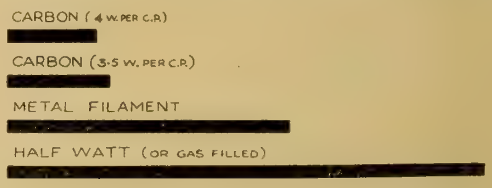


Fig. 4.—Light (c.p.-hours) obtained for One Shilling.

Satisfied consumers being an immense asset to any central station, it is interesting to examine just what half-watt lamps mean to the consumer on that simplest of all bases—lighting hours obtainable for given investment. This is shown diagrammatically in fig. 4, the upper row of rectangles representing to scale the amounts of light obtainable for a shilling from incandescent lamps of various types, using energy at 4d. per kw.-hour in each case. These rectangles are obviously a direct measure of consumers' increasing satisfaction with electric lighting, and show that in this respect as in all others, the half-watt lamp is an invaluable aid to extending central station service.

Electric Taxicabs for New York.—A scheme is in course of development in New York to start a service of 700 electric taxicabs in that city. A sample chassis has been built, and as a result of the trials, it is announced that the Electric Taxicab Co., of New York, has been formed, with a capital of £200,000.

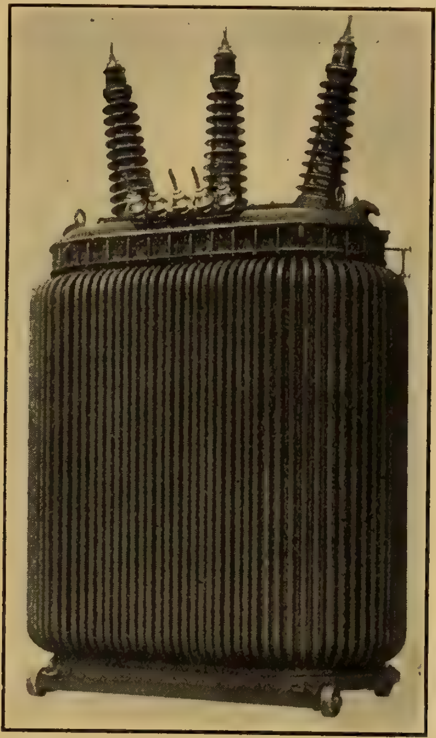
THE ELECTRIFICATION OF THE CHICAGO, MILWAUKEE AND ST. PAUL RAILWAY.

In our issue of February 12th last we gave a preliminary description of the electrification of the Chicago, Milwaukee, and St. Paul Railway. Construction work on the electrification of the western lines has been prosecuted most actively since the initial order for equipment was placed with the General Electric Co. (U.S.A.) in September of 1914. The remarkable progress made is summarised in the present article, which we are enabled to publish through the courtesy of the British Thomson-Houston Co., of Rugby.

Chicago, Milwaukee and St. Paul 3,000-volt direct-current Freight Locomotive on Test.

The overhead construction, which will include 650 miles of single track, has been completed for a distance of more than 200 miles. The 100,000-volt transmission line, being erected by the railway company to parallel the electrified tracks, has been completed for an equal distance, and tie-in lines from the 100,000-volt system of the Montana Power Co. are ready for service. The trackage now ready for train operation includes extensive yards and sidings at Three Forks, Deer Lodge, and Piedmont, and passing tracks at other points. The rail-bonding crews have followed the overhead construction gangs completing the ground circuits.

Single Track Curve showing Overhead Line Construction, C., M. & St. P. Railway.



1,900 k.v.a. 100,000-volt Transformer.

One of our views shows the general appearance of the new type of trolley construction and transmission lines, and it will be noted that wood-pole construction is used throughout, both for cross-span and bracket construction. The twin 4/0 trolley wires are suspended individually and separately from the same steel catenary, and the hangers of one trolley wire are located at points mid-span on the other. In the switching yards only one trolley wire is used.

Seven sub-stations, designed to supply power to the first half of the 440 miles of route, have been completed, and electrical equipment is being rapidly installed. Complete shipments of transformers, motor-generator sets, switchboards, and other accessories have been made by the General Electric Co. (U.S.A.) for the stations first erected, and the equipment of four sub-stations is practically ready for operation, while the erection of the remaining seven sub-stations between Deer Lodge, Montana, and Avery, Idaho, is being proceeded with.

The equipment for the fourteen sub-stations includes 32 motor-generators in 2,000 and 1,500 kw. capacities, giving a total of 59,500 kw., and 74,600 k.v.a. of transformers in 2,500 and 1,900 k.v.a. sizes. Each of the motor-generator sets consists of a 60-cycle, 3-phase, 2,300-volt synchronous motor direct-connected to two 1,500-volt direct-current generators. The generators are connected permanently in series to supply 3,000 volts to the trolley. Each set is also provided with an exciter at each end, one providing excitation for the revolving field of the motor and the other supplying the separately excited fields of the d.c. machines.

These sets are in general similar to the five 1,000-kw., 2,400-volt units in operation on the Butte, Anaconda and Pacific Railway, except as regards voltage and capacity. A new feature, however, which deserves mention, consists of the longitudinal ventilation of the core and field coils, similar to that employed in the well-known G.E. ventilated railway motor. The use of this method of cooling has effected a considerable reduction in the floor space required per kilowatt.

The d.c. generators are equipped with commutating poles and compensated pole face windings to ensure sparkless commutation under heavy overloads. This overload capacity is 150 per cent. normal load for two hours, and 300 per cent. normal load for periods of five minutes, which will provide ample margin for starting a train of maximum tonnage on the most difficult grades.

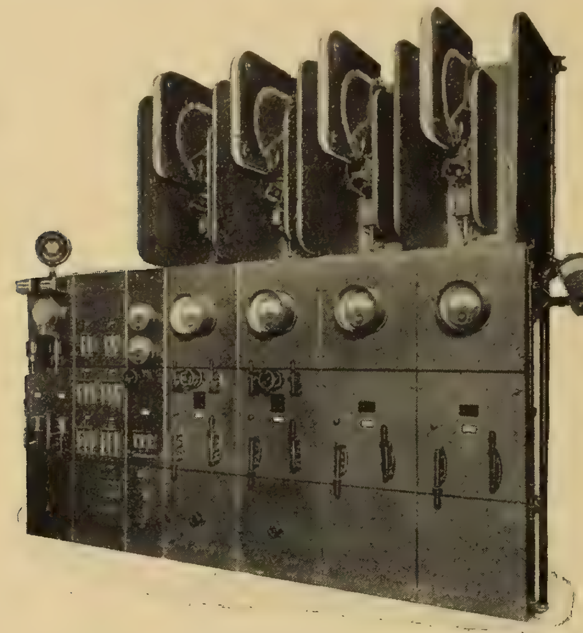
It is interesting to note in connection with these sub-stations that the motor-generator sets are designed to operate inverted in case the regenerated power exceeds that required by other trains operating near by. For this reason, there is no necessity for water boxes or other energy-consuming devices, since the excess energy is transmitted to the 100,000-volt system.

The main direct-current switchboard in each station is of special interest, since it represents the latest practice in high voltage direct-current switching apparatus. A panel is provided for each set, and two panels are provided for feeders in each direction.

The circuit-breakers and switches are mounted on separate panels located above and a short distance behind the main panels, similar in general to those now operating in the Butte, Anaconda, and Pacific sub-stations. The control handles for operating the breakers and switches are located on the main panels, and are connected to the circuit-breaker panels through insulated wooden rods.

In addition to the special high voltage D.C. panels, switchboards are also being furnished for the synchronous motors and auxiliary circuits. Oil switches and other standard 100,000-volt equipment are also being installed for the high-tension circuits.

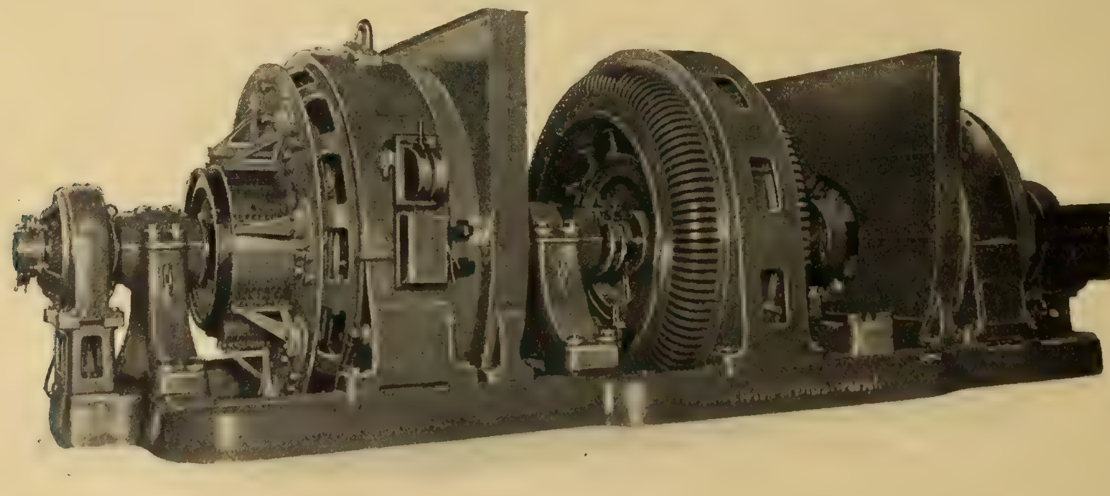
There are a total of 32 transformer units for stepping down the power supply from the 100,000-volt transmission line to 2,300 volts as required for the synchronous motor-generator sets. These transformers will be installed in 14 sub-stations, which will furnish power for the entire electrification from Harlowton, Montana, to Avery, Idaho. There are 23 2,500-K.V.A. and nine 1,900-K.V.A. units located.



High-voltage Direct-current Switchboard, for Railway Sub-station.

These transformers are all of the 3-phase core type, with a ratio of voltages of 102,000 to 2,300. For regulating purposes taps are provided for 97,200 volts and 94,200 volts. Taps are also brought out on the secondary windings to give 1,150 volts or half voltage for starting the motor-generator sets.

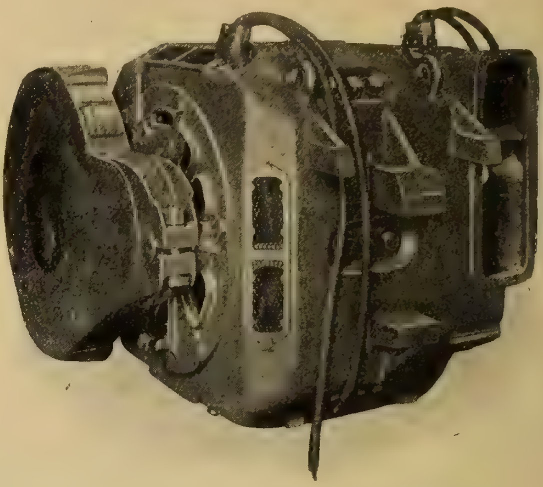
The transformers are oil-cooled and the tanks are of the tubular type, the main body consisting of steel plate with tubes welded to the side of the tank at the top and bottom, giving absolutely oil-tight joints. An air drier and breather is attached to the tank, so that all interchange of air between the interior of the tank and the outside must take place through this channel. This dryer is provided with chambers containing a moisture-extracting medium, thereby preventing the entrance of moisture to the tank.



2,000-kw., 3,000-volt Direct-current Motor Generator Set, C. M. & St. P. Railway.

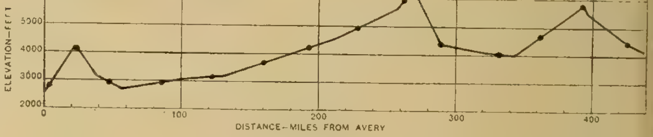
The bushings furnished with these transformers are weatherproof, and, as all joints are tight, they are suitable for outdoor as well as indoor operation. At the top of the high-tension oil-filled leads is a glass cup, which shows the height of oil in the leads. Accessories, consisting of thermometer, oil gauge, and drain valve, are also provided. Each transformer is mounted on flat wheels to facilitate movement for making repairs, and a lifting device is furnished for removing the transformer core.

In addition to the main transformer equipment, each sub-station will be furnished with a standard 10-KW., 3-phase transformer stepping down from 2,300 to 110 volts for the lighting and auxiliary power circuits.



430-H.P., 3,000-volt Motor for Locomotive.

For operating the railway signal circuits, a standard 25-KW., single-phase transformer is being installed in each sub-station, stepping up from 2,300 to 4,400 volts. A portable oil-drying outfit will be used for removing moisture from the transformer oil. This outfit consists of a motor-driven pump, which forces the oil through a filter and the electric drying oven for drying the filter paper. A portable transformer dryer and an oil-testing set will also be supplied.



Profile of Electrified Division, showing position of Sub-stations.

For housing the families of the sub-station operators, a four-room and five-room bungalow is being constructed at each station, and these will be furnished with light and power from the low-voltage auxiliary circuits.

Work on the construction of the forty-two 282-ton locomotives for this electrification is progressing rapidly at the General Electric (U.S.A.) and American Locomotive Cos.' works. The first complete locomotive was placed on the test tracks early in September, and shipment was made, as scheduled, on September 25th. This locomotive has been taken in charge by the railway company at Chicago, and is now being exhibited at various points on the Chicago, Milwaukee, and St. Paul system, under the direction of Mr. C. A. Goodnow, assistant to the president. A complete set of tests indicate that the locomotive will easily exceed the expectations of the designers.

The actual weights of the completed freight unit are as follows:—Total, 564,000 lb.; on drivers, 448,000 lb.; per driving axle, 56,000 lb.; per guiding axle, 29,000 lb.

Twelve of the locomotives on order are geared for passenger service, and the remaining 30 are geared for freight service. Both freight and passenger types are equipped for regenerative braking, this apparatus being under control of the engineer. All of the passenger locomotives and several of the freight locomotives will be equipped with oil-fired steam boilers for heating the passenger trains. This equipment will include ample storage tanks for oil and water.

ELECTRICITY SUPPLY IN CHINA.

In the course of his presidential address to the Birmingham and District Electric Club, part of which we abstracted last week, Mr. W. G. L. Riddle said that in the settlement of Shanghai it would be very difficult to find a dwelling-house of any size that did not have its electric fans, and, needless to say, electric light in every room; he was never in any house in Shanghai that was not lighted by electricity. Sometimes one would find gas, but only to heat the geysers for the baths.

The popularity of electricity for power was undoubtedly due in great measure to the liberal terms upon which motors could be hired from the department without additional charge for installation or maintenance. A 5-h.p. motor was hired at a rental of 15s. per month, and other apparatus at proportionate rates; as a consequence, but few motors were owned by consumers, who were thus relieved of the responsibility of maintenance or renewal.

The major portion of the street lighting, representing a load of approximately 290 kw., was carried out upon the constant-current series system, incandescent metal-filament lamps and also the nitrogen-filled half-watt lamps being utilised where high-power units were required. Current for the series circuits was supplied through the medium of constant-current transformers, having a 2,000-volt primary winding which induced a constant current of 4 or 7 amperes (as required) in the secondary winding. These automatic transformers were eminently satisfactory, and the system offered the advantage of a great saving in copper, inasmuch as the section of wire necessary to supply some 200-300 lamps was limited to that required to carry the current value adopted. In practice the limit was fixed not by the electrical carrying capacity, but by the mechanical strength of the wire necessary to allow of overhead spans 50 yds. in length. Short circuits upon the system caused no damage, inasmuch as the maximum current available was that required by the lamps and was automatically regulated. The low current to be transmitted, and, in consequence, the low copper losses, allowed of the central control of the lighting of districts, all circuits being brought to a common distributing centre and controlled from that place.

All main roads were lighted by 4-lamp cluster fittings suspended in the centre of the road. Pole brackets were utilised for streets of lesser importance, and also upon tramway routes.

The number of existing and proposed supply undertakings in China was legion; the Chinese were essentially a commercial nation, and, as individuals, thoroughly alive to the potential value of electricity supply as an investment. This value particularly applied to the tropical and sub-tropical districts, where fans were essential to ordinary comfort during several months of the year, and where any heat-producing illuminant would add to the very material discomforts already present. Also, the Chinese were rapidly becoming keenly alive to the manifold possibilities of electrical driving for all industrial ventures requiring power. Another factor was the absence of a Board of Trade, or any form of administrative control which would tend to impose "capital sinking" restrictions or discourage enterprise. In rare cases where overhead distribution has been permitted in Britain by the Board of Trade, the elaborate guarding arrangements insisted upon have seriously reduced the capital saving effected over an underground system, and the "danger to public safety" bogey had been worked to a shadow. In this connection Mr. C. S. Taylor, during three years' association with extensive overhead transmission and distribution systems in Shanghai and Hankow, carrying pressures up to 6,000 volts, was unable to record a solitary accident attributed to the falling of aerial cables, though these systems had been subjected to extremes of temperature and to typhoon gales of a force unknown in Great Britain; further, they were in operation in intensely congested districts where the population reached the limit of density per unit of area. Apart from considerations of low capital expenditure associated with overhead transmission, the ease and speed with which extensions could be carried out were a revelation to anyone who had previously been accustomed to the more ponderous expansion of an underground system. Also, faults were as rare as their location was simple, which feature was of paramount importance to any undertaking supplying energy to large industrial concerns working under a penalty clause in case of failure of supply.

The absence of an authority having equivalent power to the Board of Trade in connection with the framing and enforcement of rules and regulations governing electricity supply, had two aspects. While certain requirements of that body were somewhat irksome by reason of their questionable necessity and capital spending requirements, China would ultimately benefit by the introduction and enforcement of temperate regulations drawn up with a view to ensuring a reasonable degree of safety, consistent with obtaining the maximum useful service for the minimum capital outlay. Such regulations must, inevitably, come into operation sooner or later. The influence of an expert engineer invested with powers somewhat equivalent to those of a L.G.B. inspector would tend to keep in check the exuberance of non-technical promoters of unsuitable and inefficient systems. An undertaking which held the concessions for the supply of an important industrial town in Central China, the potential value of which was unquestionably very great, continued to be administered in defiance to all accepted engineering practice and entirely without regard to the splendid opportunities which the future held. Picture a plant with a capacity of about 1,100 kw. running non-condensing and minus economisers, or any efficient feed-water-heating arrangements; running with a coal consumption of 14 lb. per B.O.T. unit generated, and a load factor of 9 per cent., having a scale of charges which was such as to render the utilisation of electrical energy for power purposes unthinkable. This undertaking was undoubtedly but one of many in China which were stifling electrical progress in its infancy and making the task of those interested in electrical plant importation a difficult and disheartening proposition.

Another very potent factor was, undoubtedly, the long credit and extended payment systems adopted by Continental firms. Open to criticism as this system was, it was as certainly indirectly responsible for a large proportion of the engineering enterprises which the Chinese had undertaken. While in China, he was informed of a case of a 10,000-spindle electrically-driven cotton mill which was built and equipped without any expenditure upon the part of the nominal owners, the whole of the plant being supplied under an arrangement whereby the cost of the same was to be met by the surplus revenue (if any) after payment of a fixed minimum dividend. Such was the faith of the factors of the plant in the possibilities of the cotton industry in China.

This combination of factors had resulted in the evolution of supply undertakings whose systems of supply were as varied as they were numerous. In the majority of cases, consultants had been an unknown quantity, their functions being carried out by the firm able to put forward the scheme which appealed to the minds and pockets of the non-technical promoters. Hence, the chaos of pressures, systems, and periodicities; hence, also, the finding of a direct-current supply endeavouring to fulfil the requirements of a scattered area, and, conversely, an alternating-current high-tension system dealing with a compact town. It must be confessed that this state of affairs was not altogether due to lack of technical advice, but could be ascribed, in many cases, to a desire to unload semi-obsolete plants upon those who had, knowingly, placed themselves in the hands of the vendors; for this reason, there might be in the future an extensive and remunerative field open for consultants in China. The serious question of multiplicity of systems had occupied the attention of the Standardisation Committee appointed by the Engineering Society of China, and many valuable data, experience, and opinions had been collected. The conditions associated with the administration of the Republic were at present, however, such as to make any representations upon this subject premature and of little avail in dealing with the problem.

Lamp Posters.—The General Electric Co., Ltd., has issued a new Osram design for posters, postcards, catalogues, &c. It represents a gasfitter whose occupation is obviously gone, contemplating a brilliant Osram drawn-wire lamp. Posters and showcards, lithographed in 10 colours, will shortly be available, and in a few days' time a small folder and a quarto-size four-page list of the lamps will be ready for distribution.

Electric Steel in Germany.—According to data published by Dr. K. G. Frank (American representative of the Siemens-Halske & Siemens-Schuckert concerns), the total production of electric steel in Germany in 1914 was just on 90,000 tons, and only 5,800 tons less than the total output of crucible steel. The total output of crucible and electric steel was 184,400 tons. Twenty electric steel plants were in operation, 10 having Siemens-Halske furnaces, seven Héroult furnaces, two Nathusius furnaces, and one a Keller furnace. Of these 20 installations, eight are producing high-grade electric steel to supplant crucible steel, and the remaining 12 use the electric furnace to melt ferro-manganese. A number of steel-works are said to be contemplating the installation of electric furnaces. Of a total of 44,000 tons of electric steel produced in furnaces controlled by Siemens-Halske, 34,400 tons were made in induction furnaces, 7,400 tons in Girod furnaces, and 2,250 tons in radiation furnaces. Four of the works producing high-grade electric steel use only induction furnaces, two employ Girod as well as induction furnaces, and two use only Héroult furnaces. As regards the 12 plants used to melt ferro-manganese, four are of the induction type, three are Héroult and two are Keller furnaces, whilst one each of the Rombach, Girod and Nathusius types are employed.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

NEW ZEALAND.—The Board of Trade have received from H.M. Trade Commissioner in New Zealand copies of certain resolutions which have been introduced into the New Zealand House of Representatives, and which propose to amend the rates of duty leviable on certain articles on importation into the Dominion, with effect from August 26th, 1915. Among the amendments are the following:—

The heading "Gas engines and hammers, and oil engines, and motor engines for bicycles" (formerly dutiable at 20 per cent. if of foreign origin and free if British) becomes "Gas engines, hot-air engines, and oil engines, all kinds," and the rate of duty has been altered in the case of British goods to 10 per cent. *ad valorem*; the duty on foreign goods remains the same. It is stated by H.M. Trade Commissioner that it is understood that the heading "Gas and oil engines" includes all internal-combustion engines, stationary and marine engines, and not only engines for motor bicycles and cars.

The duties on electric machinery and appliances, viz., electric generators and electric motors, including slide rails therefor, electric lamps, and electric transformers have been altered from 15 per cent. for foreign goods and 10 per cent. for British goods to 20 per cent. for foregin goods, the rate for British goods remaining the same. This item previously included "electric lamps, including globes for arc lamps."

The Minister of Finance in his Budget speech stated that it would be proposed to place a duty of 50 per cent. *ad val.* on all importations from countries that are enemies of the British Empire, excepting such goods as may be exempted from time to time by Order in Council.

The Government have declared zinc plates, rolled, plain, in the rough, not bored or otherwise worked, to be free of duty.

AUSTRALIA.—The Government have decided to prohibit the importation of "Electric or magnetic belts, or any belt which is alleged or intended to produce a therapeutic effect by electric or magnetic influences."

RUSSIA.—The following goods have been added to the list of those for which certificates of origin will not be required on importation into Russia: Carbons for electro-technical purposes; india-rubber, prepared or manufactured; copper and other similar metals in bars, rods, and sheets; manufactures of these metals and alloys, viz., articles not ornamented in relief, not engraved, and stamped articles, even if combined with wood, iron, tinplate, leather, or other common materials; cast-iron wares in the rough or worked; iron and steel manufactures wrought, stamped, moulded not specially mentioned; forged rails; steam boilers, and similar apparatus; also all unspecified manufactures of sheet-iron or steel; iron and steel manufactures (unspecified), worked, turned, polished, ground, bronzed, or otherwise elaborated, even with parts composed of wood or of copper or copper alloys; wire of copper or copper alloys, aluminium, nickel, cobalt, bismuth, cadmium, etc., or chrysocolle, tombac, argentan, Britannia metal, etc.; manufactures of wire of such metals and metal alloys; electrical cables of all kinds; machines and apparatus, complete or incomplete, fittted together or in parts; instruments and apparatus, astronomical, physical, chemical and mathematical, geodetical and drawing; instruments, etc., for medical purposes, manometers, vacuometers, indicators and measuring apparatus, electrical current interrupters, commutators, safety cut-outs, holders for electrical incandescent lamps, rheostats and commutators of all kinds, fitted together or in parts, telegraphic and telephonic apparatus, electrical and pneumatic bells and accessories for electrical signalling; electro-technical measuring appliances (ammeters, wattmeters, voltmeters, and calculators).

BASUTOLAND, BECHUANALAND PROTECTORATE, AND SWAZILAND.—The tariff of the Union of South Africa has been obtained in these districts, with effect from March 5th, 1915.

NORWAY.—The exportation of the following kinds of lead and lead wares from Norway has been prohibited: Lead unworked and lead alloys unworked; scrap of lead and lead alloys; lead and lead alloys worked, viz., plates, rolls, tubes, and paintless tubes, wire, rods, and lead work. It has also been decided that goods which are not covered by any special prohibition of export shall not be allowed to be exported from Norway if they are produced, wholly or in part, from raw materials the exportation of which is prohibited, and if it is evident that the goods have been produced in order to render it possible to export the raw materials or semi-manufactured articles used in their production. The notice states that the Customs authorities are to decide whether particular classes of goods sought to be exported come within the scope of this general prohibition.

SWEDEN.—Exportation of the following goods has been prohibited as from September 25th:—Rubber, in solution or in the form of paste (but not rolled into sheets or further manufactured), with or without admixture of other substances, such as sulphur, graphite, and resin; also artificial soft rubber; manufactures of soft rubber, with the exception of transmission and driving belts and of rubber boots and shoes; manufactures of hard rubber (ebonite, etc.), even if in combination with other materials.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

14,696. "Spark-gap arrangements for oscillatory circuits." Siemens & Halske Akt. Ges. October 18th. (Convention date, November 23rd, 1914, Germany.) (Complete.)

14,729. "Arrangement of circuits for the transmission and reception of ether waves, *e.g.*, those used in wireless telegraphy." A. W. Long. October 19th.

14,734. "Sparking plugs." F. A. L. Johnson. October 19th.

14,742. "Telephone exchange plugs and the like." A. Marr. October 19th.

14,746. "Electric heating apparatus." Automatic Telephone Manufacturing Co., Ltd., & C. H. Archer. October 19th. (Complete.)

14,769. "Wireless signalling systems." British Thomson-Houston Co., Ltd. October 19th. (General Electric Co., U.S.A.)

14,783. "Electric stoves." J. D. Crary. October 19th. (Complete.)

14,790. "Device for facilitating the engagement of trolley wheels with overhead trolley lines." H. Lowe. October 19th. (Complete.)

14,803. "Electric cable bracket and bolt." R. Woolley & S. Timmins. October 20th.

14,819. "Internal-combustion engines having electrical accessories." J. B. Ferguson. October 20th.

14,851. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and G. J. Ralph. October 20th.

14,864. "High-frequency generators." J. Gell. October 20th.

14,881. "Sparking-plugs." R. Colin. October 21st.

14,885. "Dynamo meters." Heenan & Froude, Ltd., H. Heenan, and G. H. Walker. October 21st.

14,895. "Magnets for/of magnetos." M. Pedersen. October 21st. (Divided application on 9,054/15, June 21st.)

14,896. "Make-and-break mechanism for/of magnetos." M. Pedersen. October 21st. (Divided application on 9,054/15, June 21st.)

14,897. "Armatures or cores for/of magnetos." M. Pedersen. October 21st. (Divided application on 22,741/14, Nov. 19th.)

14,898. "Armatures or cores for/of magnetos." M. Pedersen. October 21st. (Divided application on 9,054/15, June 21st.)

14,915. "Leading-in conductors." British Thomson-Houston Co., Ltd. October 21st. (General Electric Co., U.S.A.)

14,941. "Electric and gas lamps." L. H. Pearce. October 22nd.

14,955. "Electro-magnetic pumps." E. Bachelet. October 22nd.

14,965. "Telephone headpieces." S. G. Brown. October 22nd.

14,993. "Magneto-electric machines for ignition in internal-combustion engines." M. S. Conner. October 23rd.

14,994. "Spooling machines, specially applicable for winding coils for electrical apparatus." W. McGee & Son, Ltd., and A. G. Walls. Ocotber 23rd.

14,995. "Contact making and breaking devices of magneto-electric machines for ignition in internal-combustion engines." M. S. Conner. October 23rd.

15,008. "Systems of electric ship propulsion." British Thomson-Houston Co., Ltd. October 23rd. (General Electric Co., U.S.A.)

15,010. "Telephone receivers." A. Rosenberg. October 23rd.

PUBLISHED SPECIFICATIONS.

1914.

15,788. Electrical Vacuum Discharge Devices. British Thomson-Houston Co. (General Electric Co., U.S.A.). July 1st.

18,239. Telephone Installations. Siemens & Halske Akt. Ges. August 1st. (August 4th, 1913.)

18,242. Transmission of Electrical Impulses over Telegraph Circuits of High Electrostatic Capacity. G. Musso. August 1st. (Patent of addition not granted.)

18,243. Apparatus for the Transmission of Electrical Impulses in Telegraph Systems. G. Musso. August 1st. (Patent of addition not granted.)

19,446. Protecting Hot-cathode Vacuum Tubes or other devices having similar characteristics from overload. British Thomson-Houston Co. (General Electric Co., U.S.A.). September 4th.

20,453. Manual and Semi-automatic Telephone Systems. Relay Automatic Telephone Co. (formerly known as Betulander Automatic Telephone Co.) and W. Aitken. October 2nd. (Cognate application 22,716/14.)

20,557. Catenary Supports for Electric Conductors. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 5th.

20,650. Apparatus for Generating High-tension Electricity. J. E. James, J. B. Wilkie, A. Kenyon, & W. Torrance. October 7th.

22,721. Speed Governors. Warwick Machinery Co. (1908) (General Electric Co., U.S.A.). November 18th.

22,906. Telephone Call Recorders. D. J. McGauran. November 23rd.

22,936. Regulating Devices for Electric Polyphase Shunt Commutator Machines. O. Imray (Siemens Schuckertwerke Ges.). November 23rd.

23,761. Joints for Metallic Telegraph Posts and other like Posts or Poles. Bullers, Ltd., & H. C. R. Dagnall. December 9th.

23,778. Thermal Switches. G. Wilkinson. December 9th.

1915.

2,148. Telephone Apparatus. W. Martin (K. M. Turner). February 10th.

2,968. Covers or Protectors of Electric Switches or other Electrical Parts or Members, and the manufacture of the same. J. H. Tucker & J. A. Crabtree. February 24th.

4,820. Dielectric Composition. R. C. Sharp. March 29th.

5,174. Microphone. E. M. C. Tigerstedt. April 9th. (April 9th, 1914.)

8,770. Electro-magnetic Make and Break Devices. Soc. Anon. des Etablissements L. Bleriot. June 14th. (July 7th. Divided application on 16,080/14. July 6th.)

9,783. Sparking-plugs for Internal-combustion Engines. Daimler-Motoren Ges. July 5th. (July 6th, 1914.)

Falmouth as a Winter Resort.—An illustrated booklet has been issued by the Corporation of Falmouth setting forth the attractions of the place as a resort for those who, under normal international circumstances, would leave England for the winter. Copies may be obtained from the Town Clerk.

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Vol. LXXVII.] CONTENTS: November 12, 1915. [No. 1,981.

Page
European Electrical Companies in War Time 609
Putting the Loss on the Rates 610
Trade in South Africa 610
The Wire-Drawing Industries 611
Lead 611
Our Trading Opportunities throughout the World 612
Battery Exchange System for Electric Vehicles 614
War Items 615
New Electrical Devices, Fittings and Plant (*illus.*) 616
Correspondence—
  The B.E.A.M.A. and Foreign Firms 617
  The A E.G Meeting 618
  Decimal Coinage and the Metric System 618
  A Noisy Motor-Generator 618
  Trade with Russia 518
  An Invitation from South Africa 618
  The I.E.E. and Alien Enemies 618
  A Contractor's Complaint 619
Legal... 619
Our Legal Query Column 619
Business Notes 619
Charles P. Sparks, President of the I.E.E. (*illus.*) 623
Shanghai Electricity Works (*illus.*) (*continued*) 624
Enlisting and Employment in the Electrical Industry ... 628
Notes 628
City Notes 632
Stocks and Shares 633
Share List of Electrical Companies 634
Market Quotations 634
Decimal Coinage and the Metric System (*illus.*) (*continued*) ... 635
The Relation of Science to Practice in Engineering 637
The installation and Working of Storage Batteries 638
The Training of an Engineer 639
The Stave Falls Power Development 639
Import Trade of China 640
New Patents Applied for, 1915 640
Abstracts of Published Specifications 640
Contractors' Column ... ... Advertisement page xx

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NOTICE.

IN view of the recent Increase in the Postal Charges, our Subscription Rates for Great Britain and Canada will until further notice be increased to £1 1s. 8d. and £1 3s. 10d. respectively.

EUROPEAN ELECTRICAL COMPANIES IN WAR TIME.

THE influence which has been so far exercised by the war on electricity supply works, tramways and certain other electrical undertakings on the European Continent, has been of a varied character, and has depended upon a variety of factors which differ according to circumstances. Among these may be borne in mind the particular country concerned, the location of the undertaking in relation to the actual area of war, the withdrawal for military purposes of large numbers of the employés and the substitution of less skilled workers and of female labour, and the reduction in consumption and traffic on the one hand, whilst on the other an advance in the use of electricity has taken place in some cases for meeting the additional requirements of works or factories engaged on army contracts, and also for affording a substitute for the scarcity of petroleum where formerly used for lighting. At the same time it has to be remembered that, although the war has continued for over 15 months, no single undertaking has yet been able to record the financial results for a complete period of twelve months of war, one or more peace months being generally included in the year's working; and in the case of those concerns whose financial year terminates with the calendar year the former naturally only comprises five months of war time.

It might be thought from the fact that Berlin is one of the principal centres of the electrical and mechanical engineering industries, and is largely engaged on war work, that the consumption of electrical energy in the twelve months ended with June, 1915, would have experienced an increase. But the figures which have just been issued by the Berlin Electricity Works Co., which has hitherto had a monopoly of the public supply in the capital, show that this assumption is incorrect. The consumption, in fact, has declined from 267,589,000 KW.-hours in 1913-14 to 252,762,000 KW.-hours in 1914-15, owing to the war and the displacement of the ratio borne by lighting to power purposes, and the dividend on the ordinary shares has fallen from 12 per cent. to 9 per cent. In the case of the city of Hamburg the outbreak of the war at first caused a large diminution in the consumption, amounting to as much as 25 per cent. in individual months. At the beginning of 1915, however, a perceptible improvement took place, particularly on the introduction of a new tariff for large consumers, but it was impossible to equalise the decline in the first half of the year, and the consumption recorded by the Hamburg Electricity Works Co. is returned at 43,453,000 KW.-hours as against 45,146,000 KW.-hours in 1913-14, and the dividend 8 per cent. as compared with 8½ per cent.

The Alsace Power Station Co., of Schlettstadt, is one of the few undertakings whose works are directly situated with the theatre of war, although its financial year ended on April 30th, 1915. But the effects of the war were only of a transitory character The production, which amounted to 525,000 KW.-hours in July, 1914, as compared with 321,000 KW.-hours in the corresponding month in 1913, receded to 190,000 KW.-hours in August, but after the battles in Alsace the output rose to 360,000 KW.-hours in October and to nearly 400,000 KW.-hours in December. The mains to Markirch and the Weiler Valley were interrupted in August, 1914, but were subsequently restored, no great damage being done to the mains and transformer stations or to the mains and buildings in course of erection. The net profits have not been sufficient to enable the payment of a dividend, but this was also the case in 1913-14. A similar observation in regard to the financial results also applies to the Lorraine Power Supply Co., of Metz, which, being close to the war area, suffered to a greater extent than the undertakings more in the interior of the country. It has also been necessary to postpone until the end of the war the projected extension of feeders and local distributing networks. On the other hand, the Oberhausen Electric Overland Central Station Co., although having been adversely affected by the war, is yet able to pay 6 per cent. for 1914-15 as in the preceding year. But in this instance also the development of feeders and of local networks has had to be postponed.

If there is one district more than another in Germany where a great expansion in the consumption might have been expected it is that of Rhenish-Westphalia, on account of the many collieries, iron and steel works, and engineering works which are located in this particular province. Yet the progress judging from the working results of the greatest undertaking in that area, has been by no means very remarkable. Situated in one case, if not also in two cases, on the pit bank, the value of the connections of the works of the Rhenish-Westphalian Electricity Co., of Essen, increased from 320,000 KW on June 30th, 1914, to 357,000 KW. in the same month of 1915, the number of glow-lamps from 1,300,000 to 1,400,000, and the number of motors from 34,000 to 37,000 in round figures. It was, however, impossible to secure a corresponding augmentation in the consumption, which advanced from 290,048,000 KW.-hours in 1913-14 to 293,002,752 KW.-hours last year. The company also supplies gas, of which 26,895,374 cubic metres were transmitted by means of the long-distance mains, whilst a further 4,350,294 cubic metres were furnished by the company's gasworks at Rotthausen, Borbeck, Mattmann and Dulken. The dividend, which absorbs £200,000, amounts to 8 per cent., as in 1913-14. A smaller undertaking—that of the Berggeist Electricity Works, of Bruhl—also succeeded in effecting a larger turnover, the consumption having advanced from 34,298,000 KW.-hours in 1913-14 to 56,511,000 KW.-hours last year. In this case the company experienced a reduction on the advent of the war, but a considerable increase as compared with the equivalent months in 1913-14 soon took place as a result of the many industries supplied, which were chiefly engaged on war work.

If consideration is now given to the financial results of a number of companies distributed over the European Continent, it will be found that they have in general succeeded in maintaining for 1914 or 1914-15 the rates of dividend which were paid in the preceding year. Even in the case of the Italian companies, whose best results are mostly for 1914, the figures would be less satisfactory than they are were it not for the large use of water-powers in that country, as although Italy did not participate in the war until May, 1915, the coal question has played a part in the economic and industrial life of Italy since the outbreak of the war as it has done in other countries. We give in our War Items a table showing the dividends of a number of companies for the two years.

Although the financial results quoted above are in general favourable, a more definite opinion of the real effects of the war on the companies will only be ascertainable when the working figures for the whole of 1915 or 1915-16 become available.

Putting the Loss on the Rates.

A CORRESPONDENT has informed us that, according to one of our contemporaries, an Irish County Court Judge has laid it down that where a local authority is running a municipal electrical undertaking at a loss, the loss must be made good, not out of the rates, but by raising the price to the consumer. It is pointed out "that if future new undertakings are restrained by law from deriving any support from the rates, and have to increase the tariffs of electricity supply to an extent sufficient to recoup the initial losses, it will be almost impossible to develop any new undertaking." Whatever the result of this alleged decision—which is said to have been pronounced two years ago—we should very much like to see a full report of the facts, arguments, and judgment, before accepting it as final. So far as can be ascertained there is nothing in the Electric Lighting Acts, 1882, 1888, 1899 and 1909, which, with a slight variation referred to in Sec. 37 of the Act of 1882, apply to Ireland, which in any degree controls the action of a local authority in the matter of charges for electricity. It is presumed that the matter came before the County Court Judge by way of an appeal from a surcharge or disallowance of something improperly charged upon the rates; but even in that case we fail to discover anything in the Public Health Acts which confers such a power upon an auditor or any other person.

Trade in South Africa.

ON another page we print some extracts from a report on the trade position in South Africa, by Mr. H. E. Gauntlett, who is acting as H.M. Trade Commissioner for the Union now that Sir Sothern Holland has joined the Home Staff of the Board of Trade. A perusal of this illuminating report, which comprises over 100 pages, will repay any manufacturer or exporter. The very much greater extent to which British firms have taken advantage of the organisation of H.M. Trade Commissioner's Office since the war began proves, to Mr. Gauntlett's mind, that one of the most apparent failings of the British manufacturer lies in deferring his efforts until the position is critical, instead of taking early steps to prevent the crisis. German trade was as worthy of capture years ago. In this connection some pointed remarks are contained in the Report as to the necessity for catering for the exact needs of the market. The British manufacturer may see no good or immediate reason for reducing the high quality of his output, or varying his standards, to meet the demand of a new market which is not educated up to purchasing a superior article.

But it can easily be understood that a firm whose turnover in the "up-country" (or native) trade of, for example, the South African market, has been enormous, will have made a name amongst the big importing firms. When, in due course, the importers demand a better quality of the articles they have handled so successfully in the past—which demand must arise from the steady improvement in the standard of living—they will naturally give to their regular oversea suppliers the first opportunity to satisfy their new requirements, and they will rarely find that a foreign firm cannot supply such needs. To this condition of affairs Mr. Gauntlett attributes the decline of trade in many lines experienced by British firms in the past few years.

When in August last year Germany's trade campaign was brought to a sudden stop by the outbreak of war, H.M. Trade Commissioner assured the Chambers of Commerce throughout South Africa that British manufacturers were making concerted and unprecedented efforts to capture in the South African market the trade which hitherto had gone to Germany and Austria; and that these efforts comprised not merely improved organisation but the manufacture of goods practically identical with those to which the market has become accustomed. The Board of Trade here has been giving our manufacturers an opportunity of inspecting samples of German and Austrian goods which have succeeded in such markets. The question arises then: will British manufacturers stand by the Commissioner's assurances by seizing the first opportunity of suiting their output to this market's requirements, and thus show their appreciation of the practical assistance which has, in this connection, been given ungrudingly to British trade by certain South African firms?

Germany's exports to the Union in 1913 amounted to £3,500,000. This is obviously worth adding to the figures of any country in a position to manufacture the goods. The American pre-eminence in labour-saving method—which goes far to counterbalance Germany's cheap labour—is enabling the United States to reap a rich reward at this juncture. Mr. Gauntlett's view is that the American share in South African trade is mainly limited by her lack of direct steamship communication.

We do not wish to revive the cry: "Business as Usual," whilst the engineering trade of the country is rightly devoting itself almost entirely to war work, but in view of Mr. Asquith's recent warning as to our vanishing export trade, we feel justified in emphasising the point Mr. Gauntlett makes, viz., that, in allowing the South African market to be controlled increasingly by foreign suppliers of "cheap" lines, British manufacturers will be adding to the strength of their competitors, which strength may be in due course diverted to opposing the position now held by British firms in the markets of the United Kingdom, the Continent, and elsewhere.

The Wire-Drawing Industries.

Now that nearly all the most important wire-drawing firms in this country have been put under Government control, it is generally expected that the demands for supplies from private sources, which in some sections have tended to diminish slightly during the past month, will show a further small decline for the next few months. For the greater part of the past 12 months every wire-drawing establishment throughout the country has responded to the demands of the War Office and Admiralty, with results highly satisfactory to all concerned.

In consequence of the disorganisation and upheaval under which trade generally has been labouring during the past 12 months, it has proved no easy matter for wire manufacturers in this country to look adequately after the interests of their old customers who have no war claims for preference in the matter of deliveries. Every effort, however, has been made, often at great inconvenience and expense, to meet the requirements of this section, with the smallest possible delay.

As soon as the end of the war is within measurable distance, every effort will, doubtless, be made to forestall German and American competition in the wire trades, by adopting, throughout the home markets in particular, a still more comprehensive and effective system of personal representation than was in force prior to the war. Recent inquiries have shown that several of the chief competitive German wire-drawing firms had more agents in this country alone, prior to the war, than some of the British firms had throughout the world.

That the German system cannot be regarded in the light of a failure, or anything approaching that state, is largely proved by the past heavy exports from Germany into this country, of copper goods for electrical purposes, and it would appear not unreasonable to expect a still more vigorous attack to be directed at these valuable markets as soon as normal working conditions are restored after the war.

This attempt of the German firms to recapture their lost export trade with this country will certainly be characterised by entirely new methods when the time for action has arrived; and although the name German may be anathema in this country for many years to come, means are, we hear, being fully provided for to meet this contingency, by adopting the new plan of campaign already indirectly hinted at above. These ulterior designs on the part of the German firms, however carefully planned they may be beforehand, will probably be effectively frustrated by, among other measures, the adoption in the future by every important wire manufacturing firm in this country, of a still more adequate and comprehensive system of personal representation in every market throughout the United Kingdom.

Lead.

The market has kept up a good deal better than most people in the trade anticipated would be the case, but the fact is that lead is coming forward in disappointingly small quantities, owing partly to the shortage of labour which is making itself felt in Australia, and partly to the excessive difficulty in obtaining freight, the result being that material is being held back in the countries of origin. Until more reasonable conditions obtain in the shipping world the position in this respect is not likely to undergo any improvement. The October imports were 14,796 tons against 17,435 tons last year, making the total for the 10 months 213,192 tons, an increase of about 30,000 tons on the year, while at the same time there has been a big falling off in our exports and re-exports. The balance is undoubtedly going into the supply of munitions, and the demand for lead for this purpose must be on a larger scale than had ever been contemplated. The buying for Russia has been on a colossal scale, and this still goes on, but owing to the vagaries of our authorities there is no knowing when the lead may be permitted to go forward. First there is the difficulty of obtaining permits, to say nothing of the vexatious and unnecessary delay which occurs in granting them. Then when the permit is obtained, it is quite a common thing for the steamer on which freight room has been engaged to be commandeered.

In despair at this perpetual raising of difficulties, attempts have been made to divert the lead from Archangel to Vladivostock, but this move on the part of merchants anxious to supply Russia with munitions seems likely to be effectively frustrated by the commandeering of Vladivostock steamers. It is quite certain that Russia cannot fight without munitions, and it is equally certain that a bad impression is being created by the ceaseless difficulties put in the way of her obtaining material. The home trade here is, of course, consuming huge quantities for munitions, as has been said, but the general trade demand is decidedly quiet. Should it happen that the large quantities of lead held up because shipping facilities to Russia are so seriously curtailed must be resold, there would certainly be a substantial break in the price, but meantime the American market has moved sharply upwards, and the general position defies solution, for everything is chaotic. During September the price of soft foreign lead for prompt delivery ranged between £24 15s. and £26, and forward between £22 10s. and £23 10s. a ton.

OUR TRADING OPPORTUNITIES THROUGHOUT THE WORLD.

It has been remarked in certain high quarters abroad that the Central States of Europe have, by their deliberated efforts to dominate the world, thrust civilisation backward by one hundred years. While bloodshed and carnage continue, while the fires of Europe not only remain unquenched but actually spread and bring new combatants into the conflict, it is not surprising that there should be some to give way to sentiments or statements of that kind. But we may wonder whether those who express such an opinion have any very definite idea of what they mean by "civilisation." Our feelings in regard to the future and what it will bring may be influenced very considerably by our conception of the true meaning of the word. If we mean that what the last fifteen months has revealed to us as German *Kultur* is civilisation, then we may hope that the prophecy is correct, for the world of to-day has no room for that abomination. But if by civilisation we mean the general development of the human race and the progressive utilisation of the earth's resources by the practical applications of engineering science, industrial operation, and commercial enterprise, then we think that the forecast is one which may be disregarded. Whatever may be the effect of the present warfare among Christian nations upon the minds of those whom we generally describe as Heathen; whatever may be the loss sustained through a number of great nations sacrificing millions of their physically fittest, the flower of their manhood, and among them potential students and thinkers in many important departments of activity; whatever may be the consequences of it all to particular empires and emperors; whether the map of Europe be materially altered or not—one thing seems to us to be certain, that all the changes that may be introduced cannot take us back again to the state of things that existed one hundred years ago. We may, perhaps, get back to simpler living, may be controlled by the pursuit of higher ideals than we had a year or so ago, may perhaps have freedom from the oppressive menace of ambitions for world conquest, may be free to devote ourselves more assiduously to the arts of Peace, but we shall not go back to a world that possessed little knowledge of the elementary principles of steam generation, that knew not the laws of induction, merely played at the utilising of falling water, knew nothing to make it discontented with a rush light or a gas jet, had few railways and no telegraphs or telephones, and lived what now we should most of us regard as a monotonously sleepy and uninteresting sort of existence. The world, or the greater part of it, will inevitably be poorer for a time as a result of the terrible waste of thousands of millions of money, but who shall say that when there shall have passed away the first shocks of the return of statesmen, armies, navies, and peoples to ordinary avocations in years of Peace—God grant it may be unbroken in the aftermath of the huger conflict, by a succession of smaller ones—the development of all countries shall not leap forward once again? Of course, new development must be held up for a time; we cannot take up the thread of industrial world enterprise exactly where it was broken just over a year ago. Many schemes have been deferred; some of them will never take the form intended in the pre-war days; there will be much of change, and some of the countries of the world which looked to Europe for money and equipment and expert knowledge must hold up their cherished plans for a time. But it will only be for a comparatively brief period—not one hundred years, perhaps far less than one-tenth of that period. All the manufacturing nations will be, as a matter of sheer necessity, obliged to overrun the world again in their efforts to keep factories in operation and to repair their respective national losses. The rehabilitation of devastated lands and ruined cities will make huge demands, and somebody will have to pay indemnities; but notwithstanding these reconstructional operations and financial manipulations the world will not be stopped in its clamouring for progressive development. Can it be imagined, for instance, that our great Colonies and dependencies will remain at a standstill, with all the germs and possibilities that lie within them as the outcome of enterprising measures of the last few decades? Can it be supposed that the vast market of China will return to slumber after the awakening westernising movements of recent times? Can it be thought that the engineering lessons of this war will leave the vast resources of Russia still unutilised? Is it to be supposed that with America's manufacturing ability unhindered, with her taste for foreign effort in trade made keener, with her money-bags well filled, or with our own manufacturing capacity enlarged as the result of factory extension for war purposes, and with the large accession of formerly unemployed or unskilled labour into the ranks of, more or less, skilled working life of this country—things of the development class are going to be at a standstill? Even this mere cursory statement of the case is its own answer to the suggestion of a century set-back.

It may reasonably be supposed that in some countries it will not be easy to raise money for large enterprises such as the world will be calling for, and in this matter of future finance we can only see through a glass darkly. We are not all able to remember it, but many do, and for all of us it is in the records, that after the Franco-German struggle of just over forty years ago, France recovered her position in a remarkable and unexpected manner. That was only a small affair, comparatively speaking, and what is happening now must have farther-reaching effects, but they will be spread over many countries, and the recovery may be more rapid than the signs may lead us to anticipate.

It is interesting to fall back for a few minutes into the frame of mind that was ours five or six years ago, when we tried occasionally to conjure up before our imagination the vastness of the opportunity that scientific and engineering discovery and achievement, and the general forward movement among men everywhere, seemed to be opening out to us. At that time we endeavoured in these pages, as we have done consistently ever since, to keep the larger outlook in the mind of the British manufacturer and trader, and to induce those having responsibility in these departments of electrical and engineering work to lay themselves out to take advantage of the occasion. In those days the influences of German industrial and financial competitors were gathering considerable strength, and if we could have presented a massed army of operators in the fields where they were active, and could have protected our reputation and our interests against the enemy's insidious attacks and deeply-laid machinations, and could have re-arranged our home manufacturing facilities, supported with adequate financial co-operation, we should not have to hear the stories that reach us of the success which has been attending our rivals' efforts. The tentacular hold of the enemy upon the markets where merit for merit we ought to have held sway, or at least progressed along the lines started by our enterprising forefathers in those fields, would have been a less harmful thing than it is to-day. Our brave Colonial forces under Botha have smashed German influence in Africa; the British flag floats gloriously in other once-German colonies; and our magnificent Navy has swept the seas clean of German ships. But neither military nor naval effort can directly sweep out the influence of the Teuton in many of the countries where his active and thorough agents have secured concessions, developed interests, and nursed the people's customs, fostering and satisfying their needs, until to-day German trade has made itself almost as great a menace commercially as the enormous German military forces were generally to the liberties of the entire world. But we did not organise, we did not co-operate, we did not tackle the situation whole-heartedly—perhaps we could not, perhaps we were short of money, perhaps the profits of British electrical manufacturing left us too small a margin, perhaps the Continental connections of some of our firms rendered big co-operative or amalgamated schemes impossible—and now we have got to deal with those markets in ways best suited to the prevailing and prospective situation. Let us hope that somehow the Government will come to our aid with export bounties and with a more generous attitude toward technical attainments; or let us suppose that the enemies will have to pay so heavily that they will have to loosen their hold on some undertakings where their bands have been growing tighter; or let us hope that the anti-German sentiment will assist us in many parts of the world. These things, or some of them and possibly some others, will probably operate in our favour. But is there a British manufacturer to-day who thinks that they will suffice for the needs of the approaching times, without some real, thorough-going effort on the part of the whole British electrical and engineering industries? The time for many little costly efforts to win the world has now passed away. What shall we do to be entirely ready when there shall have burst in Germany that last British or French shell which shall precede the call for a truce, to be followed by Peace, when the last miserable German shall have outraged common decency, the last devilish Zeppelin shall fail to return to its den, when the hope of Von Tirpitz shall have gone down with his last submarine, or the starving hosts of the Central Empires shall have stormed the strongholds of Prussian militarism?

We fully recognise the difficulties that stand in the way of efforts to immediately deal in detail with the trade position as we shall find it at the close of the war, but we are still of opinion, as we have been for the past twelve months, that during war-time we must elaborate our schemes for peace-time. Certainly those who can afford to be active now will stand to gain most when, later on, our private manufacturing and exporting activities are less restrained. It is our desire to assist to the full limit of our power, any organisations and firms which may be occupied with deliberations in this connection, and to that end we shall publish during the next few weeks a good deal of information that has been prepared by expert observers, consuls, and others, in markets in which we may hope to stand better in future than we have done recently. Whatever may be the shortcomings of our Governmental commercial and consular services, we shall commit a great error if we shut our ears to the advice that our representatives are giving us just now. We begin this week by publishing an abstract of the report of H.M. Acting Trade Commissioner in South Africa.

TRADE IN SOUTH AFRICA.

Mr. H. E. Gauntlett, who is in charge of the office of H.M. Trade Commissioner for South Africa, has written a highly interesting report on the trade of the Union (and Rhodesia) for the year 1914. This has just been issued by the Board of Trade,* and below we summarise the portions of it which concern the electrical manufacturer and contractor.

By separating the trade returns for the months preceding the war from those for August to December, and making a comparison with the corresponding periods respectively of 1913, it is evident that the trade of the country up to the time of its outbreak was below normal. The reasons for this are, in their order of increasing importance:—

Drought (especially in the Orange Free State Province).
Slump in the ostrich feather industry.
The aftermath of the January strike.

But the ill-effects of these adverse factors continued, and to them must, of course, be added the two other chief causes of loss of trade, viz.: The European War and the Rebellion in South Africa. The rebellion produced throughout the whole country a feeling of insecurity, and merchants (who were, because of the European war, already sufficiently nervous about adding to their stocks the normal quantities ordered in the past) refrained from indenting to the extent for which they otherwise were prepared. It will be less easy for merchants to recover the trade that might have been done but for the rebellion, than it would have been for them to have maintained the trade that was being done before the local unrest arose. For these reasons, therefore, I do not anticipate that trade in the immediate future will be much greater than it was during the closing months of 1914.

Although the great dependence of the Union upon its mineral production may in certain circumstances prove an economic weakness, the greatness of its mineral wealth has been, in existing abnormal conditions, an important factor in preventing a far more serious crisis than the country was called upon to face.

The percental decreases in imports are smaller in the case of electrical material and miscellaneous machinery than in almost any other class of goods, owing to their close connection with the mining industry. Nevertheless, the drop in the imports of electrical material is disappointing. During the first eight months of the year it had increased by £73,000. The import trade of the last four months altered this amount to a loss of £17,600 on the imports of 1913. The comparative figures are interesting:—

1914 COMPARED WITH THE SAME PERIOD IN 1913.

	First 8 months. £	Last 4 months. £	Total for the year. £
Machinery	+ 73,000	– 90,600	– 17,600
Wires and cable	– 29,500	– 27,000	– 56,500
Fittings and posts	– 8,000	– 24,000	– 32,000
Telegraph and telephone material	– 1,000	– 2,500	– 3,500

Union Government Imports.—From the British exporter's point of view, the Railways and Harbours Department is by far the most important spending department of the Union Government. The Department postponed considerable expenditure which was planned for 1914, including £43,000 on electric cranes at Table Bay. Restriction of Government expenditure on imports is to be faced in 1915, and a decrease may be looked for in expenditure on the establishment and maintenance of general public works. This must of necessity have a detrimental effect on trade generally.

Future Trade.—Although there is need for care on the part of business men, the present depression is mainly artificial. The country has a great recuperative capacity, and cannot help rising in prosperity, probably soon after the difficulties of the immediate present disappear. For one thing, the possibilities of South Africa as a meat-producing and exporting country have hardly yet been realised; when they are, ostrich farmers, many of whom are now growing lucerne, will realise that the ostrich feather slump of 1913-14 was not an unmixed evil. Lack of capital for industrial purposes generally is a drawback which may not soon be overcome, although there is still a considerable amount of money in the Union that could profitably be employed in helping the country forward. The balance due at the end of last year to depositors in the Post Office Savings Banks was £6,300,000. If South Africa avoids the difficulties due to the careless investment of capital, the overburdening of stores with stock, and too heavy immediate borrowing, there is room only for optimism, and there is no adequate reason why the subsequent prosperity of the country should not be ensured, or why British firms should not secure a great share in the increasing import trade that must accompany its progress.

Capture of German Trade.—At the commencement of the European war, the "Capture of German Trade" appealed not as a mere phrase to British manufacturers. In Dominion markets, also, this ideal gripped the imagination of the "man in the street" more than that of the importer. The latter recognised that practical difficulties, not evident to the consumer, would appear as soon as the war was over, since the ideal thus expressed would, of necessity, strike at one of the main principles of commercial ethics, namely, buying in the cheapest market.

Cheap trade is a matter upon which I wish at this point to make myself perfectly clear. It is admitted that a certain quantity of trash comes into South Africa, and is bought by natives and "poor whites," often under serious misapprehension. These are not the "cheap" products referred to when I use this word; what is meant is a cheap grade of a quality compatible with (and sometimes in advance of) its low price—either goods which, in the better qualities, meet the needs of a white population, or those which are used almost solely by natives, but are intrinsically worth the low price paid. No manufacturer needs to be told of the great success that has followed German efforts to cater for this class of trade.

Reasons of German Success.—To account for this success there are many reasons which are difficult to classify, since they are closely inter-related. Finance enters very largely into the matter. Subsidies are known to have been granted by the German Government by means of exceptionally low transport rates upon certain goods for export, and, in addition, there are German trusts, or rings, whose object is the establishment of a strong position in the world's markets, achieved by means of the many advantages incidental to such combines.

One advantage the combines gain is in their oversea organisation. Instead of, say, half-a-dozen travellers being appointed by as many firms to push their several interests in oversea markets, *in competition with one another*, the same number of men are appointed, but work together in the interests of the one combine. This staff is often controlled by a manager in the oversea market, through whom every order passes to the home organisation. It is easy to realise the greater efficiency made possible oversea by this method of working; the value of personal supervision of travellers by a competent head cannot be over-estimated.

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*Wyman's: Price 6d. Cd. 8,073.

At this point it is necessary to refer to one detail practically unknown to British firms who are represented by an agent in the South African market. German combines, and many German firms, send by each mail to their agent or agent-manager a list of orders executed during the week, showing, amongst others, the following particulars:—

$$\left.\begin{array}{l}(a)\ \text{Works or f.o.b. cost; and}\\ (b)\ \text{Price accepted by agent.}\end{array}\right\}(b)-(a)=\text{works profit.}$$

which enables the agent to see at once from former indents (provided that costs of production have not risen in the meanwhile) by how much he can "shade" his price, if necessary, to secure a special order. Such co-operation ensures the mutual advantage of the manufacturer and his oversea representative.

Need for Co-operation.—There are British firms who, through lack of appreciation of the benefits of co-operation, seem to grudge every cheque given to the agent, and who are not anxious, apparently, to assist him at their own immediate expense to increase his turnover for them; it is not to be wondered at if such agents, in time, fail to do their best. This mutual policy of getting as much as possible for as little as possible is, of course, fatal to the interests of both parties. British manufacturers have no right to expect success in the South African market unless they are prepared to believe that their agents, importing firms, and others in a good position to judge, are fully aware of the difficulties to be found in the market, and of its most intimate needs.

Supply the Goods Wanted.—I have laid stress elsewhere upon the vital need for the manufacture by British firms of the goods to which the market is accustomed. Having made clear that the "cheap" lines are not necessarily trashy goods, but merely cheaper grades of lines in many cases already manufactured by British firms, one must repeat that the mainstay of the South African market is goods that meet the requirements of the native and "poor white" populations. In the higher qualities, purchased almost entirely by the European population of the large towns, British manufacturers have, on the whole, a position from which it would be difficult for foreign competitors to remove them. Nevertheless, their present position of security should not lead them into thinking that they are entirely unassailable in their superiority. It is common for one to hear that the British manufacturer is content with the trade in the better-class lines already being done satisfactorily by him, and that he cannot see that it would be to his advantage to gain a reputation for manufacturing cheap and inferior quality substitutes. The fact remains, however, that reputations in this market have, in the past decade, been built up by German firms through the exploitation of these same "cheap" goods, and many of such firms are perfectly capable of turning out the better-quality article as soon as it is demanded, or are already doing so. I am convinced that unless British firms make strenuous efforts to capture this "cheap" trade from Germany at this opportune moment, they will not only find that it will be secured by other countries, or that Germany herself will retain it, but they will be affording their competitors an opportunity to undermine their position in the better-class articles. The statistics of the past few years clearly show that the United Kingdom has lost trade in what may be termed the competitive articles, and is barely maintaining her percental position even in articles which have been regarded as practically British monopolies.

The Danger of Neglect.—Some British firms may find that the whole of their output can be placed satisfactorily within the United Kingdom, in Europe, or in other oversea markets, without their troubling about South Africa, whose requirements, it is true, may not be in lines of the exact quality which they now manufacture. In such case they may be justified in leaving South Africa alone; it is worth while, however, for them to consider the fact that, in allowing the South African market to be controlled increasingly by foreign suppliers of "cheap" lines, they will thus be adding to the strength of their competitors, which, in due course, may be diverted to opposing the position now held by British firms in the markets of the United Kingdom, the Continent, and elsewhere. I cannot come to any other conclusion than that, for the sake of their own security of position in the future, it is worth while now to oppose foreign competition which meets us in *any* market.

South African importers are more sympathetic towards the British manufacturer than they have been for many years. That sympathy will, however, last no longer than the success of the British manufacturer in supplying the needs of the South African market in competition with foreign factories. United States firms have put forward strong efforts through their representatives in this market to capture some of Germany's past trade. Whatever of this trade these firms can capture will strengthen them in their future dealings with South Africa, perhaps at our expense. This is, therefore, a further reason why British firms should capture as much of Germany's trade with South Africa as possible.

Catalogues and Representation.—In the Bureau established in connection with the office of H.M. Trade Commissioner there are about 1,500 catalogues of British firms on file. The bulk of these deal with machinery, although those covering smaller every-day requirements are in greater demand. There is some excuse for omitting prices, etc., from the former, but not from the latter. Yet firms constantly write: "Is there any opening for our goods in your market? Catalogues are enclosed," without prices, discounts, weights, etc.!

The extent of local demand is not, in the great majority of cases, governed so much by the article itself (on account of its being in universal use) as by its price; moreover, its price in the United Kingdom is often only a poor guide to its cost to the importer in South Africa. I venture, therefore, once again to impress upon British firms the need for furnishing H.M. Trade Commissioners with the fullest possible information in this regard. If it is necessary, by all means produce special oversea catalogues. If the trade is worth getting it is worth trouble; if the trouble and expense are too much for the British firm, the foreign firms thinks differently and profits accordingly.

One is glad to say that British firms are becoming more alive to the need for representation, and are finding the benefit. One could detail cases, from actual experience, in which British firms have refused to take official advice on this question, and have emphasised their intention of trading direct or through London export houses. In not a few cases, however, as a result of the energy and activity of prospective agents whose interest I have aroused, orders have been sent to the United Kingdom, and have proved to the firms concerned that direct representation is practicable and satisfactory. Consequently, the United Kingdom firms have abandoned their opposition to direct representation, have appointed an agent at my suggestion, and have expressed themselves highly satisfied with the result.

I want to emphasise the advisability of British firms keeping H.M. Trade Commissioner posted both as to the appointment of South African representatives, and as to any change they may make in their representation.

(*To be continued.*)

BATTERY EXCHANGE SYSTEM FOR ELECTRIC VEHICLES.

One of the papers read at the annual convention of the Electric Vehicle Association of America, last month, dealt with the Hartford Electric Light Co.'s experience with the battery exchange system of commercial vehicles.

The author, Mr. W. M. Thayer, mentions that the company's battery service originated with a circular letter offering to furnish such service for G.V. trucks for any mileage, on which the price would be based. The customer was to be relieved from any responsibility for care of batteries.

The first car purchased for operation on this system was started in June, 1912, and all cars previously sold were changed over to the service as rapidly as possible. In June, 1915, 64 trucks were in use, travelling an average of 47,615 miles a month.

The customer purchases trucks without batteries; the company buys the batteries, charges them, and installs them in the trucks. The company's equipment consists of batteries, the means for charging them, and the apparatus for placing them on customers' trucks.

The odometers on the trucks, with cradles for extra batteries, are also part of the company's equipment. The service consists of charging batteries in cars at night and charging batteries out of cars. The former is done at the garage of the Commercial Electric Co. from 11 p.m. to 7 a.m., a rotary converter and motor generator being installed there. Separate batteries are handled at State Street station, where 31 sets of charging equipment are installed, each comprising an ammeter, Sangamo amp.-hour meter, circuit-breaker, and switch. Edison batteries of standard size and G.V. trucks, fitted with Universal cradles, are used exclusively on the service.

The cradle is an underslung battery container held by four hooks, which is removed from the vehicle by placing it over a hydraulic lift (with a 10 in. travel), a Cowan truck being first run on to the lift platform, so that the battery can be transported on it to the charging room.

Two hydraulic outfits are provided for changing batteries, and the complete exchange of a battery is made in three minutes or less.

No instruments are used on the cars except odometers. All battery charging is based on the mileage covered, with allowance for road conditions. When a battery is removed from a car the odometer reading is taken. The previous reading gives the miles covered, and a slip is placed on the battery showing this distance. The man who places the batteries on charge uses this distance as the basis, multiplying it by a certain constant, depending on road condition, size of truck, etc. The Sangamo meter is set at the number of ampere hours required and runs back to zero, when the circuit-breaker cuts it out.

The voltage of individual cells is followed during the charging and serves as a check on the ampere-hour meter.

The Sangamo meter is practical and accurate, and is certain to take the battery off charge before excessive charging occurs. Batteries are cleaned with live steam at a pressure of 10 or 15 lb.

Data are given showing that the introduction of battery service has tended to increase the mileage covered.

In June last there were 64 cars and 89 batteries in use, ratio 1.4 per truck. In December, 1914, cars on the road represented 1,432 car days, and 1,284 battery exchanges were made, or 90 per cent. of the cars changed batteries every day; for June, 1915, the figures were 1,594 car days, 988 exchanges, or 64 per cent. of cars changed batteries every day.

The power used is measured by wattmeters, and includes all losses in transformation and stepping down.

For December, 1914, the total energy consumed was 57,856 KW.-hours, the mileage covered 40,787, the average energy used, per mile, 1,418 watt-hours.

For June, 1915, the total energy consumed was 50,414 KW.-hours, the total mileage covered 47,615, the average energy used, per mile, 1,058 watt-hours.

The Edison batteries used on the "service" are in some ways subjected to very hard usage. The total number of cells in use at the end of the first period of three years was 5,094, and their service was the equivalent of 113,850 cell months. Seventy-six cells have been returned to the factory for repairs in these three years—44 on account of leaks or broken seams, and the balance of 32 cells for other causes, such as failure to charge up or broken terminals.

Data regarding the operating costs for the "service" are included. These are credited to *operating labour, i.e.*, exchange of batteries, filling, charging, changing solution, etc.; *operating material, i.e.*, distilled water, solution and other battery material; *repair labour, i.e.*, actual battery repairs; *repair material, i.e.*, parts for battery repairs or repairs at factory; *repair service apparatus, i.e.*, labour and material for repairs to charging sets, and extra apparatus required for handling batteries.

	1st yr. Dols.	2nd yr. Dols.	3rd yr. Dols.	3-year total. Dols.
Total operating items ...	3,847	13,505	14,352	31,705
Income	5,543	18,559	26,559	50,662
Per cell per month.				
Total operating items ...	.2885	.3102	.2518	.2793
Income	.4158	.4263	.4661	.4449
Per car per month.				
Total operating items ...	21.61	25.92	20.89	22.87
Income	31.14	35.62	38.65	36.55
Per average mile.				
Total operating items ...	.032	.036	.028	.032
Income	.046	.053	.054	.051

A development of the system foreshadowed is an arrangement with central stations in surrounding towns, so that trucks may make long trips and get boosts when necessary, the charge being made to the company furnishing battery service and a proportion charged to the customer.

WAR ITEMS.

American Electrical Export Trade.—The New York "Electrical World," in a recent editorial on the above subject, describes the figures for American electrical exports as being disappointing, and asks why they are not better. Our contemporary continues thus:—"On the surface it would seem that electrical export trade should have had some kind of boom, unless it has been affected adversely by world conditions cutting down all international trade other than that in weapons of destruction. But the neutral markets of the earth have been opened to us as never before, and our competitors who still enjoy the freedom of the seas are seriously preoccupied. It is generally understood, for example, that in England many electrical factories are busy on munitions of war; and, if that is the case, they cannot be turning out electrical goods as well. Indeed, England itself would be on these terms an excellent source of consumption for our electrical goods and have little left for export. This must apply with even greater force to all central Europe, including France, Belgium and Italy, as furnishers to the markets of, say, the Far East and South America. But when one line of electrical goods alone—insulated wires and cables—accounts for 650,000 dol. gain in the seven months, other branches would not appear to be keeping pace, although some of them bore marks of greater activity. Perhaps we are not going after the foreign trade possibilities as we should; perhaps we don't know how, and have yet the lesson to learn. If so. now is the time to learn it before our European competitors turn again to the arts of peace and with the energy of desperation try to regain lost ground with goods at any old price. The figures of the Bureau of Commerce do not reveal destinations, but it must be true that South America is looking this way and expects to be cultivated by various commercial attentions."

After the War: Two Views.—At the annual general meeting of the Phœnix Steelworks, Herr Beukenberg, the managing director, in the course of a long statement on the position of the company, made the following remarks:—

> What the conditions will be like after the war cannot be conjectured at present. There is, however, no cause for great anxiety, although it is certain that our capital and that of many countries which are our principal selling markets is being weakened. The danger also exists that North America, owing to enormous profits her iron industry is now reaping, will be financially exceedingly strong after the war, and will therefore be able to compete with us accordingly in the world's markets. On the other hand, we have seen that neither North America nor England has succeeded in injuring us with our foreign customers during the war. In any case, in Germany itself there will be much work for our industry after the war which will allow of no postponement, such as the repairing of permanent-way material and rolling-stock, the building of merchant vessels, and the reconstruction of the devastated districts. If the war ends as happily as we hope, the spirit of enterprise will also revive in the building trade.

The following advertisement is translated from the "Kölnische Zeitung":—

> BUSINESS WITH ENEMY COUNTRIES AFTER THE WAR.—After the conclusion of peace many German firms will presumably experience difficulties in creating or renewing business relations with enemy countries. Such difficulties may be minimised or removed *via* Holland, and an experienced Rotterdam merchant, not without means (formerly many years resident in Germany), places his services at disposal. He also undertakes to buy Dutch goods of which the export is permitted.

Then follows the address of an advertising agent in Düsseldorf, to whom replies are to be sent.—"Ironmonger."

Electricity Works and Depleted Staffs.—Rather late in the day, but better late than never, the Minister of Munitions has had his attention drawn to the danger that the country will run if, owing to enlistment, its electricity supply and gas works are left understaffed. The said Minister finds that the work of many munition factories is being imperilled by the difficulties now being experienced by the electrical supply companies and gas companies, which provide them with power and light, in retaining a sufficient staff for their immediate needs. The Minister desires to point out that such companies are engaged upon work of vital importance, and that the removal of their employés even to munition work may frequently have the effect of prejudicing the output of munitions of war. He would at the same time invite employers to assist him in the matter by refraining from attracting labour from these essential undertakings.

Those who have known how real the difficulty and danger have been in some areas for some time past will wonder why the attention of the Minister of Munitions was not drawn to the matter earlier.

Llandudno U.D.C. has not granted Mr. J. E. Evans, second assistant at the electricity works, permission to volunteer for munition work, having regard to the number of men who have already left the department at the call of the State.

Interesting figures concerning men enlisting from various departments of Blackpool Corporation (those still eligible and the number who can be spared), were presented to the General Purposes Committee on November 4th. The Tramways Department has contributed the largest number of men—64—while 37 have gone from the Electricity Department. The Tramways Department can still spare 20, and the Electricity 6.

Criticising the action of the Dundee Town Council in passing a resolution calling for the enlistment of eligible employés, a correspondent asks:—"Have they tried to foresee the effect, as a contribution to war needs, of allowing the skilled staff of the electrical department to enlist? At present a good round dozen of big establishments on shells, khaki, and Admiralty materials, not to speak of sand-bags, would come to a dead stop if a breakdown occurred in this department. The mere lighting consumer or the user of the services of almost any other public department must take his war risks, but the electrical department, with its costly plant, its specially trained engineers, and its commitment to pressing war services is not for playing tricks with, and is even more vital than many controlled establishments whose employés dare not enlist or transfer their services."

The Whitby U.D. Council has passed a resolution deciding to pay the electrical engineer (Mr. J. Piggott) 10s. per week extra during the period of the war, or until the Council determine otherwise, on his undertaking to do jointing and to take one alternate Sunday shift at the power station when necessary. This matter originally rose by Mr. Piggott offering to do the extra work necessitated through a man earning £2 per week having left the works.

Limitation of Output, in War and in Peace.—"Limitation of output as practised by some trade unionists has recently attracted a large amount of attention. It is argued in some quarters that this practice, although it cannot be too strongly deprecated during this period of national necessity, may be very right and proper in normal times. If it is wrong to restrict output while we are at war, it cannot be right to do so in times of peace. In neither case can we afford to decrease our efficiency as manufacturers. When we are at war we must have munitions as quickly as possible, so as to keep our armies properly equipped; in times of peace we require the largest possible output from our machines, so that we may combat our competitors' efforts to supplant us in the world's markets. How any sane person can hope to capture German trade if our workmen are content to receive a day's pay for less than a fair day's work passes one's understanding. We are well equipped by nature for obtaining our fair share of the world's trade. We have good and abundant raw materials and unequalled shipping facilities. The distance between mine, furnace, mill, works, and port is less in this country than in that of any serious competitor. We must supplement these natural advantages by the encouragement of enterprise, industrial organisation, and manufacturing skill. So by deserving success we may obtain it."—"Alfred Herbert's Monthly Review."

Provisional Orders in War Time.—The Board of Trade hereby give notice to parties contemplating the promotion of Provisional Orders in respect of electric lighting, gas and water, piers and harbours, and tramways, that for the duration of the war they will not be prepared to entertain such applications except in cases in which they are satisfied that extreme urgency exists.

European Electrical Companies in War Time.—The following is the table of European company dividends for the last two years, to which reference is made in our leading columns to-day:—

	1913 or 1913-14.	1914 or 1914-15.
Officine Elettriche Genovesi, Genoa	10	10
Società Meridionale di Elettricità, Naples	4	5.2
"Dinamo," Società Italiana, Milan	3	4
Società Idroelettrica Ligure, Milan	8	8
Società Adriatica di Elettricità, Venice	7	7
Società Elettrica Riviera di Ponente Ing. Negri, Milan	6	6
Compania Sevillana de Electricidad, Seville	8	8
Compagnies Réunies Gaz et Electricité, Lisbon	7½	*
Strassburg Electricity Works	11	11
Rheinfelden Power Transmission Works	8	8
German Transmarine Electricity Works, Berlin and Buenos Ayres	11	10
Abo Electricity Works (Finland), Berlin	7	—
Silesian Electricity & Gas Works, Breslau	10	10
Mark Electricity Works, Berlin	5½	3½
Upper Rhenish Power Works, Mulheim	6	—
Konigsburg (Prussia) Electricity Works and Tramways	8	8
Main Power Works, Hochst	5	5
Lech Electricity Works, Augsburg	7½	*
Thuringia Electricity Supply Co., Gotha	4½	4½
Lower Elbe Electricity Works, Altona	4	5
Electricity Supply Co. (Investments), Berlin	12	10
Bavarian Electricity Supply Co., Bayreuth	—	4
Petrograd Electric Lighting Co. of 1886	8	8
"Electrica," Roumanian Lahmeyer Co., Bucharest	9	9
Compagnie Générale d'Energie Electrique, Paris	5	—
Central Swiss Power Works, Lucerne	5	5
Unione Italiana Tramways Elettrici, Genoa	9½	8½
Berlin Elevated & Underground Railway	6	4½
Silesian Secondary Railways, Kattowitz	2½	2½
Bitterfeld Electrochemical Works	10	10
Brandenburg Carbide & Electricity Works, Berlin	—	7
Bavarian Nitrogen Works, Munich	8	*
Brown, Boveri & Co., Baden	5	5
Felten & Guilleaume, Mulheim	8	8
"Motor" Applied Electricity Co., Baden	7	7
"Watt" Co. for Electrical Undertakings, Glarus	6½	5½
Société Centrale pour l'Industrie Electrique, Paris	6	—
Società per lo Sviluppo delle Imprese Elettriche, Milan	7	7
Trustee Bank for the Electrical Industry, Berlin	4	4
Electro-Trustee Bank, Hamburg	5½	5½
Electricity Co. (late Lahmeyer), Frankfort	7	6

* Dividend not yet announced.

Australian Government and its Contractors.—With reference to the statement reproduced in our last issue from the "Melbourne Age," in which allusion was made to the position of Messrs. Falk, Stadelmann & Co., Ltd., we have received from the firm in London the following copy of a cable dispatched by them on October 30th addressed to Mr. Hughes, the Attorney-General:—"Attorney-General Hughes, Melbourne.—If statement made by you is accurately reported in "Argus," September 17th, saying this company is 'almost entirely owned by Germans,' that it is 'masquerading under the guise of British registration,' or 'dominated by German influence,' we respectfully state that evidence produced to High Commissioner, in London, conclusively proves that none of these conditions apply to us.—Falk Stadelmann."

A Fresh German Price Advance.—The German syndicate of makers of weak current apparatus has raised the prices of light electrical engineering apparatus and accessories so that these now stand at 30 per cent. in excess of those prevailing in the pre-war period. As the present increase does not cover the actual cost of production in many cases, the syndicate reserves its right of further advancing the list quotations in any particular case.

Miners on National Service.—The Home Office has issued a notice to coal miners and to surface workers, including electricians and fitters, informing them that the country depends upon them for the success of its efforts no less than upon the men who are serving with the Forces. Those who offer themselves as recruits will only be accepted on condition that they go back to work in the mine until they are called upon. Armlets will be provided. Without coal, victory is impossible.

German Activity in Neutral Countries.—The "Standard" special correspondent in Switzerland says that a characteristic example of pushing German business enterprise which aims at securing financial and, indirectly, political influence in neutral countries, has just been given in the Swiss canton of Berne. With a view to obtaining the contract for the construction of the new electric railway from Haute-Argovie to Seeland, the Allgemeine Elektricitäts Gesellschaft, of Berlin, bought shares in the Swiss company formed to build and work the line to the extent of £3,750, of which £880 had been paid up. But the Swiss Government, on learning of the transaction, intervened, and compelled the directors of the Haute-Argovie company to cancel the sale of shares to the Berlin concern and to refund the amount already paid, with interest at 6 per cent., to the German purchasers. The Swiss Government now makes it known that this step was taken "in the interests of Swiss industry."

Australia and German Trade.—Reuter's agent at Melbourne quotes Mr. Hughes, the Federal Prime Minister, as saying to a deputation that he was wholeheartedly in favour of doing everything in his power to injure Germany, and that the Ministry was considering the question of removing from the register all German trade names.

Aluminium Exports Prohibited.—By an amendment to the Proclamation of July 28th, it is now declared that the exportation of "aluminium, manufactures of aluminium, and alloys of aluminium," which is already prohibited to all destinations abroad other than British possessions and Protectorates, should be prohibited to all destinations.

Electricity Works and War Badges.—The Stretford D.C. has received 19 war badges for the engineering staff at the generating station.

Controlled Establishments.—The number of "controlled" establishments is now 1,679.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Tramway Differential Gears.

For some months past Mr. R. H. Wilkinson, manager of the Huddersfield Corporation Tramways, has been operating 11 cars fitted with differential driving gears, with a view to testing whether or not rail corrugation is caused by the skidding and slipping of wheels of unequal diameter; the effect of such a drive on energy consumption and tire life is also being watched. The cars are exclusively run on a route which was subject to corrugation trouble, but on which the corrugations were ground out before

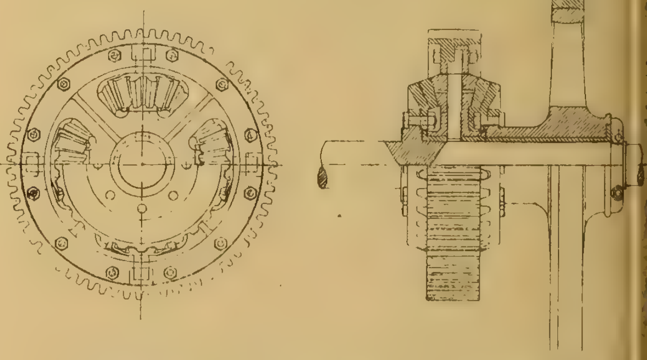


Fig. 1.—Differential Gear Fitted to Huddersfield Cars.

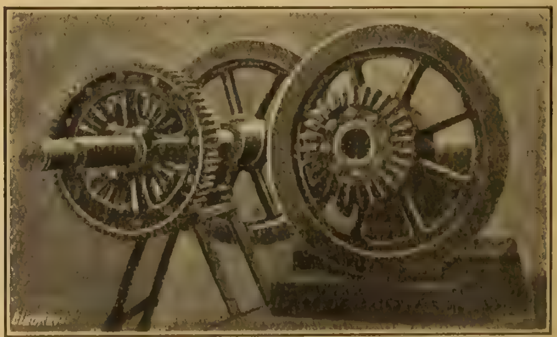


Fig. 2.—Tramway Differential Gear Dismantled.

running the special cars. The differential gear wheel replaces the ordinary gear wheel, one half of the differential bevel being bolted to a collar forged on the axle, while the other half is bolted to an extension of the hub of the near wheel, which is loose on the axle and fitted with a gun-metal bush. The gearing is of cast steel with machine-cut teeth, and is bushed with gun-metal; a thrust collar is provided outside the hub of the car wheel, removal of which enables the gear to be dismantled.

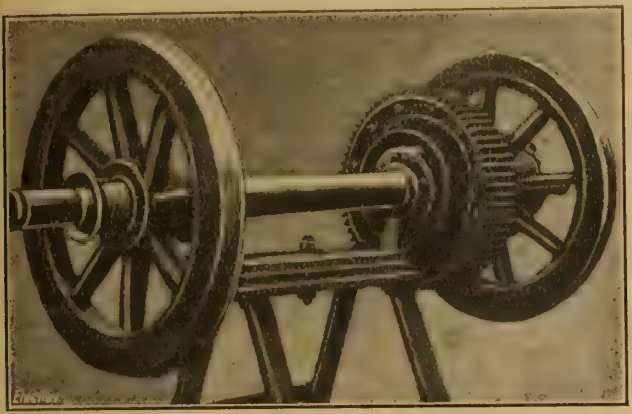


Fig. 3.—Tramway Axle fitted with Differential Gear.

Inspection Lamp for Shell Work.

To facilitate the examination of shell interiors during construction the British Thomson-Houston Co., Ltd., of Mazda House, 77, Upper Thames Street, E.C., have brought out the workmanlike hand lamp shown in fig. 4.

A stout brass wire guard with top and bottom plates forms a "squirrel cage" accommodating a tubular lamp of size not exceeding 4⅞ in. by 1½ in. diameter. This guard (which can be removed if required) is carried in the usual manner by a bayonet lampholder, which is mounted on a brass carrier-rod. At the outer end of the latter is a boxwood handle, incorporated with which is a push-bar switch. The lamp, which is supplied wired with 12 ft. of 35/40 workshop flex to a cocus adapter for connecting to existing electric light installation, is built to withstand hard workshop service.

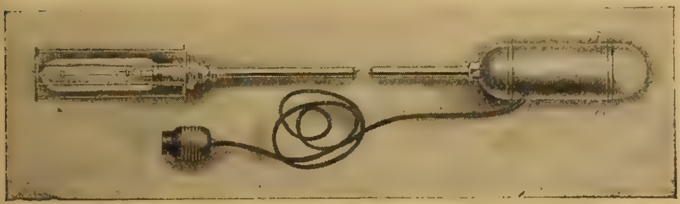


Fig. 4.—Inspection Lamp for Shell Work.

A very important point is that when an ordinary electric light supply is not available, the new inspection lamp, equipped with one of the many types of Mazda miniature bulbs, can be worked from a low-voltage accumulator or even dry cells. It can therefore be used effectively in every munitions workshop.

New Cantie Switch.

The Cantie Switch Co., Ltd., of 67, Mount Street, Nottingham, has introduced a new pattern of single-pole mining switch, shown in fig. 5. This consists of a robust and simple switch mechanism fixed in a porcelain base, which is mounted in the interior of a circular iron case. The switch has a long, quick break and quick make, and is positive in action; the controlling spring is subject to slight extension only. The cover slides into the base, and the joint provides ample cooling surface for hot or burning gases; the cover is secured by a hinged bolt on either side, and lifts off with the handle, exposing the interior mechanism. The design is an exceedingly compact one, and is also embodied in the form of a high-voltage, quick-break switch, with a flat brass cover on a 3½-in. diameter porcelain base, the handle projecting through the cover, this pattern being a good mechanical substitute for the large types of tumbler switch.

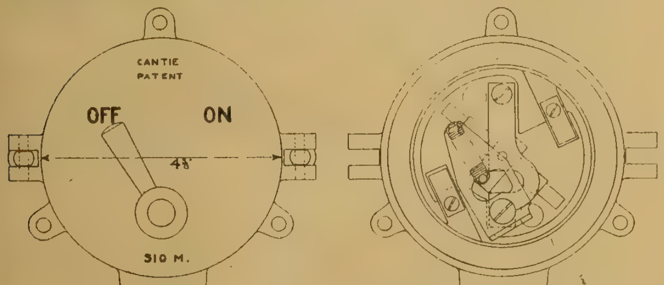


Fig. 5.—Cantie Mining Switch.

Anti-Zep Shades.

The Edison & Swan United Electric Light Co., Ltd., of Ponder's End, Middlesex, have issued a new leaflet, S.S. 3,121, illustrating and describing their new Ediswan anti-Zep shades, which have been specially constructed to meet the shaded light regulations which are being enforced by the local authorities.

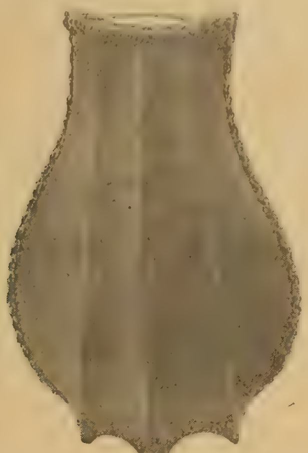


Fig. 6.—Ediswan Anti-Zep Shade.

Three types of shades are listed in dark green sateen, one being a conic pendant shape, and another, which we illustrate in fig. 6, of shell shape.

CORRESPONDENCE.

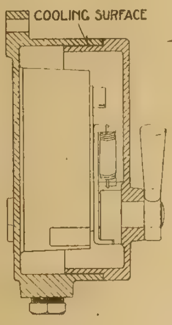
Letters received by us after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The B.E.A.M.A. and Foreign Firms.

I have before me a photograph showing parts of shells picked up in Flanders, from the identification marks on which their origin is traceable to two of the largest electrical manufacturing firms in Germany. These firms still have their subsidiary or associated companies operating in this country to the detriment of our own people, and it was my first thought that some measure should be taken to give as wide publicity to this fact as possible, but—a further thought forces itself on one's mind. How many British electrical firms are there at present in this country who are manufacturing munitions? Do we consider it criminal on their part in coming to their country's aid? Likewise is not the possibility of the finding of a shell made by a British company in the German trenches productive of equal discomfiture to its associates (if any remain) in enemy territory?

The answers to these questions apply equally to both sides when put from their own point of view, hence the futility of holding up to odium and disrepute what we in ourselves would praise.

It is well known that we on our part grant greater privileges and freedom to foreigners in our midst than we receive from them in their country, and it is due more to this inequality of treatment that our own people suffer than by the patriotism of the enemy.



While British firms and their associates ceased to enjoy all privileges in Germany almost from the commencement of the war, we have here German subsidiaries who have never at any time manufactured goods in this country, merely serving as distributors of foreign made articles, still able to carry on their business. Such firms under present conditions would receive but little support from patriotic Britons were it not for the fact that their identity is too often obscured by their English titles.

I would, therefore, suggest for the serious consideration of the B.E.A.M.A. and all other manufacturing and trading associations the necessity of immediately bringing about such alterations in company law as would disclose the origin and the extent of foreign financial interest in such concerns by enacting:—

1. That the use of the word *British* be not allowed except to all-British concerns.

2. That companies of foreign origin having 50 per cent. or more of their shares held by non-British subjects be required to

register under the full name and title of the foreign promoting company; initial letters not being permitted.

3. That companies originating in English-speaking parts of the world, not within the British Empire, and having financial qualifications as above be required to use the full name and title of the parent or promoting company, with the addition of the words (Great Britain) Ltd.

4. That all alien companies, whether subsidiaries of existing concerns or newly formed, be required to frame their titles according to a specific standard which would serve as an indication that the predominant interests were foreign, viz.:—

Allgemeine Elektricitäts Gesellschaft (Great Britain), Ltd.
The Constantinople Electrical Co. (Great Britain), Ltd.

No doubt many difficulties will present themselves in applying the above principles to individuals acting for themselves or as agents, but surely these are not insuperable.

The British Empire has been the happy hunting-ground of all and sundry, and it is time we reserved to ourselves benefits proportionate to the initiative and responsibilities of our own people in building up this magnificent structure; to say nothing of the sacrifice in blood and money that is now being made to support and maintain it.

C. W. Crosbie.

Bedford, *November 4th*, 1915.

P.S.—Since writing the above your issue of 5th inst. is to hand from which I note that the above principles are being acted upon in Australia and by a few of our municipalities at home; nevertheless, it is necessary that they should be embodied in the "Law of the Land."

The A.E.G. Meeting.

May I be allowed to add a few further remarks to this correspondence, which I initiated, and which seems now to be arousing some real interest. I have reason to believe that many of the articles which the Electrical Co. are factoring are obtained from manufacturers on the basis of pre-war contracts. Hence (the Electrical Co. being in the eyes of the law a British Company), no single manufacturer could refuse to supply under the terms of a pre-war contract without running the risk of an action for breach of contract. There appear to me, therefore, only two alternatives: (1) for the manufacturers who made pre-war contracts with the Electrical Co. to combine to repudiate these contracts, or (2) for the retail trade to refuse to purchase from the Electrical Co. It is for the B.E.A.M.A. and the T.L.A. to consider the first alternative. Possibly certain of their members would be willing to bring pressure to bear on their councils to act in a collective manner. It must always be remembered, however, that any such action, however patriotic, would be to the detriment of the individual and collective manufacturers' sales! As regards the second alternative, there is no doubt that the contractors are more guilty from a patriotic standpoint than the manufacturers, because they are not bound by contract to purchase.

Now the letters of Messrs. E. P. Allam & Co. show the right spirit, and I suggest to this patriotic firm of contractors that they call a meeting of other contractors to consider the whole question. In order that those who call or attend the meeting should not be liable to prosecution for conspiracy in restraint of trade, it would be necessary that the subject should be treated in a general manner, and that the name of the Electrical Co. be omitted altogether from the proceedings. Those who use the protection of the law for unpatriotic purposes must expect those who fight them to be equally cunning.

Inquisition.

November 6th, 1915.

My attention has been called to the letter in your issue of the 29th ult., signed "Anti-Humbug," and I very much regret your correspondent did not think it desirable to append his own name.

He seems to think it patriotic to sling mud in every direction without, apparently, the slightest grounds for his statements. I notice, with pleasure, that you have already replied to the unwarranted attack upon the Technical Press, and I should like to say, upon behalf of the Electrical Contractors' Association, that there is not the slightest ground for any of the statements made. The E.C.A. do not regard trading with the enemy with apathy. On the contrary, this is a matter which has received drastic treatment at various meetings. There is not the slightest alien influence at work within the Association, nor is there anything to fear of a like nature from outside.

Your correspondent states that on information he has received, "it is as much as the Association's existence is worth to interfere with, or tackle, the subject." What the meaning of this can be I am at a loss to understand.

H. Marryat,

Ten Years Member of Council E.C.A.

London, E.C., *November 3rd*, 1915.

Decimal Coinage and the Metric System.

I have followed your articles upon this matter with great interest, and the field covered has been so wide, that I am afraid there is very little I can add to what has been said by your correspondents and yourselves. To me, however, it appears that if the desired object is to be attained, very substantial and united effort is necessary; any isolated attempt will be useless.

I am strongly of opinion that the adoption of the Continental systems in this country would be of considerable benefit and assistance to our overseas trade in general, and would be a step in the right direction if we are to grapple successfully with the German competition in foreign markets, which will be fiercer than ever after the war. A nation possessing such an effete system of weights and measures as ours must naturally be at considerable disadvantage in its commercial aspirations alongside of its more up-to-date rivals.

In so far as coinage is concerned, I think your suggestion that all catalogues for foreign trade should quote in terms of francs, as an alternative to our own coinage, especially worthy of notice, as it should surmount to a large extent the difficulty of quoting in local coinage, so vulnerable to fluctuation. The equivalent value of the franc is generally known in all countries, but this much can hardly be said of any unit of our own coinage.

I am very doubtful, however, whether the Government will take any steps towards the universal adoption of the metric systems, unless the movement is supported by all the leading and influential bodies of public service throughout the country. To effect this, a vigorous campaign—such as you have originated—must be conducted by the various technical journals interested. Would it not be well to take the matter up with the various electrical and allied engineering manufacturers and other associations, with a view to inducing them to agree *en bloc* to support the adoption of the modern system? If responsible bodies such as these showed their emphatic approval of the proposal, I think it would have far-reaching consequences. I suggest also that the London Chamber of Commerce be approached, amongst others, with a view to obtaining their support and united effort in the matter.

Aurora Borealis.

[The Chambers of Commerce, not only of London, but of the Empire, have strongly advocated the compulsory adoption of decimal coinage and the metric system for more than 20 years.—Eds. Elec. Rev.]

A Noisy Motor-Generator.

Could any reader tell me the cause of the following trouble which I have with a motor-generator?

The A.C. motor is a single-phase slip-ring, 400-volt, 50-period 1,500-rev. ball-bearing machine. The stator is wound three-phase, star connected. The rotor is a three-phase wound rotor, and is also star connected.

The trouble is a surging noise which can be heard all over the building. I have tried to remedy it by putting masculite under the bed, but this has no effect. I have tested the rings, and find when running they are completely short-circuited. The set has been tested for balance and found quite correct.

Troubled.

November 8th, 1915.

Trade with Russia.

With this letter we have the honour to ask you to note in your esteemed journal for the information of your readers that our company, who are concessionaires of electric lighting stations in Pawlowsk Uman, and Kamenetz Podolsk, and of tramways in Elizabethgrad and Uman, have opened at the present time a branch for the re-sale of electrical machines and apparatus, and insulating materials, and also of steam and naphtha engines and water-turbines, and desire to enter into relations with first-class factories in your country producing these goods, with the view of becoming their agents in Russia.

At the same time we have the honour of informing you that our company belongs to the Russian and French Bank, and we have full possibility to offer for all our engagements the complete guarantee of this bank.

Russian Society for Electrical Enterprises, Ltd.

Petrograd, *October* 12/25, 1915.

An Invitation from South Africa.

Now that the German houses have ceased to exist here, I shall be pleased to hear from electrical supply houses that are not represented in this country with a view to assisting in the establishment of an all-British market for South Africa.

Catalogues, samples, best export terms, shipping weights and dimensions will be gladly received, and I trust you will be able to spare me a line in your valuable weekly, the Electrical Review, in order to bring my desires to the notice of our home manufacturers.

T. H. Alex. Brown,

Electrical Engineer, Heidelberg Municipality.

Heidelberg, Transvaal,
October 11th, 1915.

The I.E.E. and Alien Enemies.

It seems to me that your correspondent "A.M.I.E.E." is trying to confuse the issues when he makes out that we should not be honouring our "Scraps of Paper" if we asked members of alien enemy origin to withdraw from the Institution of Electrical Engineers. I have been associated with the I.E.E. for 10 years, and it was only last week that I gathered from "A.M.I.E.E.'s" letter that naturalisation papers carried the right of membership of the I.E.E., and that expulsion from the I.E.E. carried with it a denial of British citizenship.

What are the facts regarding German residents in Belgium, France and Russia? Wherever the German armies have penetrated, the inhabitants have discovered to their sorrow that the peaceful, decent German who had lived beside them for years, and whom they had come to regard as one of themselves, had been planted there for a definite purpose. We have not had to undergo that kind of awakening because there is a British Navy, but does "A.M.I.E.E." really believe that German organisation, which has silently and thoroughly prepared for 40 years to dominate the world, has really forgotten to plant emissaries in these islands? Germany's advance guard in this country we may be sure are naturalised British subjects, a trifling formality to a German, for alien enemies would be interned immediately on the declaration of war by any prudent Government, and so would be of no value to Germany.

Naturalisation papers, business interest, and every other device that could disarm suspicion, have been practised by those who have betrayed their Belgian, French and Russian fellow-citizens, and with this record of Germany's duplicity before us, the Council of the I.E.E. would be fools indeed if they accepted members of German origin at their own valuation.

Even if there were a few decent Germans among them, they should be the last to complain at the loss of a few privileges because the present state of affairs has been brought by the act of their own people. Natural-born British subjects are cheerfully submitting to galling restrictions for the safety of their country, and if the Germans who have been naturalised have the good of their adopted country at heart, they should be ready to recognise that every precaution must be taken against an unscrupulous foe.

Perhaps if the German blight were removed from the management of the affairs of the I.E.E., there would be an awakening from the criminal policy of "do nothing" which has distinguished the I.E.E. for the past few years, at the very time, too, when the electrical industry was fighting for its existence against unfair German competition.

Another Station Engineer.

Our correspondent of last week, "A Member" of the Junior Carlton Club, informs us that the Royal Automobile Club, which is the largest in England, if not in the world, and of which he is also a member, has also through a notice issued by the Committee requested members who, though naturalised, are of German, Austrian, or Turkish birth, to abstain from using the Club during the war.—Eds Elec. Rev.

A Contractor's Complaint.

Reading the article in your issue of October 29th, on "Apprenticeship in the Electrical Contracting Industry," has led me to venture into your columns with a few remarks on this same industry. Does it not suggest itself to some of these existing "Associations" of one kind and another in the electrical world, that the first needed reform is to improve the lot of the contractor? When will some such association be formed whose business it will be to see that electrical contracting is kept in the hands of men trained in electrical work, who have served their apprenticeship and worked as charge hands on responsible works, before they are allowed to foist themselves on the public as "electrical engineers and contractors? The existing Electrical Contractors' Associations are all very well in their own localities, but they have failed to stop wholesale firms from giving trade terms to ironmongers, cycle agents, and, in fact, any kind of shop-keeper who chooses to write for their lists; why should ironmongers be allowed full trade terms off lamps, &c., when they have never devoted a minute of their lives to the study of electricity? Why should not an an electrician be entitled to get trade terms if he wants to buy a frying-pan or a gridiron?

Since the introduction of metal-filament lamps there is an interesting and productive field for the energies of the contractor in the carrying-out of village lighting schemes. This class of work is gradually being snapped up by cycle agents, thanks to the business enterprise of a certain wholesale house, who send their representative to give any necessary technical information that the cycle agent wants, with the result that the latter usually blossoms forth in the course of a few weeks as an "Electrical Engineer and Contractor" in competition with the man who has spent time and money and energy in learning his business and accumulating experience solely in electrical work; and the public usually support the cheap man (I am writing of my own experiences "somewhere in the North of Ireland").

When the Electrical Contractors' Associations are able to dictate to the big supply houses they will have justified their existence and improved the condition of their fellow contractors.

J. S. L.

LEGAL.

Widow's Compensation Claim.

In the King's Bench Division, the Lord Chief Justice and a special jury heard an action by the widow of Arthur Blach, an electrician, against the Port of London Authority, for damages for the death of her husband, which, she alleged, was caused through the defendants' negligence. It was stated that the deceased man was engaged in the electric lighting of a vessel which was being re-constructed, and while on his way home on Christmas Eve last he lost his way in the fog and fell in the defendants' dry dock, which, the plaintiff alleged, should have been fenced round. The defendants repudiated negligence, stating that Blach should have displayed more care when using the side of the dock on such an occasion as the one in question.—The jury disagreed, and were discharged.

An Electrical Company Prosecuted.

Charges of exporting prohibited goods were heard at Woolwich the other day, when the Western Electric Co, Ltd., were charged with sending telephone parts to Woolwich Post Office for export to Norway. It appeared that a letter addressed to a firm in Christiania was opened by the Censor and led to an inquiry. It was alleged that the defendants sent the goods by parcel post to avoid the delay of getting an export licence. The case was adjourned.—*Daily Mail.*

Locker-Lampson and Another *v.* Isaacs and Another.

In the Chancery Division on Friday last this action was mentioned. Mr. Gore-Browne, K.C., moved for the defendants to stay the action on the ground that the plaintiffs were not proper plaintiffs, and that the company ought to be the plaintiff, if anybody. The defendants had put in affidavits in support of the allegation that the action was frivolous and vexatious.

It was arranged that the motions should stand over for three weeks.

OUR LEGAL QUERY COLUMN.

"Scotland" writes:—"The following is an abstract question which will probably interest your readers. 'A' is a consumer of electric light whose premises have been destroyed by fire, the origin of which has not been discovered. The meters, cut-outs, and service lines on 'A's' premises have been entirely destroyed, and the undertakers are claiming against 'A' for the value of their property. Although the premises are fully insured, can 'A' refuse to pay the undertakers on the ground that he is not liable? The Electric Lighting Acts do not deal specifically with the point, nor yet does the undertaker's provisional order. Can the undertakers, therefore, claim against 'A' for the value of their property?"

⁂ Everything appears to depend upon the terms of the agreement between the undertakers and the consumer. If 'A' is the hirer of the meters, &c., and if he is subject to liability to deliver them up in good repair at the end of the hiring, he must reinstate or pay damages. If, on the other hand, he is a mere bailee, it is conceived that he would not be liable. In Halsbury's "Laws of England" it is stated that "apart from special contract, a custodian is not responsible to the owner of the chattel entrusted to him in case of its destruction." Inasmuch as the meters and cut-outs are on the consumer's premises as well for the benefit of the consumer as the undertakers, it is probable that the law will regard him for this purpose as a custodian.

BUSINESS NOTES.

The Increased Postal Charges.—The attention of our readers is called to the fact that consequent upon the recent increase in the Postal charges for newspapers, the subscription rates for the Electrical Review for Great Britain and Canada will, until further notice, be raised to £1 1s. 8d. and £1 3s 10d. respectively.

Liquidation. — "Dac" Accumulator Syndicate, Ltd.—A meeting is to be held at 61 and 62, Lincoln's Inn Fields, W.C., on December 6th, to hear an account of the winding up from the liquidator, Mr. H. C. Bound.

Bankruptcy Proceedings.—Harry Arthur West, electrical engineer, late of 73, Old Dover Road, Blackheath.—This public examination was held on Tuesday, before Mr. Registrar Brougham, at the London Bankruptcy Court. The accounts showed liabilities £654, and assets nil. In reply to questions put by Mr. J. B. Knight, who attended as Official Receiver, the debtor stated that for the past 37 years he had been employed by an insurance company, his present salary being £370 per annum. In 1910, with a view to setting his son up in business, he purchased the business of an electrical engineer carried on at 55, Old Dover Road, Blackheath, under the style of F. Clayton. The purchase price was £175, which he borrowed and still owed to a Mr. Lister. He removed the business to No. 73 in the same road, and put in his son as manager, but the trading was not successful, and he eventually closed the business in March, 1914. His son was not a good business man, and he neglected the business, with the result that he, bankrupt, was involved in further indebtedness. He had borrowed a considerable amount of money from Mr. Lister, who had obtained judgment against him for £340, and there were other loans for which he was liable, amounting to between £200 and £300. The whole of the money was borrowed for the purpose of the business.

He estimated his loss on the business at considerably more than £350. In July, 1914, he wanted further money, and told Mr. Lister that his son was entitled to an interest under a will which would eventually be worth £1,000 when his son was 25 years of age. He did not tell Mr. Lister that the interest was mortgaged to the Norwich Union Co. for £300, but that was an oversight on his part. Eventually Mr. Lister took proceedings, and the action was heard before Mr. Justice Avory, when his wife went into the witness box and said she had concealed the fact from Mr. Lister that the reversionary interest had been charged. His wife and son had not concealed the matter from Mr. Lister for the purpose of defrauding him, but it was done inadvertently. When the case was heard, judgment was given against him and his wife with costs. He attributed his failure entirely to losses on the electrical engineer's business he purchased for his son, and to his household and personal expenses having exceeded his income. He only kept rough books of accounts in connection with the business. He had never failed before, or made any arrangement with his creditors. The examination was ordered to be closed.

Arthur Nicholas Pazolt, described as an electrical engineer, of 58, York Street, Westminster, "The Tapestries," Old Windsor, and the Public Schools Club, Albemarle Street, Piccadilly.—An application was made on November 5th to Mr. Registrar Brougham, at the London Bankruptcy Court for an order of discharge. Mr. J. B. Knight, Official Receiver, reported that the bankrupt failed in December, 1913, with liabilities £696; the assets had realised £37, and no dividend had been paid. He was an American citizen, and by profession an electrical engineer. From 1906 to 1911 he acted as assistant engineer to the Brighton Corporation. In the latter year his mother died, and he became entitled to property in America of the value of about £55,000. The failure was attributed to extravagance. After hearing Mr. Hansell in support of the application, his Honour granted a discharge, subject to a suspension of two years. Order entered accordingly.

J. W. Dewhurst, electrical engineer, 52, North End Road, West Kensington, London, W.—Receiving order made November 2nd on creditor's petition. First meeting, November 15th; public examination December 8th; both at Carey Street, W.C.

G. J. T. J. Parfitt, consulting electrical engineer, Keynsham, Somerset.—November 23rd is the last day for the receipt of proofs for dividend by Mr. C. H. King, 26, Baldwin Street, Bristol.

Catalogues and Lists.—Mr. Chas. Willetts, Jun., Colonial Works, Cradley Heath.—Illustrated and descriptive circular giving prices of "Eclipse" screw pulley blocks.

The Electrical Supplies Co., 53 Victoria Street, London, S.W.—Illustrated folder showing the "Quead" and "Ensign" electric fires and their convenient employment in the household.

The Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, London, S.W.—Eight-page publication ("E.A.C. Notes") giving many small illustrations of, and particulars regarding, their house service meters, c.c. motor-starters, motor control panels, gear, oil-immersed switch gear, &c.

Messrs. J. & W. B. Smith, 15-23, Farringdon Road, London, E.C.—Thirty-two page illustrated catalogue (No. 101) in which are well shown and priced a variety of designs of electric light fittings and glassware. This is a supplementary catalogue, and the contents cover many artistic brackets, hall lanterns, electroliers, adjustable pendants, electroliers with chain suspension, Holophane reflector bowl fittings, semi-direct lighting fittings, silk shade pendants, portable standards, fancy bead and glass shades, semi-direct lighting bowls, and opal and enamelled iron shades. Three pages are devoted to a range of electric cooking and heating apparatus. A separate sheet shows six designs of "Glasmi" electric fires, and gives prices and other particulars of same.

The "Z" Electric Lamp Manufacturing Co., Ltd., and Reduced, Southfields, London, S.W.—Small pocket price list of "Z" drawn wire lamps and "Z" half-watt lamps. Quantities, overprinted for dealers' use, can be supplied on application.

Electrical Openings in France.—H.M. Consul-General in Paris (Mr. W. R. Hearn) reports that an electrical engineering firm in that city established for over forty years, which has brought into being several of the electric lighting sectors of Paris, desires to secure the agencies of United Kingdom manufacturers of electrical supplies of all kinds. This firm adds that after the war there will be a great demand for electrical supplies for refitting the factories and lighting plants in those parts of France at present invaded. A unique opportunity will be afforded for United Kingdom manufacturers to secure a large part of the market formerly in German hands. The name, &c., of the firm can be ascertained on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Trade Announcements. It is announced that the business of the late Mr. Geo. Redhouse, electrical engineers, of Hitchin Street, Baldock (Herts.), will be continued by the executors, with Mr. Ralph Doult as manager.

The Allies Electric Lamp Repairing, Co., Ltd., of Hammersmith, are prepared to repair burnt-out metallic-filament lamps by a patented process.

Mr. Alfred A. King, for many years with Messrs. G. Straus and Co., Ltd., has started business in partnership with Mr. Greenhill Owen, under the name of Owen, King & Co., Ltd., at 211, Shaftesbury Avenue, London, W.C., as electrical factors. He desires to receive manufacturers' catalogues.

Book Notices.—"British Standardisation Rules for Electrical Machinery (excluding motors for traction purposes)" Report No. 72 of the Engineering Standards Committee. London: Crosby Lockwood & Son. Price 10s. 6d. net.—This Report entirely supersedes Report No. 36, published in August, 1907. The Rules, which do not apply to traction motors, are divided into 20 sections dealing with types of machines, classes of rating, maximum cooling air temperature, measurement of temperature, embedded temperature detectors, limits of both temperature and temperature rise, mechanical and stalling requirements, dielectric tests, transformer terminal marking, &c. The subjects are dealt with very completely, the Report containing 123 clauses. The Committee has had the benefit of the co-operation of the American Standards Committee and the Canadian National Committee of the I.E.C. in its work, with the result that on all essential points the American and British ratings of electrical machinery are in practical agreement. All interests concerned have been fully consulted, and the Sub-Committee includes representatives of the large spending departments of the Government, of the I.M.E.A., of the B.E.A.M.A.. and of the consulting engineers. A single rating has been adopted, and the equivalent of the overload previously specified has been included in this single rating. A value for the maximum cooling air temperature has been adopted, namely, 40° C. A very complete section deals with dielectric tests, and the information to be given on the rating plate is set out in detail. Diagrams for three-phase transformers are included, and the methods to be adopted for marking the terminals of single and three-phase transformers are specified. We shall review the Report in an early issue.

"Institution of Electrical Engineers, List of Officers and Members." 1915. London: The Institution.

"Reports of the Tokyo (Japan) Electro-Technical Laboratory." No. 16. "Transmission Losses in Common-Battery Subscribers' Loops." No. 17. "Transmission Losses in Telephone Lines."

LIGHTING AND POWER NOTES.

Acton.—Minimum Charge.—The Metropolitan Electric Supply Co. has notified private consumers that in future a minimum charge of 13s. 4d. per quarter will be made.

Argentina.—The grandiose scheme for utilising the great waterfall on the Rio Uruguay called el Salto Grande, for the generation of electricity on a large scale to supply Uruguay, Brazil, and Argentina, for which a Frenchman named Mollard secured a concession some two years ago, has come to an inglorious end by the National Congress withdrawing the concession. The concessionaire had failed to find the capital in France or to float the company to realise his aims. An electric plant is in course of installation in the township of Rawson, in the Chabut department, to supply current in that locality and in the neighbouring township of Trelew. On September 20th an electric service was formally inaugurated at Arequito, with Westinghouse dynamos driven by producer gas engines supplying continuous current at 220 volts. A small plant has also been installed at Devoto, in the Cordoba Department.

Australia.—Victorian Electricity Undertakings.—The annual official return of electricity supply undertakings operating in Victoria under the Electric Light and Power Act, shows that 107 orders have been granted, eight have been cancelled and in six cases the powers have been transferred to others. The largest undertakings are those of the Melbourne City Council with a plant capacity of 17,750 kw. and connections amounting to 23,271 kw., and the Melbourne Electric Supply Co., Ltd., with 14,100 kw. of plant and 30,884 kw. of connections; the North Melbourne E.T. and Lighting Co. at Essenden has a 1,000-kw. plant, while the Electric Supply Co. of Victoria, at Ballarat and Bendigo, has plants of 1,725 and 1,750 kw. respectively. The Melbourne E.S. Co. also has a 1,000-kw. plant at Geelong. The great majority of the installations are of under 100 kw. and gas engine-driven plant largely predominates. As would be expected, overhead transmission and distribution is a feature of all the undertakings; the Melbourne City Council has 150 miles of overhead conductors, and the Melbourne E.S. Co. 1,438 miles, in the metropolis and suburbs. A majority of the undertakings supply public lighting, and in Melbourne the returns show 721 arc and 1,392 incandescent lamps under the Council, and 200 arcs and 1,217 incandescents under the Supply Co.

A scheme has been submitted to the Minister for Mines for the erection of a big electric power station, in a central position, to supply electricity to the shaft head of each mine on the three lines of reef at Bendigo, to operate special pumping plant for drainage purposes.

Hydro-Electric Scheme.—A proposal to use the waters of the Kiewa River, in the north-eastern district of Victoria, for the generation and transmission of electricity in bulk to Melbourne, and to municipalities *en route*, has been placed before the Minister of Water Supply by the Victorian Hydro-Electric Co. The cost of the undertaking is estimated at £1,000,000.

In view of the fact that there are various schemes suggested for the supply of electricity for lighting and power to South Brisbane and neighbouring districts, and as the Queensland Government considers that municipalities should, wherever practicable, undertake these enterprises themselves, it has decided to appoint a npetent authority on electrical engineering to inquire into, and ort upon, the advisability of establishing a Government power tion, and to report on the utilisation of waste gases from the e ovens, and the practibility of transmitting power to the city Brisbane, and other matters dealing with the question of ctric supply.

The Katoomba Municipality (N S.W.) is taking steps to augment local water supply, the dam of the waterworks having been sed to give a total capacity of 35,000,000 gallons; the question utilising electricity for pumping from the dam to the reservoir being considered, and the Katoomba Electricity Supply Co. has oted 1½d. per unit for a 10 years' period.—*Tenders.*

Bacup.—Mill Supply.—The Corporation has acceded applications from Throstle Mill and from New Hey Mill for ctricity for power. An application from Messrs. Hartley Bros., bion Mill, has been referred to a Sub-Committee to be dealt with. The question of granting a reduction in the charges for current lighting supplied to the Lighting Committee on account of the uced street lighting, has been referred to a Sub-Committee.

Ballymote (Co. Sligo).—E.L. Scheme.—A meeting of siness men has decided to proceed with the scheme for the ctric lighting of the town, at an estimated cost of close upon ,000.

Barking.—The Council has decided to accept the offer a loan of £13,654 at 4½ per cent. with commission, including mps of 1½ per cent., the loan to be for a period of 10 years rtain, and to be used for electrical extensions.

Belfast.—The City Council has received a deputation m the Amalgamated Society of Engineers with reference to the pointment by the Electricity Committee of a senior and junior gineer-in-charge on probation. The Society considers that the sition should be given to mechanical engineers. The Chairman the Electricity and Tramways Committee recently stated that the me Office inquiry into the circumstances connected with the fire the power station had been held, but the report had not yet been rnished to the Committee.

Birmingham.—Nechells Plant.—It is expected that rrent would be available from the new temporary 10,000-kw. wer station at Nechells in about a fortnight,

Bo'ness.—Proposed Extension.—The T.C. has reted, by 6 votes to 5, a motion that the proposed extension of the ctricity works was necessary at the present time, so that the tition to the Scottish Secretary becomes of no importance. A fficulty arose as to how the Council was to reply to the petition, d the eventual finding was in effect to back up the petitioners' guments, and to leave the Scottish Secretary to decide the ntroversy.—*Edinburgh Evening Despatch.*

Clayton.—Prov. Order.—The U.D.C. has decided to tain further information as to the Yorkshire Electric Power 's application for a prov. order. It was stated that there should some definite understanding as to the time within which the mpany would commence the supply.

Dover.—The T.C. has entered into an agreement with e Post Office authorities to supply current for lighting the stal premises at 4½d. per unit on a guaranteed yearly consumpn of 12,000 units. Owing to the small quantity of current used r lighting garages and by prepayment meter consumers, it has en decided to charge the former consumers a minimum of units per quarter, and the latter a minimum of 20 units. The ctrical engineer has suggested that the charge for motor meters ould be 3s. for the meter, plus 1d. per each horse-power.

Downham Market.—Proposed E.L. Scheme.—The uncil has received a letter from Mr. C. H. Best, of Bradford, ting that it is proposed to form a company for the purpose of pplying electric light and power to the town. It has been decided consider the matter.

East Ham.—Electricity Charges.—The Electric ght and Tramways Committee has reconsidered the suggested crease of 20 per cent. in the charges for all current supplied, and w recommends that the charges should be increased by 10 per nt. (with the exception of current supplied for public lighting) commence with current supplied during the March 1916, arter. The question of the charges for public lighting was ferred. The Council having considered the recommendation has, 9 votes to 8, referred the recommendation back for further coneration.

Fakenham.—Proposed E.L.—The Council has decided inform Mr. C. H. Best, of Bradford, that as a Council it would t oppose his proposed electricity scheme.

Hastings.—Price Increase.—The Corporation has cided to increase the charges for public lighting (during the ntinuance of present conditions) by an addition of 10 per cent. is is equal to a sum of £2,447 for the half-year.

Heywood.—The formal opening of the extensions at e electricity works in connection with the taking of a bulk pply from Bury took place on Saturday last.

Hoylandswaine.—Prov. Order.—The U.D.C. has cided to support the application of the Electrical Distribution of rkshire, Ltd., for a prov. order, on condition that a clause is serted giving the local authorities the option of purchase at the d of 21 or 35 years.

Ingleton.—Village Lighting.—The Parish Council last week again considered the question of lighting the houses constituting the model village. It was reported that an arrangement had been made with the Electric Light Co. for the erection of poles, wires, &c., complete, on payment by the Council of from £32 to £35. It was the intention to erect 10 lamps, at a cost of about 26s. each, as compared with 22s. 10d. for the present lamps. It was decided to accept the offer.

Larne.—The Urban Council has agreed to a proposal of the Larne Electric Lighting Co. that a proportional allowance at the rate of £100 for the full year should be made in view of the extinction of the whole of the public lighting at 11 p.m., as from November 1st last to July 31st, 1916.

Llanfyllin.—Street Lighting.—Owing to the local gas company having increased the price of gas, the Council, as a measure of economy, has decided to discontinue the lighting of the streets. An offer has been made by Mr. R. A. Jones, builder, to light the town with electricity from a new plant which he proposes to install, and the Council has decided to give him permission to experiment with the scheme, on the understanding that the Council does not bind itself to adopt electricity for public lighting. —*Montgomery Times.*

Leyton.—Loan Sanction Refused.—The L.G.B. has informed the Council that the application for sanction to a loan of £18,158 for the electricity undertaking cannot be entertained at the present time, but a loan of £500 for money already expended on services has been sanctioned.

London.—St. Marylebone.—The Electricity Committee has decided that, in future, only in exceptional cases are the department representatives to name a contractor, when customers require installation work carried out; customers are to select the contractors whom they wish to quote for their requirements.

During the quarter ended June 30th, 3,067,675 units were sold, a decrease of 9·6 per cent. compared with the 1914 quarter; similarly, the gross revenue, £32,865, showed a drop of 2·07 per cent. Working and management costs amounted to £16,873, an increase of £1,157; the average working expenses per unit sold were 1·318d., as against 1·1d. in 1914, and generation costs amounted to ·648d., as against ·486d., due to the heavier cost of coal.

Hackney.—The Electricity Committee recommends that a contract for the supply of electrical energy at 6,000 volts, to a new factory to be erected, be entered into with Messrs. Dick, Kerr and Co., Ltd., on terms and conditions which have been approved by the Committee.

Battersea.—The Electricity Committee, has considered the question as to the means to be adopted to secure the payment of 10 per cent. on the accounts for the supply of electrical energy through prepayment meters, and is arranging for a charge of 9d. per meter per quarter, to be made payable in advance.

Luton.—The Electricity Committee has decided to utilise a portion of the highways depôt, for the extension of cooling towers in connection with the new plant at the electricity works.

Malvern.—An application by the U.D.C. for the whole of the staff at the electricity works to be allowed to remain at their work, and to be exempted from military service, has been refused. As the staff's services are indispensable, an appeal is to be made to the local tribunal set up under Lord Derby's scheme.

Manchester.—Heating Research.—The Sanitary Committee has adopted a resolution to the effect that application be made to the Committee of the Privy Council for Scientific and Industrial Research for a grant of £400 for the purposes of research into the efficiency of domestic heating appliances.

Monaghan.—E.L. Scheme.—A company has been formed for the installation of electric lighting and to buy the undertaking of the Gas Co. The Urban Council has given permission for the erection of poles and wires.

Nelson.—Year's Working.—There was a profit on the Council's electricity department for the past year of £1,145, as against £1,903 in 1913-14.

Newcastle (Co. Down).—Cottage Lighting.—The Urban Council has decided to ask the Electric Lighting Co. to install electricity in the workmen's houses, and charge a fixed rate per week, an arrangement of this kind having been made at Ballyclare (Co. Antrim).

Peterborough.—Price Increase.—The T.C. has decided to increase the charges for current by 10 per cent. as from October 30th, and has asked the Electric Traction Co., Ltd., to agree to pay a similar increase for current used by it under contract.

Sandgate.—Restricted Lighting.—The U.D.C. has sent to the Folkestone E.L. Co. a request that the rebate in respect of public lighting should be increased from £210 suggested by the company, to £245 or £250.

Shanklin.—Street Lighting.—The U.D.C. has received a letter from the Electric Light Co. agreeing to accept half the amount of the contract price for the period ending March 31st.

Shelf.—Prov. Order.—Consideration of the application of the Electrical Distribution of Yorkshire, Ltd., for an electric lighting order for the district, has been deferred until the next meeting of the Council.

South Africa.—Train Lighting.—In the last annual report of the general manager upon the working of the South African Railways, it is stated that:—"The experiment commenced in 1912 with Edison cells for block train lighting at Cape Town for suburban services, having proved entirely successful, this is being generally extended in the Cape suburban area. In 1912 a trial was also made with the Vickers train lighting system, six sets being fitted to main line stock. The trial has proved fairly satisfactory, although no great improvement over other systems has been demonstrated. A further six sets have also been ordered for equipping certain coaches now being erected in England. One equipment was also purchased from Messrs. Mather & Platt, and is giving satisfaction."

Southport.—Year's Working.—The annual report of Mr. Black, borough electrical engineer, states that the result of the year's working was a net profit of £2,213, an increase of £350 in comparison with that of the previous year. There was an increase in the number of units supplied to the Corporation tramways, but a decrease in the number supplied to the Southport Tramways Co. There had been a large reduction in the supply of current to private consumers, but this had been more than counterbalanced by the increased number of consumers and the more extensive use of electricity for purposes other than lighting. Much revenue had been lost through the restrictions upon outside shop lighting.

Stretford.—Annual Accounts.—The abstract of accounts for the last financial year, which has just been approved, shows that on the electricity department the total expenditure on capital account amounted to £109,173, and the balance of loans outstanding was £77,537. The trading account showed a net surplus of £254.

Swindon.—G.W.R. Plant.—At the wagon building department of the Great Western Railway at Swindon, a gas-electric plant is in use for supplying the motor driving. This includes three sets of producer plant supplying gas to three 290-b.h.p. Campbell gas engines direct-coupled to G.E.C. 150-kw. compound-wound generators. The engines are of the four cylinder vertical pattern running at 220 r.p.m. The switchboard was constructed by the company's electrical staff.

Turton (Lancs.).—The U.D.C. has adopted the scheme of the electrical engineer to supply residents of Riding Gate, Harwood, with electricity, at a cost of £220. A few public street lamps will be converted to electricity when the supply is available.

Warminster.—The B. of T. has granted a year's extension of time for carrying out the work scheduled under the E.L. order.

Winchester.—Despite the great increase in the cost of production of current, the T.C. has decided not to increase the tariff at present. As the contractors for the new plant for the station are entirely engaged on war work, and cannot give a definite date when the plant will be delivered, the Council has purchased a second-hand 200-kw. generating set for £760, to assist in maintaining the supply during the winter. The Electricity Cammittee has intimated that it does not propose, after the end of the year, to retain the consulting engineers, and will in future only engage them when necessary for particular work.

TRAMWAY and RAILWAY NOTES.

Birkenhead.—Year's Working.—For the year ended March 31st last, the total receipts of the Corporation tramways amounted to £65,785, while the gross profit was £26,318, or £898 less than 1913-14; after meeting interest and sinking fund charges there remained a surplus of £4,500, of which £1,000 was placed to reserve and the balance to renewals. The net surplus has only once been exceeded in the history of the undertaking; £4,750 was spent on renewals during the year, and the fund at March had £22,062 in hand. During the year 14,822,697 passengers were carried, giving an average revenue of 13·05d. per car-mile; the system covers nearly 14 miles of route.

Dover.—Light Railway Order.—The B. of T. has renewed until February, 1916, the Dover, Martin Mill, and St. Margaret's Light Railway Order.

Edinburgh.—Tramway Fares.—A conference of representatives of the Tramway Committee of the T.C. and a deputation from the Tramway Co. has discussed the proposed new scale of tramway fares. It was pointed out for the company that it had to meet increased expenditure, which amounted to about £25,000, and which did not include allowances which it was making to dependents of employés. The company offered (an offer which the Committee refused) to retain the fares at the present rates provided the Corporation would guarantee the company the same rate of profit as had been realised during the last three years. The deputation also pointed out that similar action had been taken by the Birmingham tramways (which were owned by the Corporation), by which it was expected to raise additional revenue to the amount of £100,000. In making the increases the Edinburgh Co., it was stated, was acting quite within the provisions of the lease, and it was the duty of the company to look after the interests of the shareholders. The deputation from the company expressed its willingness, at the end of three months, to reconsider the matter if the increased fares were producing more money than was necessary to cover the additional expenditure.

Female Conductors.—The vogue of the lady conductor is making great progress in Lancashire. The first women conductors started work at Ashton-under-Lyne last week; Darwen and Nelson have decided to employ them, and Stalybridge and Southport have both engaged a number of them. Manchester is inviting further applications from women desirous of acting as car conductors, and at Liverpool a large number of applications have been received for such positions.

Hastings.—Female Inspectors.—The women tramway conductors are reported to have been so successful that during the past week women inspectors have been introduced to replace men joining the army.

London.—L.C.C. and Female Labour.—The Highways Committee recommends that the employment of women conductors on the Council's tramcars be authorised during the war, and that they be paid proportionately to the time worked at a rate equivalent to the daily rate of male conductors.

Owing to the difficulty of obtaining unskilled labour, the Committee also recommends that women be employed at the central car repair department on work of an unskilled character in connection with the repair of tramcars, the commencing rate of pay to be 20s. a week, with 3s. war bonus.

Nelson.—Year's Working.—The profit on the light railways for the past year was £314, as compared with £1,980 in the previous year.

Oldham.—War Bonus.—Clerks in the tramways department who were excluded from a war bonus award have made application to be included among those receiving the bonus, and the Tramways Committee has decided to send their application to the special committee which has been dealing with the war bonus question, with an expression of opinion that the clerks ought to be included.

Recently the Corporation were defendants at the Manchester City Police Court, having been summoned for using a too brilliant lamp on a car in the Manchester area. It was pointed out that the lighting restrictions were not now applicable to Oldham; but the Failsworth area, through which the cars pass, was very badly lighted, and it was not considered safe to reduce the lighting of the cars further. The summons was dismissed.—*Manchester Courier.*

Rochdale.—Wages Increase.—The Tramways Committee has decided to recommend an advance of a halfpenny per hour to employés earning 30s. or under per week, and an advance of a farthing per hour to employés earning over that amount. As previously reported, the war bonus arrangement under which the men on the lower scale got 2s. per week and the men on the higher scale 1s. per week, is to come to an end on the 18th inst. The war bonuses were estimated to amount to about £800 per annum, and the new permanent increases now to be recommended will mean about £1,100 per annum to the department.

West Hartlepool.—Female Conductors.—Owing to enlistments on the part of the staff, the T.C. has decided to engage female conductors for the tramcars.

Wolverhampton.—Year's Working.—The accounts of the Corporation tramways department for the year ended March 31st last showed a gross profit for electric traction of £20,257; and after meeting interest and sinking fund charges, the net profit on tramways and omnibuses was £9,160, from which £396 was carried to renewals, £5,020 devoted to additions to plant, and £3,744 to rate aid. The reserve fund now stands at £53,987. For the first six months of the present financial year 6,617,063 passengers were carried, the receipts amounting to £29,521 (12d. per car-mile), all figures being in excess of those of 1913 and 1914.

In its annual report to the Town Council, the Tramways Committee states that after consideration it has resolved to issue free passes to wounded soldiers in the borough, which will enable them to travel to and from the town once daily.

York.—Female Conductors.—So many of the employés of the Corporation tramway staff have enlisted, that the T.C. has decided to employ women conductors.

CHARLES P. SPARKS, President of the I.E.E.

On October 1st the office of President of the Institution passed from Sir John Snell to his successor, Mr. Charles P. Sparks, M.Inst.C.E., M.I.E.E., who will be installed in the chair on Thursday next.

Whilst offering him our congratulations on the attainment of the highest honour that the Institution can bestow on any of its members, we are pleased to be able to present his portrait to our readers—though he is so widely known and so generally popular that there can be few members of the Institution, at any rate, who are not already familiar with his likeness.

Mr. Sparks, who was born in London in 1866, was educated at Repton School, and later entered the Hammond Electrical Engineering College (now known as Faraday House), to which is due the credit for having trained so many of the prominent leaders in the electrical profession. Leaving the College in 1884, he became an engineering pupil in the workshops of the Ferranti-Hammond Co., and subsequently assistant to Mr. S. Z. de Ferranti, who was then developing his system of high-pressure distribution with transformers; in 1887, *i.e.*, at the age of 21, he entered into partnership with Mr. Ferranti and Mr. Francis Ince, the firm carrying on business as S. Z. de Ferranti & Co., in London and Paris, and he was a director of Ferranti, Ltd., until 1899.

Photo. by] Charles P. Sparks. *[Russell, Baker Street.*

From 1886 to 1891 Mr. Sparks had charge, under Mr. Ferranti, of the Grosvenor Gallery lighting station and distributing mains, and supervised the erection of additional machinery at that station; during this period the business was transferred to the London Electric Supply Corporation, and while the Deptford station was being erected, Mr. Sparks supervised the laying of the first 10,000-volt transmission mains and the equipment of the main sub-stations. Thus he was at the very heart of the electrical world in those pioneering days, when everything that was done was something new, and monotony was the very remotest risk of an electrical engineer's existence.

In 1891 Mr. Sparks left the London Electric Supply Corporation, and became works manager to the Ferranti Co., in which capacity he carried out contracts for the manufacture and erection of engines, alternators, and electrical equipment for many power stations. He became chief engineer of the County of London Electric Supply Co. in 1899, and is now acting as engineer-in-chief to this company, which gives general supply in an area of 23 sq. miles out of the 117 sq. miles included in the Metropolis; the company is also supplying areas outside the Metropolis aggregating some 160 sq. miles.

Since 1899 Mr. Sparks has carried on a consulting practice, having taken his brother, Captain H. C. Sparks, into partnership in 1907. The principal work carried out has been in connection with the erection of electric power plant industrial undertakings, covering collieries, metalliferous mines and mills in Great Britain, U.S.A., India and the Colonies.

His connection with the Institution of Electrical Engineers dates from 1885, when he was elected a Student; he became an Associate Member in 1899, and Member in 1905. He served as Associate Member on the Council in 1892, as Member of Council, from 1900 to 1907, and as Vice-President from 1907 to 1909. He became Associate Member of the Institution of Civil Engineers in 1894, and full Member in 1900.

Mr. Sparks has served on many Committees of the Institution of Electrical Engineers, including the Wiring Rules Committee, with which he has been connected for twenty years, having been chairman for fifteen.

He is also a Member of the Engineering Standards Committee as one of the representatives of the Institution of Electrical Engineers.

His contributions to the *Proceedings* of the Institution include two papers respectively entitled: "The Electrical Equipment of the Aberdare Valley Collieries of the Powell Duffryn Steam Coal Co., Ltd." in 1906, and "Electricity Applied to Mining" in 1914.

The comprehensive experience which the new President has acquired in the course of his career, and the ability of which he has given so many proofs, together with the high esteem in which he is held by all who have come in contact with him, afford a guarantee that his period of office will be in no way less successful than previous terms.

So far we have referred only to Mr. Sparks in his professional capacity, but as a citizen of the Empire he is equally entitled to honour and congratulations, for three of his four sons are serving with the Colours—one in the Royal Engineers, one in the Royal Artillery, and one, the youngest, in the Suffolk Regiment. The last has so distinguished himself in action that he has not only been mentioned in dispatches, but has also been awarded the Military Cross by the King. This is, indeed, a record to be proud of, and we offer our respectful congratulations to Mr. and Mrs. Sparks.

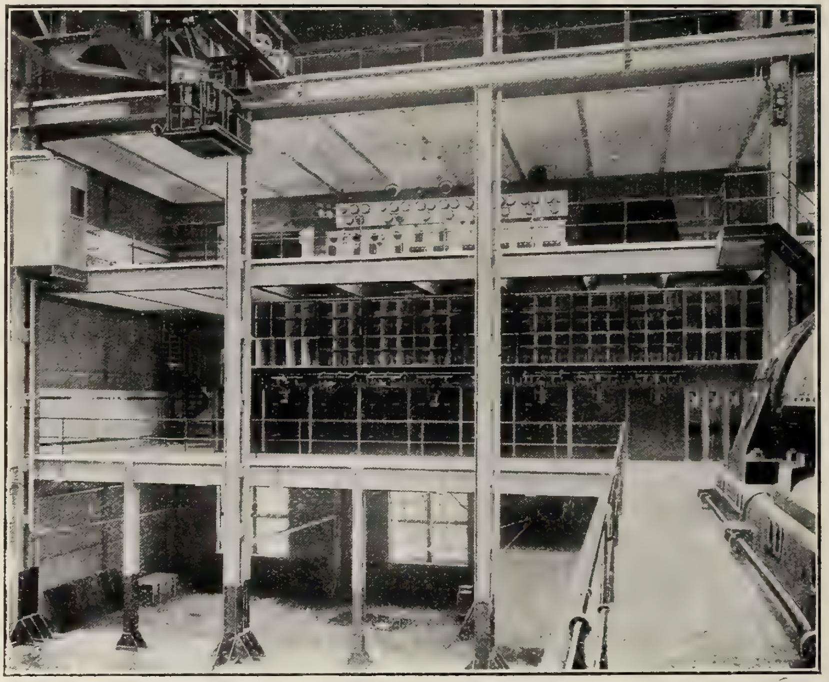
The new President assumes office in a period of stress, and will have many opportunities of assisting the Government in connection with military matters; in such circumstances his wide experience will no doubt prove of the greatest value. We trust, however, that before he vacates the chair the cause of the Allies will have triumphed, and that the blessings of peace will have been restored to this country.

SHANGHAI ELECTRICITY WORKS.

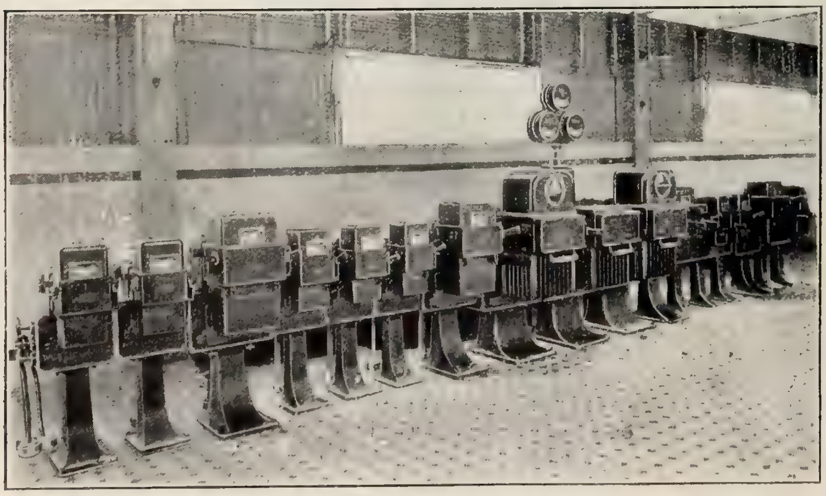
(*Continued from page 594.*)

The low-pressure distributing networks are fed from sub-stations, varying from about 100 kw. in the small sizes to 2,000 kw. in the larger ones. Whilst pressure regulation on the single-phase feeders is effected by means of automatic feeder regulators or boosters installed at the Fearon Road centre, in the three-phase sub-stations the pressure regulation is performed by three-phase regulators installed in the sub-stations and connected between the 6,000-volt feeder bus-bars and the transformer bus-bars of the sub-station e.h.t. switchgear. These feeder regulators were made by the G.E. Co., of New York. All high-pressure and extra-high-pressure feeders are on the ring system or else duplicated, thus ensuring continuity of supply. All low-pressure overhead mains are of bare hard-drawn copper cable; the single-phase high-pressure cables are weatherproof, but the e.h.t. three-phase overhead mains are bare, as these can only be run in outlying districts, whereas the 2,100-volt single-phase cables run through congested areas. Trouble from breaking or short-circuiting of the overhead cables, either low, high or extra-high-pressure, is almost unknown, which speaks well for the safety of a carefully-planned and erected overhead system. Oregon pine poles are used almost exclusively. These are protected by cast-iron sleeves at the wind and water line. Concrete poles are used where cables are run in and out of sub-stations. Lightning occurs in the summer season, but in recent years, owing to a carefully-arranged use of arresters in the sub-stations and Fearon Road centre, little serious trouble has been experienced. The result of several years' use of various types of arrester shows that the aluminium arrester gives the best protection. The arresters of this type are fitted with automatic recorders, which show the number of discharges which take place.

Staff Engineers' Quarters.



Riverside Power Station: British Westinghouse 6,600-volt Switchgear, and Control Desk above.



British Westinghouse Mining-type Switches for Control of Station Auxiliaries.

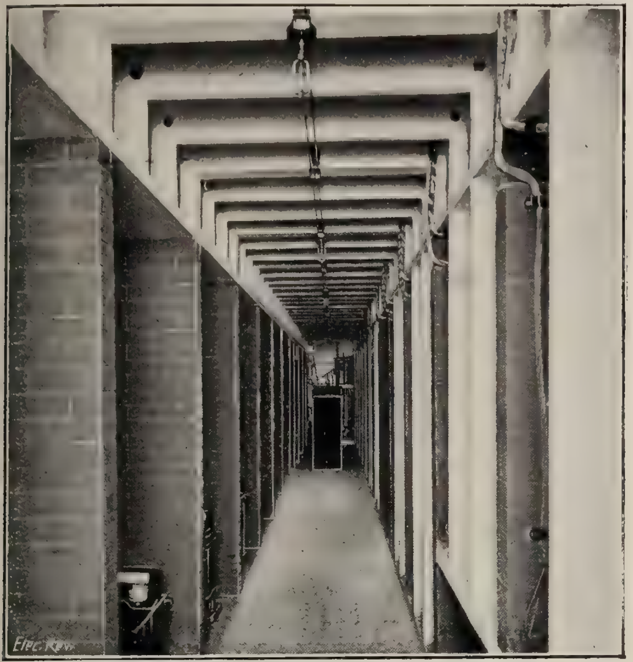
All the feeders, both single and three-phase, are looped and not teed into the sub-stations, so that any section can be isolated without interfering with the others. All the transformers, even down to 20 kw., are oil-cooled, it being found that the oil affords a valuable protection against damage by lightning on the overhead system. In country districts where sub-stations are not justified by the load, pole-type transformers of 10 kw. are used, but this is in comparatively rare instances; the pole-type system of transformation and distribution is not favoured, sub-stations of permanent construction being usually adopted.

The transformers in use are single-phase and some three-phase, made by the British Electric Transformer Co., Ltd., and three-phase made by the British Westinghouse Co., Ltd., and the General Electric Co., of New York, all oil-cooled.

Lighting generally is supplied at a flat rate equivalent to 3d. per unit. For power there is a sliding scale from a maximum of 1d. per unit down to 0·3d., and for heating and cooking the price is 0·7d. per unit. No meter rents are charged. The single-phase meters used for house services are mostly made by Messrs. Ferranti Ltd., and Messrs. Chamberlain and and Hookham, Ltd. Three-phase meters are used for power work, and are mostly of British Westinghouse make.

So great is the amount of work—both routine and new construction—going on always, that a fleet of 10 petrol cars is needed, and a 2-ton lorry. To these have recently been added three electric runabouts and a 2½-ton electric lorry, so that in this respect Mr. Aldridge is in the forefront of progress.

All electrical energy is charged for by meter, or alternatively on the fixed-rate system with the help of current limiters.



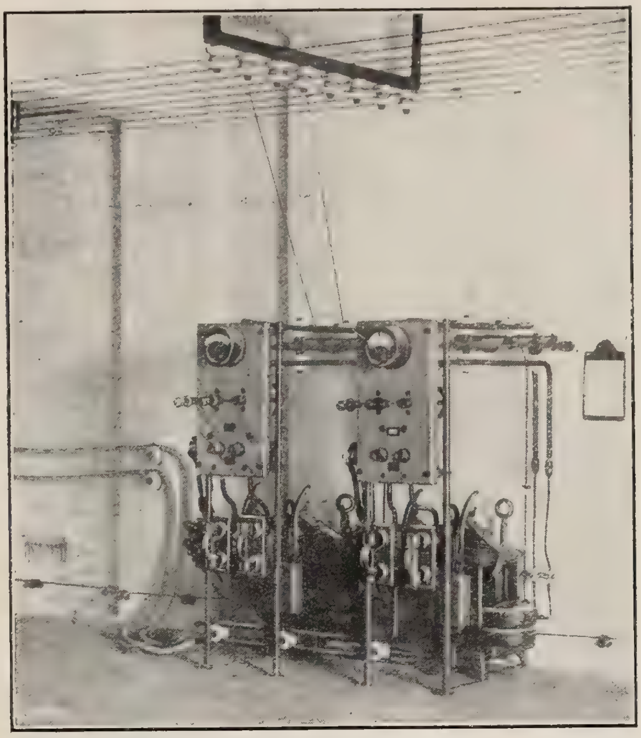
Riverside: Brick and Concrete Cubicles for 6,600-volt Switches.

The cost of coal varies, but is usually between 12s. and 15s. per ton.

Fearon Road Power Station: Belliss-Peebles 600-kw. Traction Sets.

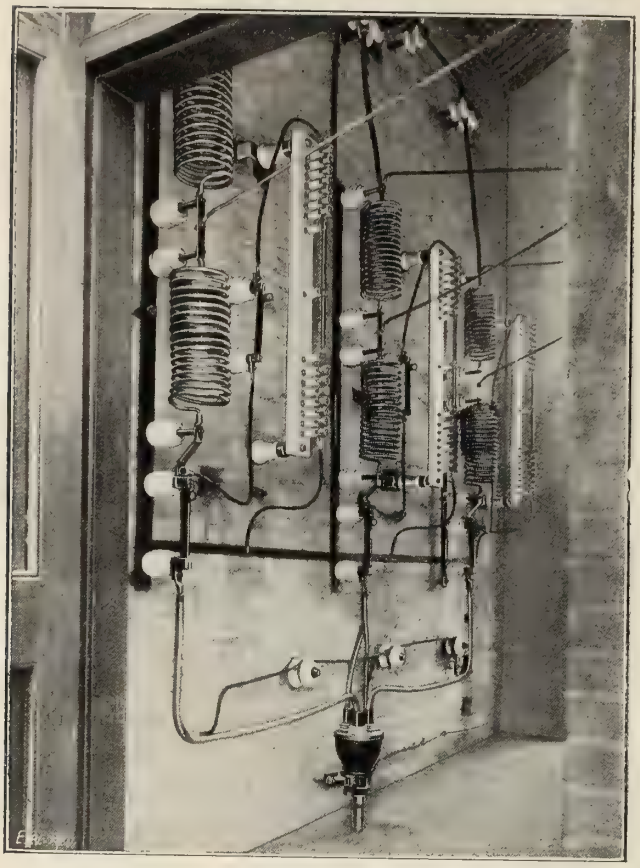
Shanghai is an important manufacturing centre. The principal industry is cotton spinning. Cotton is grown extensively in the neighbourhood, but cotton is also imported from other countries. The very low cost of electric power attracts new industries, and great development is expected in the near future.

As the cotton mills, of which there is a large number in the town, work day and night for 330 days in the year, they offer a splendid load factor, and thus the phenomenally low rate of 0·3d. per unit mentioned above is made commercially practicable. In 1915 Mr. Aldridge expects the total output will amount to 50 million units, and the following year it may exceed 60 millions; one cotton mill alone, which requires 2,500 kw. day and night, is expected to consume no less than 17 or 18 million units! At present there are orders on the books for over 10,000 kw. in industrial work, including cotton and rice mills in addition to the normal increase in small motors, such as those employed to drive printing presses and in various other minor industries. It is interesting to record that the department is supplying power for operating hydraulic packing presses for pressing bales of raw hide, &c., and steam presses are being replaced by electric motor-driven presses. Suction gas and steam installations are being superseded by electricity, and electric motors are now used almost exclusively in the smaller trades.



Constant-current Series Transformers for Public Lighting.

The development of the supply has necessitated a great deal of energetic missionary work, but now there is abundance of work in prospect. Probably now that the opium trade is dying out, some of the Indian traders will turn their attention to cotton, and there is plenty of scope for further development.



Interior of Lightning-Arrester House, at junction of Underground and Overhead Mains.

Single-phase Sub-station and Ferro-concrete Pole.

The European staff comprises over 70 persons, including engineers, clerks, collectors, &c. Twenty per cent. of the staff came home and entered the Army, but this by no means represents the percentage of men willing to serve; but it was found impossible to accede to all the requests from the staff, as important work in Shanghai calls for the loyal co-operation of the rest of the staff. The Chinese staff numbers about 800. Four houses for shift engineers are to be erected on the station site, and will be provided with tennis courts, &c. There is room on the site for 100,000 KW. of plant.

Three-phase Sub-station and Low-pressure Distributors.

Exterior of Lightning-Arrester House.

Flour Mill Sub-station, and Concrete Terminal Pole.

The whole of the work of preparing consumers' accounts and issuing debit notes is carried out by the electricity department, which also collects all the accounts, a completely organised staff being provided, under the supervision of the chief clerk, who is directly responsible to the engineer-in-chief. The returns only are sent to the treasurer's office.

The consumers' department is organised to deal with all complaints and look after new consumers. Under a resolution passed by the ratepayers some years ago, the department is not allowed to carry out wiring work or to sell fittings, but hires out electric cooking ranges, radiators, and motors, besides selling incandescent lamps. Last year the connections allotted to heating and cooking totalled 1,700 KW., and this year it is expected that they will reach over 2,000 KW. Radiators are being extensively used in Shanghai, especially for offices and bedrooms, and the Chinese consumers appreciate their advantages.

The street lighting of the greater part of the town and suburbs is electric, mostly on the constant-current series system operated through constant-current transformers from the

2,100-volt mains. Arc lighting is giving place to incandescent lighting, half-watt lamps being now almost exclusively used. At the end of last year there were 1,339 public street lamps in use.

(To be concluded.)

TELEGRAPH and TELEPHONE NOTES.

West Indies.—It is reported that a new wireless station has been installed at St. Lucia for commercial purposes.

United States.—Additions to the list of radio stations of the United States, as given by the Bureau of Navigation in its October list, include 11 special land stations and 6 ship stations.

Wireless Tower Wrecked.—At the end of September high winds prevailed in the Eastern parts of the United States, and at New York City the gale reached a measured velocity of 72 miles per hour. Large signs, trees, and telegraph poles were blown down, and at Medford, Mass., a new steel tower erected by the American Radio and Research Co. was wrecked. The tower was 312 ft. high and had been nearly finished when the accident occurred. It was mounted on a reinforced concrete foundation, and measured 3 ft. 6 in. square, being guyed at 100 ft. intervals by three-strand steel wires, the sizes of which at the two lower points of attachment were ⅝ in. and at the top guying point ¾ in.—*Electrical World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—November 25th. G.N. of Scotland Railway Co. Six or twelve months' supply of telegraph material. Forms of tender from the Stores Superintendent, 80, Guildford Street.

Athy.—December 6th. U.D.C. Tenders are invited for lighting the town with electricity. Particulars from Mr. J. A. Lawler, Town Clerk.

Australia.—December 7th. P.M.G.'s Department (various States). Non-encrusting zincs, carbon and manganese powder, manganese chloride, chloride of ammonia, porous pots (2 in.), outer jars for cells, carbon blocks, resistance boxes of 5,000 ohms, &c. See "Official Notices" October 15th.

November 30th. Commonwealth Department of Defence (Navy Office). Power station, plant and equipment, and machine tools, for Commonwealth Naval Dockyard, Sydney. (Time for receipt of tenders extended from October 25th.)*

December 20th. P.M.G.'s Department, N.S.W. 4,250 telephones (Schedule 454).

January 5th, 1916. P.M.G.'s Department, Queensland. Copper wire and accessories (Schedule 356). January 26th.—Telephone instruments (Schedule 344).

January 19th, 1916. P.M.G.'s Department, S. Australia. One common multiple switchboard, Telephone Exchange, Adelaide (Schedule 405).

Goulburn.—December 15th. Council. One 200-kw. direct-coupled generating set, gas or steam driven. Specification, 10s., from the Local Government Association, 103-4, Queen Victoria Markets, Sydney, or the Town Clerk.

Sydney.—December 6th. Municipal Council. 33,000-volt outdoor transformers and switchgear. Specifications (10s. 6d.) from Electric Light Department, Town Hall.

November 22nd. City Council. High-tension cable-testing outfit, consisting of a 350-k.v.a. single-phase transformer, a 175-k.v.a. single-phase potential regulator, a 1,600-k.v.a. single-phase inductance, and a control switchboard.*

December 20th. Metropolitan Board of Water Supply and Sewerage. Three centrifugal pumps and electric motors, each to pump 6,300 gallons per minute, and one to pump 15,100 gallons per minute, together with switchboards, starters, &c., for the pumping station at Marrickville, N.S.W. Deposit £10. Tenders to the Board, at 341, Pitt Street, Sydney, N.S.W.*

January 12th, 1916. N.S.W. Railway and Tramway Department. Two water-tube boilers, &c., for the Zara Street power house, Newcastle. See issue of October 8th for further particulars.

January 31st, 1916. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

Melbourne.—December 14th. Deputy P.M.G. Eleven sections of a lamp-signalling trunk-line switchboard, and other material necessary for increasing the equipment of Melbourne trunk exchange from 108 to 240 lines. Schedule 1,207.*

December 7th. Deputy P.M.G. Electric motors, polarised relays, Morse sounders, telephonometers and voltmeters.*

December 14th. P.M.G. For delivery in all States, 18,670 common-battery wall pattern telephones, manufactured in Australia. Sched. No. 1,264. Tenders will also be considered for instruments manufactured in countries other than Australia.*

January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

Perth.—December 8th. 294 accumulators, and power board complete, for P.M.G.'s Dept. See "Official Notices" October 8th.

Bradford.—November 13th. Corporation. Twelve months' supply of lamp fittings, insulating material and tramway stores for the Tramways Committee. Specifications from the Tramway Offices, 7, Hall Ings.

Canada.—November 23rd. Dominion Government Department of Naval Service, Ottawa. Electric cable and wire for H M. Canadian dockyards.*

Chatham.—November 24th. T.C. Twelve months' supply of incandescent electric lamps. Specifications from the Borough Surveyor's office, Town Hall.

Dublin.—November 15th. Twelve months' supply of stores for Dublin United Tramways Co. See "Official Notices" October 29th.

Enniskillen.—December 1st. Sligo, Leitrim and Northern Counties Railway Co. Twelve months' supply of telegraph materials. Forms of tender from Mr. J. Duff, Secretary's office.

Japan.—Electric tramway material for the extensions of Nagasaki tramways.*

Manchester.—November 17th. (*a*) Turbo-alternator plant, specifications Nos. 29 and 31; (*b*) induced draught plant, specification No. 30. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Rochdale.—November 17th. Steam coal for the electricity station. Mr. C. C. Atchison, Engineer and Manager, Dane Street.

Salford.—November 29th. Manganese steel crossings for the Tramway Department. General Manager, 32, Blackfriars Street.

South Africa.—November 15th. South African Railways. Twelve months' supply of rubber-insulated tinned-copper wire, as may be required. Secretary, Tender Board, S.A.R., Johannesburg.*

St. Helens.—November 17th. Erection of engine house and other works at Cropper's Hill power station. Particulars from Mr. E. M. Hollingsworth, Borough Electrical Engineer (£1 1s. returnable).

Upper Longhor.—November 15th. E.L. installation at new schools for Glamorgan C.C. Mr. T. M. Franklen, Clerk, Cathays Park, Cardiff.

Wakefield.—November 16th. Twelve months' supply of coal for Calder Vale Electricity Works. City Electrical Engineer, Old Town Hall.

Warrington.—November 16th. Supply of E.H.T. cable, for the Tramways Committee. See "Official Notices" November 5th.

November 24th. Cheshire Lines Committee. Telegraph materials and carbons (Schedule 6), required during 1916. Stores Superintendent, Cheshire Lines, Warrington.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Bristol.—The T.C. Docks Committee has accepted the tender of Messrs. J. H. Holmes & Co. for a 25-h.p. motor for working the ship elevator at Avonmouth Old Dock.

Elland.—The D.C. Electricity Committee has accepted the tender of Messrs. Thompson, Newsome & Co. for the supply of 50 tons of coal at the electricity works, and also for the supply of 30 tons monthly above contract quantity, at a price of 18s. 1d. per ton delivered at the works.

Glass Houghton.—The Pontefract R.D.C. has accepted the tender of the Pulsometer Engineering Co. for a 3-in. "Stereophagus" pump and electric motor.

Glasgow.—The Tramways Works and Stores Committee recommends acceptance of the following tenders:—

Trolley beams for Kinning Park sub-station.—Fleming Bros.
Soft copper strip.—Charles Hamilton & Co., Ltd.

Manchester.—The following tenders have been accepted by the Electricity Committee:—

Two sets of E.H.T. switchgear.—Ferranti Ltd.
Induced-draught plants.—Babcock & Wilcox, Ltd., and M. Lou's Prat.
One 800-kw. motor-converter for sub-station.—Bruce Peebles & Co., Ltd.
Purchase of scrap iron.—Wm. Faint & Son and James Moores.
Purchase of a cast-iron cylinder.—J. H. Broomhead.

London.—L.C.C.—The Highways Committee has received the following tenders for the provision of heating and ventilating installations at the central car-repair depôt (third section) :—

Colley, Meikle & Co.	(accepted)	£1,495
J. & F. May		1,597
Young, Austen & Young		1,671
W. G. Cannon & Sons, Ltd.		1,780
Brightside Foundry and Engineering Co., Ltd.		1,819
E. Deane & Beal, Ltd.		1,890
Standard Engineering Co., Ltd.	(incomplete)	382

The architect's estimate was £1,750.

The Asylums and Mental Deficiency Committee has accepted the following contracts :—

Electrical sundries (Schedule 64)—A. F. Goodwin & Co.; Edison & Swan U.E.L. Co., Ltd.; General Electric Co., Ltd.; Cox-Walkers, Ltd.; G. Maclellan & Co.

Electric lamps (Schedule 64A).—Pope's Electric Lamp Co., Ltd.

Stepney.—The Electricity Committee has accepted the offer of Messrs E. Foster & Co. for 100 tons of Walsall Wood washed beans, at 21s. 7d. per ton, and 3,000 tons of Ibstock D.S. nuts, at 22s. per ton, the coal covered by the latter offer to be delivered at the Limehouse generating station in equal weekly quantities.

Stretford.—The D.C. has accepted the tender of Messrs. W. T. Glover & Co. for cable, at £302.

Walsall.—The T.C. Tramways Committee has accepted the tender of the Daimler Co. for three additional single-deck 'buses, including extras, at £1,008 10s. each.

Watford.—The Electricity Committee of the U.D.C. has accepted the offer of Messrs. W. Cory & Son, Ltd., to reduce their contract price for Griff peas coal by 2s. 6d. per ton. Messrs. E. Foster & Co. are also prepared to reduce their contract prices of Newdigate peas by 6d. per ton, and Kingsbury nutty slack by 4d. per ton. The Clerk has been directed to endeavour to obtain a further reduction.

The U D.C. has accepted the tender of Messrs. Connare & Co., at £227, for wiring the pumping station.

West Bromwich.—Subject to the sanction of the L.G.B. being obtained, the Electricity Committee recommends that the following tenders be accepted for extensions at the electricity works :—

Babcock & Wilcox, Ltd.—Boiler and accessories.
J. Thompson.—Steel chimney.
E. Green & Son.—Economiser.
J. P. Hall & Sons.—Feed pump.
New Conveyor Co.—Coal bunker.
J. Proctor, Ltd.—Coal elevator.
British Westinghouse Electric & Mfg. Co.—E.H.T. switchgear.

Weymouth.—The T.C. has accepted the tender of Messrs. Brooking & Co. for the electric light installation at the municipal dwellings.

FORTHCOMING EVENTS.

Greenock Electrical Society.—Friday, November 12th. At 7.45 p m. At Temperance Institute, 19, West Stewart Street. Paper on "Kinematograph and Kinemacolor," by Mr. P. C. Kerr.

Physical Society of London.—Friday, November 12th. At 5 p.m. At Imperial College of Science, S.W. Paper on "The Effect of Electric Oscillations on the Magnetic Properties of Iron, Investigated by the Campograph," by Prof. J. A. Fleming, F.R.S., and Mr. P. R. Coursey. Demonstrations by Mr. R. S. Whipple.

Manchester Association of Engineers.—Saturday, November 13th. At Grand Hotel, Aytoun Street. Paper on "Science and Practice in Engineering," by Mr. C. E. Stromeyer.

Electro-Harmonic.—Monday, November 15th. At 8 p.m. At Holborn Restaurant. Ladies' Night.

Institution of Civil Engineers.—Tuesday, November 16th. At 5.30 p.m. At Great George Street, S.W. Paper on "The Punjab Triple Canal System," by Sir John Benton, K.C.I.E.

Nottingham Society of Engineers.—Wednesday, November 17th. At 7.30 p.m. At the Welbeck Hotel, Milton Street. Paper on "The Lay-out and the Equipment of Engineering Works," by Mr. F. A. Garrett.

Chemical Society.—Thursday, November 18th. At 8.30 p.m. At Burlington House. Lecture by Dr. E. J. Russell.

Institution of Electrical Engineers.—Thursday, November 18th. At 8 p.m. At Victoria Embankment, W.C. Inaugural Address by the President.

Manchester Local Section.—Tuesday, November 16th. At 7.30 p.m. At the Engineers' Club. Chairman's Address.

University College, London.—Friday, November 19th. At 5 p.m. Third Lecture on "Electric Heating and Electric Furnaces," by Prof. J. A. Fleming, F.R.S.

Institution of Mechanical Engineers.—Friday, November 19th. At 8 p.m. At Storey's Gate, S.W. Papers on "The Chemical and Mechanical Relations of Iron, Molybdenum, and Carbon," by Prof. J. O. Arnold, F.R.S., and Prof. A. A. Read, and "The Cause and Effect of 'Ghost Lines' in Large Steel Forgings," by Prof. J. O. Arnold, F.R.S.

Greenock Electrical Society.—Saturday, November 20th. Visit to the Glasgow Sewage Works at Shieldhall.

ENLISTING AND EMPLOYMENT IN THE ELECTRICAL INDUSTRY.

The following is a copy of a circular which has been issued this week to all members of the Institution of Electrical Engineers :—

Enlistment of Clerical and Commercial Employes.

At the request of the Clerical and Commercial Employments Committee of the Home Office, the Council of the Institution of Electrical Engineers desire to call the attention of employers to the urgent necessity of giving immediate and detailed consideration to the question of replacing the men now in their employ who in the near future will be called up in increasing numbers to serve in the military forces of the country.

As regards substitutes, it is understood that the supply of men who are over military age, or who have been rejected by the authorities as unfit for military service, is wholly inadequate to satisfy present and contingent demands. Of men who have been invalided out of the Army, and who will generally be regarded as having a first claim to employment, comparatively few have yet been returned to civil life. Lads under military age are being largely employed in the place of enlisted men, but here again the supply is short, and this expedient is subject to the serious disadvantage that if the employés are not far short of military age they may leave the employer just at the time when they are becoming useful.

In the case of technical assistants and skilled tradesmen, it is not possible to make any general suggestion, and the question of their replacement is one which will have to be solved by each employer according to circumstances, but as regards clerical and commercial employés it is to the ranks of women that employers must chiefly turn for substitutes. In some of the larger and more highly organised concerns, such as banks, insurance offices, &c., employers have so far experienced little difficulty in replenishing with women their depleted staffs. The women in these cases are very often the friends or relatives of members of the existing staff. The Council believe that a considerable part of the problem will be solved if large employers will adopt this means of replacing enlisted men. The women clerks so engaged are employed, at first, at all events, in the more elementary branches of clerical work, and in a surprisingly large number of cases no previous business training seems to be required.

It is certain, however, that in the near future, as men are called up for the forces under Lord Derby's scheme, there will be a great and increasing demand in all commercial centres for clerical labour which the sources of supply alluded to will be altogether unable to meet, and the above-mentioned Committee of the Home Office have accordingly decided to approach immediately the local authorities in all important towns and to invite them to start at once schemes for organising a supply of clerical workers, and for fitting them, so far as can be done in the time available, by emergency classes to supply the places of the men who will have gone.

The Council desire also to bring to the notice of the electrical industry that at a conference held at the Home Office, Lord Derby laid special stress on the desirability of giving preference, wherever possible, to women relatives of enlisted men.

In the interests of recruiting, it is highly important that the places of enlisted men should be kept open for them. This is an honourable rule, and, so far as the Council are aware, a practically universal one in the branches of employment here referred to. No less desirable is it that the employment of substitutes for enlisted men should be known to be and declared to be temporary, and for the period of the war only.

Under the circumstances, the Council wish to impress upon employers the importance of considering at once how their arrangements can best be remodelled as their present men are called up, and what number and class of women or other substitutes they will require.

Lastly, as regards the question of the exemption from military service of men regarded by the employer as indispensable for carrying on his business, the Council are informed that the arrangements on this point are under consideration.

Charles P. Sparks, *President*.

November 9th, 1915.

NOTES.

America and Trade after the War.—It is stated that the American Congress will in the coming Session be asked to pass legislation rendering it unlawful for foreign manufacturers to sell their goods in the United States below the cost of production.

Remote Control of Marine Engines.—According to the *Shipping Gazette*, it is reported that Dr. K. Ito, manager of the Mitsu Bishi engine works at Nagasaki, has invented and recently demonstrated the working of an apparatus which enables the navigator on the bridge of a steamship to start, stop, and regulate the main engines at will, without the intervention of human agency in the engine-room. The apparatus is worked by electricity, and can easily be disconnected if it is desired to control the engines in the ordinary way.

A Co-operative Society Electric Lorry.—We illustrate herewith a 30-cwt. electric lorry recently supplied by Messrs. Drake & Gorham, Ltd., of 47, Spring Gardens, Manchester, to the Blackpool Industrial Co-operative Society. The lorry is built on an Edison accumulator model "G. M." chassis, and equipped with an Edison battery capable of propelling the car for about 50 miles on one charge, the vehicle being rated to travel fully loaded at 11 miles an hour, although in practice the average speed has been found to be well up to the legal limit of 12 miles an hour. The constructive details of this type of vehicle have been often referred to in our pages; in this particular case charging of the battery is effected from the Society's own gas-electric plant at its depôt. *The Blackpool Co-operative Pioneer*, in refering to this matter, expresses appreciation of the great simplicity of operation of the new vehicle as compared with the petrol-driven machine, and congratulates the members of the society on an acquisition which bids fair to save them money.

Foreign Trade.—FIGURES FOR OCTOBER.—The following are the electrical and machinery figures given in the official returns for October:—

	Month of October.	Inc. or dec.	Ten months, 1915.	Inc. or dec.
	£	£	£	£
IMPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	86.769	+ 26,789	852,897	− 236,295
Machinery ...	520,982	+ 85,466	7,394,372	+ 1,651,583
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	245,840	+ 32,843	2,516,107	− 81.280
Machinery ...	1,503,980	− 528,758	16,115,334	− 12,023,970

Fatalities.—SOUTH SHIELDS.—At South Shields, on November 2nd, an inquest was held upon the body of Horatio Smith (31), electric welder, who was fatally injured on October 25th while following his employment with the North-East Coast Welding Co. George Rounding stated that on the date named he and deceased were welding boilers in the ss. *Hunterfield*, lying in Messrs. Brigham & Cowan's dry dock. They were using a portable generator which was at the side of the dock, the current being obtained from a trolley which worked a travelling crane. The current failed, and on going ashore they found the generator was not running. Deceased went forward to try it, but in doing so slipped from a rail on which he was standing into a pool of water, and then fell against the machine. Witness caught hold of his clothes and pulled him away. He was still alive but unconscious, and there was a burn on his neck. Artificial respiration was tried for an hour and a half without avail. Witness thought deceased received an electric shock before falling against the machine. William E. Groves, electrician in charge of the machinery, said that two men who went to assist deceased received shocks by standing on the rails. After the accident witness examined the cable and found a flaw in it, probably caused by contact with a hard substance. The cable passed over a pile of scrap chains, and he thought that the chains and the pool of water in which they were lying had become charged with electricity. Deceased had received a shock when he slipped into the water and another when he fell against the generator. Replying to Mr. W. B. Lauder, H.M. Inspector of Factories, witness agreed that at such places as the one where the accident occurred an armoured cable would be safer than one with the ordinary rubber covering. The jury returned a verdict of "Death from syncope, following an electric shock accidentally received," and recommended that cables should be more thoroughly protected at such places.

HACKNEY.—At the Hackney Coroner's Court on Saturday last, an inquest was held on the death of W. W. H. Gardiner, aged 28, of Cobden Road, Leytonstone, a telegraph wireman employed by the G.P.O., who died from injuries received owing to the collapse of a telegraph pole in the garden at the rear of a house in Mortimer Road, Kingsland, while at work removing wires.

W. Jones, foreman wireman, said that the pole broke off just below the ground line. It measured 40 in. in circumference where it broke. He had previously tried the post, and it appeared to be sound. The test was a hammer.

The lower section of the pole was produced in court, and appeared to be completely rotten.

C. E. Tattersall, sectional engineer in the G.P.O., stated that the pole was issued in 1902, and was probably erected 12 or 18 months later. The life of such poles was anything from 12 to 15 years.

The jury returned a verdict of "Accidental death," and added that in their opinion the examination of the pole before the man ascended it was hardly sufficient.

GATESHEAD.—A lad who climbed a lamp-post to extinguish an electric lamp when he heard that Zeppelins were coming touched a live wire and was killed.

Appointments Vacant.—Temporary shift engineers (£2), for Reading Corporation tramways; switchboard attendants (30s.-40s.), for Salford electricity department; switchboard attendant (27s.), for Wakefield electricity department; assistant shift engineer (42s.) and switchboard attendant (36s,) for the Battersea B.C. electricity department. Particulars are given in our advertisement pages to-day.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—Headquarters; Chester House, Eccleston Place, S.W. Orders for week commencing November 15th, 1915, by Lieut.-Col. C. B. Clay, V.D., Commanding.—

Drills, 6.25 to 7.25; 7.25 to 8.25.

Monday, November 15th.—Sections 1 and 2, Technical; Sections 3 and 4, Squad or Working Party.

Recruits and Signalling Section.

Tuesday, November 16th.—School of Arms with Architects' Corps, 6 to 8 p.m.

Thursday, November 18th.—Sections 3 and 4, Signalling Section, Shooting.

Friday, November 19th.—Sections 3 and 4, Technical; Sections 1 and 2, Squad or Working Party.

Signalling Section and Recruits.

Saturday, November 20th.—Uniform Parade, 3 p.m.

Sections for Technical Parade at Headquarters. London Electrical Engineers, 46, Regency Street. Sections for Shooting Parade at the Miniature Ranges. Unless otherwise ordered, all Parades at Chester House.

In future, and until further orders, Sections 1 and 2 will always Parade on Mondays for Technical, and on Fridays for Squad Drill, and Sections 3 and 4 will always Parade on Mondays for Squad Drill, and Fridays for Technical, but Sections 1 and 2 and 3 and 4 will alternate weekly for Shooting on Thursdays. Signalling Section will Shoot on the same days as Sections 1 and 2.

E. G. FLEMING,
Company Commander and Acting Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, November 11th, 1915:—

Week-end Parades.—Saturday.—The Battalion will parade at Baker Street Station at 2.30 p.m., and proceed by train to Kilburn Station, where they will detrain and proceed by march route to Wembley Camp. There will be Night Operations from 5.15 p.m. till about 6.30 p.m. The Quartermaster will arrange for teas to be served punctually at 4.30 p.m.

Sunday.—The Battalion will parade at the Low Level entrance, Liverpool Street Station, at 8.55 a.m., and proceed by train for Entrenching duties, returning to Liverpool Street about 6 p.m.

The Quartermaster will make arrangements for Lunch.

Musketry.—Saturday 13th inst., and Tuesday, 16th inst.—Acton, at 2 p.m. punctually.

Bisley—Saturday, 13th inst.. as usual.

Sunday, 14th inst. There will be Targets for 500 yards and 600 yards all day. Members who have already sent in their names, should report themselves to Sergeant Cotter, at 9.45 a.m., at the barrier of No. 9 Platform, Waterloo Station.

A. G. JOINER, *Major and Adjutant*, O.B.C.

Railway Shunting Engine Telegraph.—An improvement in the means of communication between the shunters and the engine drivers has recently been tried on the shunting spur on the Great Western Railway, at Southall West Junction. In effect, the arrangement is a shunting telegraph between the neck of the spur and an engine on the spur, much after the fashion of a ship's telegraph between the captain's bridge and the engine-room. The transmitting instrument, situated at the neck of the spur, is electrically connected to two conductor rails fixed parallel to the running rails along the shunting spur. By means of the indicating instrument, the shunters are able to transmit six different signals to the engine driver, viz., "Go ahead," "Back," "Stop," "Steady," "Ease up," and "Back smart." The receiving instrument is fixed in the cab of the engine, corresponding signals appearing in front of the driver in the form of illuminated indications, which remain exhibited as long as desired by the shunters. A bell also sounds in the cab of the engine at the instant any signal is given or one ceases to be shown. The engine driver has, therefore, a constant visual indication of the shunter's requirements, and, in addition, has his attention called by a bell each time a change is made in the indication. To enable the signals transmitted by the shunter to be received in the cab of the engine, three shoes are fixed on the latter. Of these, only two make contact with the conductor rails at one time, the other only coming into operation when the engine is turned in the opposite direction. We understand that the arrangement has been found particularly useful in foggy weather, and that consequently its adoption in other shunting yards of the G.W.R. may be expected in the near future.

Institution and Lecture Notes.—The Röntgen Society.—In his presidential address from the chair of the Rontgen Society on November 2nd, the new president, Mr. J. H. Gardiner, F.C.S., dealt chiefly with the historical side of modern investigation in physics and chemistry. Summarising progress so far as X-rays were concerned, he said that the little Crookes tube of 20 years ago, a laboratory-made scientific curiosity, had grown into the magnificent piece of apparatus which was known as the modern X-ray tube, an apparatus which with moderate care was practically indestructible, and through which could be passed with perfect safety 100 times the current that would utterly ruin the small one. The induction coil, except in a few instances a fragile machine rarely seen and still more rarely used, had given place to the modern high-tension transformer with its flaming torrent of sparks. The early radiographs of the hand, taken with great difficulty by four minutes' exposure, had given place to the magnificent radiograph of a thorax taken by a single flash, with a probable duration of 1/100th of a second. The X-ray, no longer an unknown form of energy connected with a series of more or less hazardous speculations, had fallen into place at the end of the series of electromagnetic vibrations, and the lengths of the waves had been measured and tabulated. The question of protection of X-ray operators from the harmful effects of the rays was a matter now being considered by the Society. There were such things as late X-ray reactions, occurring long after the use or application of the rays had been stopped, and it was evident that no one as yet knew all about the effects which X-rays produced. At the present time, X-ray installations were multiplying rapidly, and the work had of necessity to be done by those whose past experience was slight or was lacking altogether. In view of the serious results that might follow unless due care were taken, the President announced that the Council had, in the name of the Society, devised a set of suggestions for the protection of X-ray workers, and these would be supplied to all members and to as many public institutions as possible.

Institution of Civil Engineers of Ireland.—Mr. Mark Ruddle, city electrical engineer, Dublin, the newly-elected President of the Institution, delivered his inaugural address at Dublin last week, dealing in a comprehensive manner with some of the great issues—commercial, financial and industrial—involved in the war. He said it was probable that after the war there would be an exceptional demand for well-trained engineers in the reorganisation that would come with the industrial revival. The mind of the country was ready to receive new ideas, and to consider them without the tendency to prejudice that had fettered progress in times of peace. It rested with the members to develop the usefulness of the Institution, so that the benefits of its membership would be regarded as desirable by the engineering profession in Ireland. Mr. Ruddle remarked that this was the first occasion in the long history of the Institution that a member of the Electrical Section had occupied the chair.

Northampton Engineering College Engineering Society.—The arrangements for this session are not yet completed, but the Society will be carried on, as far as is possible, on the same lines as in previous years. The number of members of the Northampton Polytechnic Institute serving with the Forces is approximately 350; this number includes day students, evening students and members.

University College, London.—Mr. A. H. Barker, B.Sc., Lecturer in Heating and Ventilating Engineering at University College, will give a lecture on "The Methods of Evaluation of Standard Coefficients in Heating Engineering," in the Physiology Theatre at University College, on Tuesday, November 23rd, at 7 p.m. This lecture will be open to the public without ticket, and is especially intended for engineers and others concerned in practical work in heating and ventilating.

Institution of Electrical Engineers.—At the opening meeting of the Scottish Local Section, on Tuesday last, the new chairman, Mr. David A. Starr, delivered his inaugural address, the subject being "The Relation of the Electrical Industry to the War."

At the ordinary meeting of the Institution next Thursday, November 18th, a valuable collection of papers of Michael Faraday will be presented to the Institution on trust by Mr. D. J. Blaikley, who is the husband of the last surviving niece of Faraday.

Mr. P. V. Hunter, chairman of the Newcastle-on-Tyne Local Section, on Monday delivered his inaugural address, the subject being power station switchgear.

Electrical Association of Australia.—At the meeting of the Victorian Section on July 15th, a paper on "Electric Tramway Construction" was read by Mr. F. A. McCarty; and at the meeting on September 23rd, Mr. Douglas Little read a paper on "Overhead High-tension Transmission Mains."

A lecture on "Electrical Machinery" was given by Dr. G. W. Worrall to the Preston Mill Managers' Association on November 5th. The lecturer dealt with various defects in the construction of electrical machinery, and said these could be avoided by examination during construction by an expert acquainted with the conditions prevailing in the works which the machine was intended for. Dr. Worrall explained the great increase of efficiency and output brought about by electric driving.

Electric Heating and Electric Furnaces.—Continuing his lectures at University College last Friday, Prof. Fleming pointed out the advantages of dealing with the flow of heat through bodies in terms of resistance rather than conductivity, on the principle devised by Carl Hering, and showed how the usual conductivity constants could be utilised to obtain what could be called "thermal ohms." The construction of the integrating bolometer was then described: a sheet of platinum is sandwiched between sheets of silver, to enable the whole to be rolled out very thin; the silver is then dissolved off the platinum, and the latter is slit so as to form a grating, and is coated with platinum black by electrolysis, the result being the most sensitive device known for measuring radiant heat. The bolometer is calibrated by inserting it inside a globe of copper, which is kept at 0° C., whilst a concentric sphere inside it is kept at T° C., and the intervening space is exhausted of air. The path of the heat rays within the globe is therefore radial, and their intensity being known, the bolometer can be calibrated. Prof. Fleming explained the use of the bolometer for exploring the spectrum, and proceeded to demonstrate the use of the Féry radiation pyrometer, for measuring temperatures that were too high to allow thermoelectric or resistance thermometers to be inserted into the furnace. The importance of securing true "black body" conditions was emphasised; otherwise, the temperature would always be under-estimated.

Turning to the theories of heat and electricity, the lecturer remarked that although the atom was something like 10^{-8} cm. in diameter the electron was about 100,000 times smaller, or somewhat in the ratio of a pin's head to the dome of St. Paul's. On the electron theory, the electrons in copper were supposed to be about as numerous as the atoms, and the electric current consisted in a drift of electrons under the influence of an electromotive force. Thermal energy was due to the motion of the electrons, not the atoms, and as the energy of moving bodies was proportional to the square of their velocity, it could be shown that the energy developed by an electric current should be proportional to the square of the current strength, as in fact it was. But the resistance of pure metals, decreasing with temperature, appeared to become zero at the absolute zero of temperature, and, in the case of lead, Prof. Kamerlingh Onnes, reducing the temperature with the aid of boiling helium to within 4° C. of the absolute zero, found that its resistance actually became infinitesimal. This observation compelled a revision of the theory of conduction of electricity through metals, and Sir J. J. Thomson in August last propounded a new hypothesis to suit the facts. He assumed that the molecules of matter were electrically polarised like elementary magnets, and that the current was due to the arrangement of the molecules. This theory reconciled most of the phenomena of heat and electricity, and explained the anomalous behaviour of alloys, whose resistance did not tend towards the absolute zero as the temperature was lowered.

The third lecture will be given on November 19th.

Steel Wire for Russia: An Urgent Inquiry.—As we go to press a letter reaches us from a correspondent in Russia, who urgently requires large quantities of tin-plated steel wire of ·23, ·3 and ·35 mm. diameter. He needs about 50,000 kilograms monthly, and wishes all the British factories turning out such wire to quote him lowest prices as speedily as possible, and give particulars as to earliest date of delivery. He wishes to have the information by cable. The wire required should have a breaking stress of 250 kilograms per square mm. If, however, the manufacture of such tough wire is impossible or difficult at the present time, he would accept it with a lower tensile strength, but in no case must it be below 120—150 kilograms per square mm. He suggests that if necessary the order could be divided among several factories. He also asks for catalogues, price lists, &c., giving particulars of various machines necessary for the production of copper wire and cables. Communications should be addressed to S. S. Mogipevcev, Moscow, B. Bronnaia, Lom No. 7.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. T. K. Richardson, station superintendent to the Marylebone electricity department, has been granted three months' leave of absence, owing to illness.

Mr. C. W. Salt, A.M.I.E.E., borough electrical engineer, Torquay, has joined the London Electrical Engineers (R.E.) for the period of the war. Business correspondence may be sent to Mr. J. M. Keenan, who will take charge of the electricity department in his absence. Personal letters may be sent to Mr. C. W. Salt, Glenside, Teignmouth Road, Torquay, for forwarding.

Tramway Officials.—The General Manager of the tramways at West Hartlepool having joined the Forces, the T.C. has placed the working of the system under the superintendence of the Electrical Engineer and the Borough Engineer.

General.—Mr. R. J. Hebbert is leaving the measuring instrument department of Messrs. Siemens Bros. & Co., Ltd., at the end of November, in order to take up a position on the staff of the British Westinghouse Electric & Manufacturing Co., Ltd., at Trafford Park, Manchester.

The marriage took place at the Parish Church, Portobello, Edinburgh, on October 28th, of Mr. Wm. Wood, electrical and telegraph superintendent of the North British Railway, and Miss Lucy Laidlaw, daughter of Mr. John Laidlaw, of Portobello. The presents included a silver rose bowl from the chief officials of the railway company, a silver Queen Anne tea service from the electrical and telegraph staff, and a case of table silver from the railway electrical engineers of England and Scotland.

Councillor Albert Green, who is the new Mayor of Derby, is associated with the business of Mr. B. G. Hodges, electric wire manufacturer, of Derby, and with that of Messrs. T. H. Moon & Co., Ltd., electric wire manufacturers, of London.

In the *London Gazette* for November 5th the following appears:—Territorial Force.—Royal Garrison Artillery, Tyne Electrical Engineers. The undermentioned Second-Lieutenants to be Temporary Lieutenants:—Wm. A. Souter; J. F. S. Hunter; A. B. Williamson; J. R. Abbott; H. O. Rogerson; H. Sherlock; C. F. Scott; E. H. Gibbon; D. Myles; and P. B. C. Sutthery.

Mr. William H. Smith, who has been connected with Messrs. Simplex Conduits, Ltd., for a good number of years, has been appointed as manager to that company for Liverpool district and Ireland.

The Glasgow T.C. has appointed Bailie Alston convener of the Tramway Committee, with ex-Bailie W. M. Montgomery vice-convener, and Bailie Hannay as convener of the Electricity Committee, with ex-Bailie P. S. Stewart as vice-convener.

Mr. J. M. Ralph, chief of the testing department at the works of the British Thomson-Houston Co., Ltd., is leaving England for the benefit of his health.

Mr. Hughes Howells, who was in charge of the electrical plant of the Powell-Duffryn Co., Ltd., at Bargoed, has proceeded to the front for service with the Royal Flying Corps.

Mr. Benjamin G. Lamme, the chief engineer to the Westinghouse Electric & Manufacturing Co., Ltd., Pittsburg, has recently been appointed a member of the Naval Advisory Board, U.S.A. Mr. Lamme entered the employment of the American Westinghouse Co. in 1889, where for a period he occupied a post in the testing department; soon afterwards he took up design work, which he has since followed continuously. The American company appointed Mr. Lamme to be assistant chief engineer in 1900, and he succeeded to his present office in 1903. In the development of alternating-current apparatus, including induction motors, polyphase generators, rotary converters, and single-phase railway apparatus, Mr. Lamme has been in the front rank. He also performed pioneer work in the development of the first direct-current apparatus for railway lighting and power work. Among the more prominent installations with which Mr. Lamme has been identified may be mentioned the famous 5,000-H.P. revolving field Niagara Falls generators installed in 1895; the single-phase motor and generator equipment for the New York, New Haven and Hartford railroad; the Philadelphia-Paoli electrification of the Pennsylvania railroad, together with many other important installations.

Councillor F. A. Wardlow, deputy chairman of the Sheffield City Council Electricity Committee, and a director of Messrs. Edgar Allen & Co., steel manufacturers, has been elected Lord Mayor of Sheffield.

Mr. P. B. Smith, who has for more than three years been the outdoor representative of Messrs. Home & Rowland, electrical engineers, Charlton, London, S.E., has enlisted in the Royal Flying Corps.

Roll of Honour.—Private James Russell, of the 7th Battalion Lancashire Fusiliers, formerly employed at the British Westinghouse Works, Trafford Park, has been suffering from malarial fever, contracted at the Dardanelles, and is now on leave.

Private S. White, of the 8th Battalion Lancashire Fusiliers, who has died at the Dardanelles, aged 19 years, was formerly employed at the General Electric Works, at Salford.

Sapper Geo. Withington, of the Royal Engineers, who has been killed in action, was prior to the war engaged with Messrs. Brook, Hirst & Co., electrical engineers, of Northgate, Chester.

Pte. J. Crane, of the 2nd Border Regiment, who was engaged with Messrs. Browett, Lindley & Co., engineers, of Patricroft, has been recommended for the Distinguished Conduct Medal for conspicuous bravery on the battlefield on July 25th. Under heavy shell fire, he rescued a number of men who had been buried in a trench.

Pte. Sidney Geo. Stone, of the 2nd Worcestershire Regiment, who died from wounds received in action in France, was prior to the outbreak of war engaged with the British Thomson-Houston Co., Ltd., of Rugby.

Corpl. F. W. Green, of the 8th Berkshire Regiment, who was on the staff of the Reading Electric Supply Co., Ltd., has been killed in action in France.

Pte. Wm. Worrall, of the 1/6th Staffordshire Regiment, who was until his enlistment at the outbreak of war with Messrs. Siemens, of Stafford, has died from wounds received in action in France.

Obituary.—Mr. W. Alfred Restarick.—The death is announced of Mr. Wm. Alfred Restarick, assistant electrical overseer at Birkenhead Dockyard, and previously for 36 years on the electrical staff at Chatham Dockyard. He was 50 years of age.

Mr. Leonard Potts.—The death is reported of Mr. Leonard Potts, Town Clerk of Poplar, who acted as hon. secretary to the Conference of Metropolitan boroughs owning electricity undertakings.

Mr. P. A. B. Widener.—The death of Mr. P. A. B. Widener, the Philadelphian traction magnate, at the age of 81 years, is reported.

Captain D. R. H. P. Salomons.—We desire to tender to Sir David and Lady Salomons, of Broomhill, Tunbridge Wells, our sincere condolence in the loss of their only son, Captain David Reginald Herman Phillip Salomons, Royal Engineers, 3rd Kent Field Company (T.F.), who has been drowned at sea. The late Captain Salomons was born in 1885 and was an M.A. of Caius College, Cambridge. There is now no heir to the baronetcy. Sir David, who has always been intimately interested in electrical affairs, and who is at the present time president of the Electrical Trades' Benevolent Institution may be assured that among a very wide circle of friends and admirers the deepest sympathy is felt with himself and Lady Salomons in their severe bereavement.

Lieut. N. G. Crompton.—We also tender our sympathy to Col. R. E. Crompton, of Thriplands, Kensington Court. Lieut. Nigel George Crompton, 89th Field Company, R.E. (attached 101st Field Company), the Colonel's younger son, was killed in action on November 5th. He was 27 years of age.

Colonel P. E. Huber.—On October 4th the well-known Swiss engineer, Colonel P. E. Huber, died at Zurich at the age of 79. He was the son of a silk manufacturer, and was educated at the newly-opened Polytechnic High School at Zurich, where he first acquired a bent towards mechanical engineering. After a short period with Sulzer's at Winterthur, and Escher, Wyss in Zurich, as well as further studies in England and Belgium, in 1863 Huber founded an ironworks in partnership with an Englishman called Jackson, under the style of P. E. Huber & Co., at Oerlikon, but it went into liquidation a few years later, and in 1872 passed over to another company in which Huber held a share. The latter in 1876 became the Oerlikon Machine Tool & Engine Works. As first president of the board of management, and later general manager, he soon brought the company up to a high standing, added iron and brass foundries and steel works, and in the middle eighties established an electrical department. A striking performance carried out by the Oerlikon Works, in conjunction with the A.E.G., in 1891, was the construction of the famous power transmission from Lauffen to the electrical exhibition at Frankfort-on-Main. Up to 1894 Huber was managing director, and from then to 1911 president of the board of management, of the Maschinenfabrik Oerlikon, and from 1911 to his death he continued to be a member of the board. In addition to bringing the Oerlikon works up to their present high state of efficiency, Colonel Huber took an active interest in several other undertakings, such as the Neuhausen Aluminium Co., of whose board of management he was president for many years, and the Society of Swiss Enginebuilders, of which he was chairman from the commencement. He was a man of high character, great gifts, strong will, and good breeding, who possessed in equal measure broad views and commercial foresight and prudence.—E.T.Z.

NEW COMPANIES REGISTERED.

Telephone Manufacturing Co., Ltd. (142,023).—This company was registered on November 2nd, with a capital of £25,000 in £1 shares (10,000 7 per cent. cum. pref.), to take over the business carried on by F. T. Jackson as the "Telephone Manufacturing Co.," to carry on the business of making, selling, hiring out, buying, putting up, maintaining and working (so far as they lawfully can) private and other telephones and telegraphs, etc. The subscribers (with one share each) are: F. T. Jackson, Hollingsworth Works, Martell Road, West Dulwich, S.E., manufacturer; A. Stocken, 49, Leadenhall Street, E.C., solicitor. Private company. F. T. Jackson is permanent governing director. Registered office: Hollingsworth Works, Martell Road, West Dulwich, S.E.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hong-Kong Tramway Co., Ltd.—A memorandum of satisfaction to the extent of £200 on September 7th and £300 on September 20th, 1915, of trust deed dated July 1st, 1903, securing £195,000, has been filed.

Bracuhy Falls and Metallurgical Syndicate, Ltd. (110,780).—Capital, £48,000 in £1 shares. Return dated December 30th, 1914 (filed June 4th, 1915). All shares taken up. 10s. 6d. per share called up; £25,200 paid. Mortgages and charges: Nil.

Chili Telephone Co., Ltd. (29,252c).—Capital, £360,000 in £5 shares. Return dated July 28th, 1915. 66,000 shares taken up. £220,000 paid; £110,000 considered as paid. Mortgages and charges: Nil.

Crompton and Co., Ltd. (129,649).—Capital, £221,007 in £1 shares (136,000 pref.). Return dated July 19th, 1915. 79,539 ord. and 136,000 pref. shares taken up, of which 2,240 pref. have been forfeited. £1 per share called up on 7 ord. and 7s. 6d. per share on 133,760 pref; £50,788 2s. 8d. paid (including £621 2s. 8d. paid on 2,240 pref. shares forfeited); £163,132 considered as paid, being £1 per share on 79,532 ord. and 12s. 6d. per share on 133,760 pref. Mortgages and charges: £100,000 first mortgage debentures.

D.P. Battery Co., Ltd. (44,084).—Capital, £10,000 in £1 shares (4,996 "A," 4,996 "B," and 8 others). Return dated July 21st, 1915. All shares taken up; £10,000 paid. Mortgages and charges: £12,000.

Bray, Markham and Reiss, Ltd. (74,871).—Capital, £20,000 in £1 shares. Return dated July 15th, 1915. 9,250 shares taken up; £8,850 paid; £400 considered as paid. Mortgages and charges: Nil.

W. A. and R. J. Jacobs, Ltd.—Particulars of £1,000 debentures, created October 23rd, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £300. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Electro-Flex Steel Co., Ltd.—Issue on October 26th, 1915, of £200 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Auckland Electric Tramways Co., Ltd.

Mr. C. G. Tegetmeier presided, on Monday, over the annual meeting of the company, held at Electrical Federation Offices, Kingsway. In proposing the adoption of the report, the Chairman, after referring to the absence on active service of Capt. Leo Myers, a director, said this was the first time since the company started electrical running in 1902 that they had not been able to point to an increase, and generally a large increase. The war had affected their business in Auckland, but a comparison with the previous year might be somewhat deceptive, because in that year they had the traffic brought about by the Auckland Exhibition to increase their receipts, and, on the other hand, the discontinuance of running for 18 days during the strike. It was probable that the operation of those two causes upon their gross revenue was to counterbalance each other. The present accounts covered a period of 11 months of war-time, and closely following upon the outbreak of hostilities there was a noticeable decline in the volume of traffic. The tendency in that direction became more pronounced as the year went on, and it was still continuing. The more conservative policy adopted by the local authorities with regard to public works, the restriction of building operations, the lessened attendance at the various places of amusement, and the almost entire absence of interest in football and other athletic sports, were all contributing causes. In view of all the adverse circumstances they had had to meet, it could not be expected that their receipts would show the same expansion as under normal conditions. The total traffic receipts showed a decrease of £3,908, the whole of which arose in respect of the motor omnibuses. The motor 'buses were acquired specifically for the purpose of facilitating the exhibition traffic, and they proposed to dispose of them as soon as a suitable opportunity could be found. Power and running expenses amounted to £112,091, or a reduction of £6,039. That was mainly accounted for by the lessened cost of coal as compared with the abnormal cost in the previous year, due to the strike. The running costs were somewhat higher, owing to the fact that a considerable proportion of the men were paid on a sliding scale, increasing with length of service, and to a larger number of them attaining the maximum rate of pay. The increase in the rate for the year was about 2½ per cent., the average rate paid to motormen at the end of the year being very nearly 1s. 3d. per hour, and to conductors close upon 1s. 1d. per hour. Those rates indicated the difference in the labour conditions prevailing in New Zealand and in this country, and they could quite realise that it required a very high average of receipts to enable them to pay such wages. On repairs and maintenance they had spent £38,851, £2,820 more than in the preceding year; and in addition they spent £22,545 upon renewals, the larger portion on the reconstruction of the permanent way. The latter amount was charged to the renewals and depreciation account, which had been created specially to meet such expenditure. A good deal of reconstruction work had still to be carried out upon the earlier constructed lines. During the past year they had restricted reconstruction expenditure to work that was immediately necessary, and they were still pursuing that policy. A time came, however, when it was false economy to postpone reconstruction, and it was essential that their renewals account should be adequate to meet the expenditure when the need arose. Out of last year's revenue they were allocating £22,500 to the renewals and depreciation account. The net result of the year was that the balance available for distribution was £1,221 less than last year. The dividend upon the preference shares at £9,000 was unaltered, and they proposed to pay the same dividend of 1s. 7d. per share for the year on the ordinary shares, but it would be paid less income-tax, instead of free of tax as they had done for the past three years. The effect of deducting the income-tax from the ordinary dividend was that the amount charged for rent, rates, and taxes was £3,562 less than if the dividend had been paid as usual. It was, unfortunately, the case that the company had to pay English income-tax upon the whole of its profits, notwithstanding the fact that they were earned exclusively in New Zealand and were heavily taxed there. That was one of the many anomalies in connection with our income-tax law that pressed very hardly upon companies such as theirs, and which, in its ultimate effect, must be detrimental to the interests of the State. It was so far satisfactory to know that the Chancellor of the Exchequer recently stated that on the very first opportunity after the war the Government would devote themselves to making a reform in our income-tax laws, so perhaps they might look forward to some redress in the future. On the whole, he thought they had good reason to congratulate themselves upon the results shown, and there was no reason to doubt that when the war was over, and the end we were fighting for was attained, the progressive prosperity of the company would be resumed.

Col. Burton seconded the motion, which was carried unanimously.

Monterey Railway, Light & Power Co.

In a circular to the debenture-holders the directors state (says the *Financial News*) that, owing to the low rate of exchange prevailing between Monterey and London, it continues to be impossible for the company to provide the interest on the debenture stock. While the directors regret that they do not see any action that can usefully be taken in the interests of the debenture stockholders, they are ready and willing to co-operate with the debenture stockholders in any course thought advisable in the common interests. There is not now any court in Monterey exercising civil jurisdiction whose assistance could be sought in connection with the company's or the debenture-stockholders' affairs. The financial statements for 1914 are being prepared, and will shortly be presented to the shareholders for their annual meeting. The trustees, in a circular, say that in the existing conditions they feel that taking any proceedings might greatly prejudice the best interests of the company and the debenture stockholders.

Edison & Swan United Electric Light Co., Ltd.

The directors report that for the year ended June 30th, 1915, after providing for interest on both classes of debenture stock, and depreciation upon freehold properties and plant, there is a net profit of £14,147, plus £5,732 brought forward, making a total standing to the credit of profit and loss of £19,879, which the directors propose to deal with by transferring to reserve account £15,000, and carrying forward £4,879. As previously pointed out, it is absolutely essential in the interests of the company that a substantial reserve account be created and, for this reason, the directors regret that they are unable to recommend the payment of a dividend upon the shares. The increased turnover of the business, coupled with the rise in the cost of all raw materials and labour, have severely taxed the capital resources of the company during the past year, and additional working capital is required in consequence. This can only be provided out of profits, therefore the directors recommend the allocation of the amount standing to the credit of profit and loss as above. The accounts show that marked progress has been made during the year, and the results would probably have been still more satisfactory had it not been for the abnormal rise in the price of raw materials, labour, and carriage. Whilst on the engineering side of the works this extra cost has been partially met by a corresponding rise in selling values, the lamp side of the works has been materially affected, and, it being impossible to raise the selling price of drawn-wire lamps, the increased cost of manufacture has materially reduced the profit on sales. In spite of the difficulties attending the shipment of goods for abroad, the directors report that the export business, particularly to the British Colonies and India, has shown a marked increase, and they look for considerable development in this direction when times become normal. A resolution will be submitted to the annual meeting on November 18th for the purpose of electing to the board Mr. John Cross, who represents parties holding a considerable interest in shares of the company, and the board trust that shareholders will support this.

Australia.—According to the "Melbourne Age," the financial statement of the Hydro-Electric Power & Metallurgical Co., Ltd., covering the period of five months ended July 31st last shows an addition of £1,790 to the debit at profit and loss, which thereby is increased to £200,665. The outgoings for the term were £2,135, whilst income amounted to only £345. The directors state that the agreement with the Tasmanian Government stipulates for a supply of up to 10,000 h.p., as required, from time to time, with provision for still further blocks as may be wanted. Plans and estimates for the working unit of the electrolytic zinc plant are being prepared.

Buenos Aires Port and City Tramways Co., Ltd.—The accounts for the year to December 31st, 1914, have been issued, also further accounts made up to June 18th, 1915, on which date a receiver was appointed by the court. These show an operating profit of £6,191 for the five and a-half months, as against accrued interest on debentures, £13,781; sinking fund, £2,592; and interest on loans, £2,340. The directors are not able to say whether a scheme of reconstruction will be formulated by the receiver or by the debenture-holders; but it is hoped that some proposal may not be long delayed which will be duly submitted to the shareholders.—*Financial News*.

Metallic Seamless Tube Co., Ltd.—The report for the past year states (says the *Financial Times*) that the net profit was £3,415, and £4,349 was brought forward. A dividend of 20 per cent., free of income-tax, is proposed, adding £3,000 to reserve, and carrying forward £1,612.

British Ever-Ready Co., Ltd.—The directors have declared a dividend at the rate of 10 per cent. per annum on the preference and ordinary shares for the half-year to September 30th.

British Electric Traction Co., Ltd.—A petition for confirming the reduction of capital from £4,000,000 to £2,998,398, is to be heard on November 16th before Mr. Justice Astbury.

United Electric Tramways of Caracas, Ltd.—The *Financial Times* states that the directors' report for the twelve months ended June 30th, 1915, states that the directors, following the precedent of last year, consider it desirable that profits should as far as possible be again fully divided among the shareholders. The local company were therefore requested to declare, as last year, a dividend absorbing the whole of their net profits. After adding the balance forward, £1,206, the net revenue shows a disposable balance of £15,749, out of which the directors recommend a dividend for the year of 7 per cent. and a bonus of 1½ per cent. (less income-tax), which will absorb £14,450, leaving £1,299 to be carried forward. The profits of the local company (the whole capital of which is owned by this company) have been adversely affected by the European war, and it only requires the re-establishment of peace to enable the company to resume its prosperous career. The percentage of operating expenses is 51.38, which is 3.10 per cent. more than the previous year, due to the larger mileage run with less receipts.

Cleveland Trust, Ltd.—Explaining the causes of the smaller profit of the Cleveland Trust, Ltd. (Middlesbrough), at the annual meeting on Monday, Mr. W. H. Hustler (vice-chairman) said that one immediate cause was the unfortunate result of the war upon their electric lighting undertaking at Saltburn-by-the-Sea. They had been adversely affected in this respect a year ago, and he was afraid they would not have to look for profit from that source so long as the lighting restrictions continued. A dividend of 5 per cent. was declared.

"Z" Electric Lamp Manufacturing Co., Ltd.—A petition for confirming the reduction of capital from £150,000 to £15,000 is to be heard on November 16th before Mr. Justice Astbury.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended August 27th, 1915, amounted to 2,051,304, compared with 1,501,589 in the corresponding four weeks of 1914; and during the five weeks ended October 1st the number was 2,618,836 units, compared with 1,811,089 in the corresponding five week of 1914.

Nairobi Electric Light and Power Co., Ltd.—At an extraordinary general meeting, held on Wednesday at the offices, 30, Mark Lane, E.C., Sir Stanley Edwards presiding, a resolution was passed increasing the capital of the company from £30,000 to £50,000 by the issue of 20,000 new ordinary shares of £1 each.

Cape Electric Tramways, Ltd.—Dividend 5 per cent., less tax.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange business keeps good. It is necessary to explain that the word is used more or less relatively, but instead of about 25 per cent. of the members of the Stock Exchange paying their office expenses, the proportion during the past fortnight has probably risen to twice as much. It may be replied that the latter performance is not particularly brilliant, but, anyway, the stockbroker comforts himself with the reflection that things are not so bad as they were.

The Home Railway market is one of the firmest. Throwing off its long-protracted depression and stagnation, it has suddenly assumed a place amongst the progressive markets, and its prices have gone ahead in a fashion somewhat bewildering to those who do not appreciate how very small an amount of demand or supply is needful nowadays to bring about quite substantial movements in prices.

Other things, however, are also good. Peace rumours are said to lie at the root of the advance; perhaps the verb is appropriate, because nobody believes that Germany is so far exhausted as to sue for peace yet. At the same time, the Stock Exchange opinion favours the idea that the latest Serbian diversion, dreadful as it is for our heroic little ally, is scarcely more than a fresh flounder of the crippled giant in his net, and a desperate struggle to place his precarious footing in a position secure enough to enable him to treat for peace with the expectation of getting better terms than he could possibly hope for by simply taking the present Eastern and Western fronts into account.

The investor goes on buying shares day by day, and, it seems surprising to note, the spirit of speculation is beginning to revive. People are once more anxious to get as many shares as they can for as little money as possible; and the readiness to take risks argues that there is plenty of capital available. In the United States, gambling in stocks and shares goes on apace, and the economists look askance at the huge quantity of British gold which is being imported into the country, and which experience teaches will have the effect of accelerating gambling, and raising the prices of commodities, with everything else.

Electricity markets are feeling the changed conditions of business principally through the medium of the Brazilian-Canadian-Mexican group of securities. In Mexicans, the halt which was called last week is still operative, although the strength of most of the stocks and shares connected with the country is surprisingly well maintained. Another hiatus has occurred in the receipt of news from Mexico, so that nobody quite knows what is happening there. The Monterey Railway, Light & Power Co. has notified its debenture stockholders that the collapse in exchange has rendered it impossible to transmit funds to Europe, except at a loss. The directors, therefore, consider it best to let earnings accumulate until normal conditions are restored, and we take it that proprietors will raise no objection to such a course. Brazilian utility bonds are good, and one of the features of the week is a forward movement in most securities connected with Brazil.

Canadian issues move irregularly. New York operators put down prices on Monday last upon the publication of the terms of the United States Note to this country. There stood a group of Stock Exchange men discussing the Note, and one of them clinched the tenour of the argument with the remark that it was surprising what a lot of letters answered themselves if they remained long enough in the pocket. There is a good deal of amusement in the Stock Exchange at the tone of the American Government's demands.

The London Supply Companies show a dullish front, so far as the market in them is concerned. The market is not even assisted by the remarkably small falling-off displayed in the electric lighting bill of the City Corporation in respect of the latest period for which the figures are announced. The ratepayer in various parts may wonder why the lighting authorities do not put in smaller lamps, which consume less current and give subdued illumination, rather than continue to take a full supply of current, and to obscure the glass. From the shareholder's point of view, the latter is doubtless the more excellent way; but from the economical aspect, the former looks preferable, on the face of it. We understand that the important London companies are holding joint meetings, with a view to finding some system whereby one could help another should it become necessary in the case of fire.

Half-a-dozen falls have taken place in the leading ordinary and preference shares. Kensington ordinary and St. James' preference have both declined to 6. Westminster ordinary and St. James' ordinary are each 6½. There are a few shares on offer in this group, and, as we have noted before, buyers require a good deal of tempting before they will put money into electrical supply shares nowadays.

The telegraph division is firm. A little speculation sprang up in West Indian and Panama shares, buyers giving 23s. 6d. for them, induced thereto by the dividend announcement already mentioned here in our two previous issues. Globe ordinary and preference have repeated their previous rises of ⅛. Eastern ordinary and Western shares are both better. New York Telephone bonds remain at 100, at which they are too dear.

Substantial improvement in Anglo-Argentine Tramways issues is the principal feature amongst the foreign list. The three debenture issues of both classes of preference shares have advanced, the latter class showing a rise of 5s. apiece. Confidence is steadily returning to the Argentine Republic, and it is argued, justifiably enough, that the Anglo-Argentine Tramways securities make good speculative investments. Taking the quintet of stocks which we quote, it will be noticed that the average return runs out to 6¾ per cent. on the money. At last week's prices, it would have come to a little over 7 per cent.

At the Auckland Electric Tramways meeting, held on Monday, the chairman referred to the harsh incidence of the income-tax upon profits in the concern, pointing out that the company had to pay very heavy taxes in New Zealand and, at the same time, further taxes on this side. This is one of the many cases in which there would seem to be room for useful modification—at any rate, when peace is restored.

Babcocks are strong at 2¼, regaining twice as much as they lost last week; the shares are being bought from the provinces, where investors usually know what they are doing. Castner-Kellners are also firm; and it may be mentioned, incidentally, that the 4½ per cent. debenture stock changed hands early this week at 96½, at which it seems distinctly expensive. Henleys are better at 12¾, but Callenders are called lower at 10½. The improvement in Telegraph Constructions is continued, the price rising another 10s. to 33½.

The rubber market is decidedly good. Business is active, and many of the leading shares are keeping pace with the price of the product as it steadily hardens. The Armament group, too, is slightly better, though business remains quiet. There is further strength amongst copper shares, due to the American demand for the copper stocks popular on the other side.

In *Harper's Magazine* this month a writer on "The City of the Future" declares that, by then, "Synthetic rubber has arrived. The city traffic is entirely electrical. Trucks and motors speed swiftly without odour or noise; they are charged with power at the great central station in off-peak hours. Cooking is done on electric stoves. Electric trains have annihilated space. Balanced by gyroscopes, they speed at 200 miles an hour on a single rail." It is a little depressing to learn, after all this, that in man there is little left that is elemental, and that the laughter of children is more rare.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend, 1914.	Price Nov. 9, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	7½	—	£6 18 4
do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	3½	—	7 2 10
do. do. do. 4½ Pref.	4½	3¾	—	6 0 0
do. do. City Pref.	4½	3½	—	6 8 7
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4¼	—	5 17 8
do. 4½ Deb.	4½	87	—	5 3 6
City of London	9	12¼	— ¼	7 7 8
do. do. 6 per cent. Pref.	6	10¾	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10	—	7 0 0
do. do. 6 per cent. Pref.	6	10¼	—	5 17 8
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	83 xd	—	5 8 0
Kensington Ordinary	9	6	— ¼	7 10 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4¼	— ¼	7 1 2
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	3½	2¼	—	7 15 7
do. 4½ per cent. Pref.	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	85	—	5 6 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6½	— ½	7 13 10
do. do. do. 7 per cent. Pref.	7	6	— ¼	5 16 8
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6½	— ¼	6 18 6
do. 4½ Pref.	4½	4⅛	— ⅛	5 9 0

Telegraphs and Telephones.

	Dividend, 1914.	Price Nov. 9, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	101 xd	—	5 18 0
do. Def.	1½	23	+ ½	6 10 5
Chile Telephone	8	6½	—	6 3 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11¾	—	*6 16 2
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord...	7	123	+1	*6 13 0
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	82	—	4 18 0
Globe Tel. and T. Ord.	6	10¼	+ ⅛	*6 13 9
do. Pref.	6	10¼	+ ⅛	5 17 1
Gt. Northern Tel.	22	83½	—	6 11 4
Indo-European	13	46 xd	—	6 18 4
Marconi	10	1⅞	—	6 8 0
New York Tel. 4½..	4½	100	—	4 10 0
Oriental Telephone Ord.	10	1 15/16	—	5 3 1
do. Pref.	6	⅞	—	6 17 2
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5⅝	—	*8 2 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12⅜	+ ⅛	*6 9 4
do. 4 Deb.	4	80	—	5 0 0

Home Rails.

	Dividend, 1914.	Price Nov. 9, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented	4	68	—	5 16 0
Metropolitan	1¼	25½	+3½	4 18 0
do. District	Nil	14½	+1½	Nil
Underground Electric Ordinary	Nil	1⅜	+ ⅛	Nil
do. do. "A"	Nil	5/-	+ 3d.	Nil
do. do. Income	6	71½	+1	*9 6 3

Foreign Trams, &c.

	Dividend, 1914.	Price Nov. 9, 1915.	Rise or fall this week.	Yield p.c.
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	97	—	5 3 0
Anglo-Arg. Trams, First Pref.	5½	3¾	+ ½	7 6 8
do. 2nd Pref.	5½	3¼	+ ¼	8 9 2
do. 4 Deb.	4	75½	+1½	5 6 0
do. 4½ Deb.	4½	75	+1	6 0 0
do. 5 Deb.	5	76	+1	6 11 7
Brazil Tractions	3½	57½ xd	—	6 1 9
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	34	—	Nil
do. 5 per cent. Bonds	—	50	—	Nil
do. 6 per cent. Bonds	—	44	—	Nil
Mexican Light Common	Nil	30	—	Nil
do. Pref.	Nil	40	—	Nil
do. 1st Bonds	—	60	—	—

Manufacturing Companies.

	Dividend, 1914.	Price Nov. 9, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	2¼	+ ⅛	6 4 5
British Aluminium Ord.	5	1 1/16	—	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	10⅛	—	7 8 2
do. Pref.	6	5⅞	—	5 2 2
British Westinghouse Pref.	7½	34/-	—	8 10 8
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	10½	— ½	7 2 10
do. 5 Pref...	5	4½	—	5 11 8
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	61/-	—	4 18 6
Edison & Swan, £3 pd.	Nil	10/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	57	—	7 0 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/9	—	7 1 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	12¾	+ ⅛	*8 19 4
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	7¾	—	6 5 0
Telegraph Con.	20	33½	+ ½	*8 8 8

* Allowance made for dividends being paid free of income-tax.

Amazon Telegraph Co., Ltd.—The gross revenue for the year ended June 30th, 1915, amounted to £57,933, and the working expenses to £34,938. After providing £22,888 for debenture interest and sinking fund, there remains £107, plus £5,840 brought forward, making the balance to be carried forward £5,947.—Annual meeting: November 16th.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 10th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a „ Nitric	„	..	..
a „ Oxalic	per lb.	1/1	1d. inc.
a „ Sulphuric	per cwt.	..	..
a Ammoniac Sal	„	..	..
a Ammonia, Muriate (large crystal)	per ton	£50	..
a Bleaching powder	„	..	..
a Bisulphide of Carbon	„	£23	..
a Borax	„	£23	..
a Copper Sulphate	„	£35 10	£7 10 inc.
a Lead, Nitrate	„	..	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	..	..
a Potash, Caustic (88/90 %)	per ton	..	..
a „ Chlorate	per lb.	1/4½	..
a „ Perchlorate	„	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers	„	£11 10	..
a „ Recovered	„	..	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %)	„	..	..
a „ Chlorate	per lb.	1/3½	..
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	6½d.	1d. inc.
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	..	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	..	..
b „ Sheet, in ton lots	„	..	..
p Babbitt's metal ingots	„	..	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/1 to 1/1½	½d. inc.
c „ Tubes (solid drawn)	„	1/1¾ to 1/2	½d. inc.
c „ Wire, basis	„	1/1¼ to 1/1½	..
c Copper Tubes (solid drawn)	„	1/1¾ to 1/2	½d. inc.
g „ Bars (best selected)	per ton	£107	£4 inc.
g „ Sheet	„	£107	£4 inc.
g „ Rod	„	£107	£4 inc.
d „ (Electrolytic) Bars	„	£91	£2 10 inc.
d „ „ Sheets	„	£109	£2 10 inc.
d „ „ Rods	„	£98	£2 10 inc.
d „ „ H.C. Wire	per lb.	11 13/16d.	5/16d. inc.
f Ebonite Rod	„	3/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/7½	2d. inc.
i Iron Pig (Cleveland warrants)	per ton	67/7½	..
l „ Wire, galv. No. 8, P.O. qual.	„	£26	..
g Lead, English Pig	„	£25 15	..
g Mercury	per bot.	£16 15	20/- inc.
e Mica (in original cases) small	per lb.	6d. to 3/-	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 14/- & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	..	..
p „ „ rolled bars & rods	„	..	..
p „ „ rolled strip & sheet	„	..	..
o Platinum	per oz.	198/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	„	£162 to £163	£7 10 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/7	..
p White Anti-friction Metals	per ton	..	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a G. Boor & Co.	*h* Edward Till & Co.
b The British Aluminium Co., Ltd.	*i* Bolling & Lowe.
c Thos. Bolton & Sons, Ltd.	*k* Morris Ashby, Ltd.
d Frederick Smith & Co.	*l* Richard Johnson & Nephew, Ltd.
e F. Wiggins & Sons.	*n* P. Ormiston & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	*o* Johnson, Matthey & Co., Ltd.
g James & Shakspeare.	*p*
	r W. F. Dennis & Co.

The Belgian Buenos Aires Tramways.—It is stated that the Compagnie Générale de Tramways de Buenos Aires, of Brussels, will be unable to pay any dividend on the ordinary shares this year, this result contrasting with a distribution of 6¾ per cent. a year ago. The omission is attributed to the circumstance that the Anglo-Argentine Tramways Co., which is said to be controlled by the Belgian company, carried forward the whole of the net profits of £96,000 earned in 1914 in order to meet, as occasion might arise, the company's obligations in regard to the holders of the 5 per cent. cumulative preference shares of the first and second series. It is true that the Belgian company owns 189,612 preference shares of the first series and 399,531 of the second, but the dividends resulting therefrom only render it possible for the company to defray, besides the general expenses, the interest and redemption charges on its loans, which absorbed £91,000 in 1914.

DECIMAL COINAGE AND THE METRIC SYSTEM.

(Continued from page 582.)

Probably in no branch of industry would the benefits of the metric system be more marked than in engineering works. To begin with, drawings would be figured in millimetres throughout, and there would be no necessity to mark feet and inches, with the constant liability to error that at present exists through the confusion of ticks with figures. How easily 1′ 1¼″ can be mistaken for 11¼″ or 1′ 11¼″; or 1 3/16 can become 13/16, and so on. How many errors are made in adding up a series of dimensions containing eighths, sixteenths, and thirty-seconds. How long does it take to find, say, 23/32 on the rule? If calculations have to be made, fractions must often first be reduced to decimals, or voluminous tables be consulted. It is sometimes argued that mistakes may easily be made in placing the decimal point; more often than not, no decimal point is required, but if a mistake is made it is so great—tenfold—that the error is generally obvious. For instance, suppose the gauge of a railway were given as 14.3 metres, or 143 metres, instead of 1.43 m. (= 4 ft. 8½ in.). Who would be misled? Similarly, suppose the length of a rail were stated as 90 m. instead of 9 m.—would the error not be obvious? The liability to error would not be even as great as under present conditions. The ease of taking out quantities, which has been already mentioned, would confer an enormous gain upon draughtsmen.

It might be anticipated that difficulty would be experienced in getting workmen to adopt the metric system. This, however, has been proved by actual experience to be an unfounded belief. Messrs. Willans & Robinson have for years used the metric system for their foreign trade, side by side with British measures, and no difficulty has been experienced; they have adopted the metric system also for the manufacture of steam turbines. No new tools were necessary on account of the adoption of the metric system. Again, the Baldwin Locomotive Works, U.S.A., made 20 locomotives for a French company to metric measures; 19,000 American workmen were affected, and were enthusiastically in favour of the metric system. The Paris-Orleans Railway Co. furnished the drawings, 500 in number, representing 10,000 different parts; the work was to be done in six months, and it was impossible to make new drawings. In a few days six draughtsmen working on the locomotives, and four on the tenders, had got out the shop drawings; the company purchased metric standards, made metric gauges and templets, and supplied the men with metre rules graduated to millimetres. The dimensions were all in millimetres, without any reference to the old system. Not a mistake was made, and the work was satisfactorily accomplished. There was no trouble with the men, and the superintendent of the works, Mr. S. M. Vauclain, was converted to the metric system.

The limit-gauge system, so extensively employed n engineering works nowadays, is independent of he system of units; it is immaterial to the workman whether his gauge is exact millimetres or inches—he need not know its dimensions at all. In either case the dimensions are almost certain to be expressed in decimals. Lathes, milling machines, boring machines, etc., need no alteration at all for use with the metric system; templets are easily altered, if necessary, but how often would any alteraion be required? In any case, templets wear out, and have to be replaced. It is easy to alter bushings n jigs. Few measurements, except those where an exact fit is required, are accurately worked to, so hat the elaborate calculations sometimes put forward to show the difficulty of expressing British tandard dimensions in millimetres are beside the mark; usually the nearest millimetre is sufficiently accurate. Carpenters and joiners are not particular to an eighth, and in pattern-making rule-of-thumb allowance for shrinkage would swallow up many millimetres. Standard screw-threads, unless over 1 inch in diameter, are rarely cut in the ordinary lathe; they are cut with taps and dies which are of fixed dimensions, and it does not matter in the least that they will, no doubt, continue to be cut to inch standards. British Association Standard threads, adopted by the Standards Committee, are tabled only in metric units—rare foresight!—but we never hear of any trouble due to the confusion between inches and millimetres. Metric micrometers are conveniently made with two revolutions per millimetre, reading to 1/100 mm.; but inch micrometers have to be made with 40 revolutions to the inch, and 25 divisions to the circle, or some such awkward arrangement involving much mental effort and liability to error. The 1/100 mm. is a finer and therefore better unit than the 1/1,000 inch, which is 2½ times as coarse.

As for engineering calculations, the advantage is so enormously on the side of the metric system that it is hardly worth discussing. In the design of electrical machinery it is far easier to convert all the British measurements into metric units, work out the calculations, and convert back again, than to adhere to the British measures. This is indeed a common practice in electrical work. The opinion of Mr. C. P. Steinmetz, the distinguished American mathematician and engineer, is worth quoting in full. At the commencement of a paper on the "Steam Path of the Turbine," read before the American Society of Mechanical Engineers, he says:—

"In the following, the metric system of units will be used throughout, since the incongruous mixture of heterogeneous units, called the English system, requires so many reduction factors, that it can conveniently be used only in a narrow range of mechanical calculations, by memorising reduction factors; but where the investigation extends over several branches of science, as mechanics, thermodynamics, and electrical engineering, the English system is so cumbersome, that it is far simpler to translate the premises into the metric system, carry out the work in the metric system, and translate the result back into the English system, if so desired."

Sir Frederick Bramwell has often been quoted in favour of the existing system, which, he claimed, was the best for mental arithmetic; but he possessed altogether exceptional powers in this respect, and it is a poor argument that, because he was proficient in mental arithmetic, we should put up with the innumerable disadvantages of the British units. Moreover, he mistook the metric system for the decimal system. Users of metric units are in no way tied to the use of decimals; they use vulgar fractions whenever these suit their purpose better, and they claim the use of Sir Frederick Bramwell's short cuts as well as their own. On the other hand, Sir Benjamin Baker, an engineer of no less eminence, and of great experience in the use of the metric system, said that the latter was "incomparably simpler"; the difference was "simply marvellous!"

No English engineer can possibly object to the metric system on the score of "a string of decimals"; on the one hand, he already uses the mil, or thousandth of an inch, habitually, and on occasion expresses his dimensions in ten-thousandths—four decimal places! The same measurements can be expressed in millimetres and decimals to three decimal places only, to a higher degree of accuracy, and to two decimal places with a degree of accuracy which cannot be exceeded in practical work (4/10,000 in.), except in the very finest operations.

It would seem advantageous to give an actual example of a working drawing figured on the metric system, for the purpose of comparison with the

English system, as probably few of our readers have seen or had occasion to prepare two such drawings; we therefore reproduce a drawing which is given in Prof. Follows's "Dictionary of Mechanical Drawing" as an example of the best way of dimensioning a drawing, in terms of feet and inches, and the same drawing with the same dimensions translated into metric measures. Although the latter are taken to only one place of decimals, 18 out of the 28 different dimensions are correct to less than one mil (one-thousandth of an inch); 24 are correct within two mils; and of the remaining four, two are just over two mils too large, whilst the other two, which are of no consequence whatever (being the radii of fillets), are only taken to the nearest millimetre, and, therefore, are respectively .007 and .014 in. too small. Disregarding these fillets, there is not a single dimension where a fit is required which is as much as one mil inaccurate, and not a single dimension which is as much as .0021 in. out. To prove these statements, we give a table showing the inch measurement, the metric equivalent to thousandths of a millimetre, the figure used on the drawing, and the resulting error expressed in terms of the inch. We believe this comparison is worth careful study, if only to refute the common but groundless argument that the metric equivalents necessitate "a string of decimals." We may mention that the thousandth of a millimetre is much used in measurements of high precision, as of the wave-length of light, and is called the micron; one mil (1/1,000th of an inch) = 25 microns.

The reason why the inaccuracy due to taking the nearest tenth of a millimetre never exceeds about 2 mils, and averages about 1 mil, is obvious; the greatest error that need be incurred is 50 microns, which is less than 2 mils. If greater accuracy were needed, it would never be necessary to use more than two places of decimals, as this would give the equivalent a maximum error of ¼ mil, and an average error but little exceeding one ten-thousandth of an inch. In the case of the four dimensions that must fit other parts, one is the diameter of the journals and happens to be right to less than the ten-thousandth part of an inch, though a whole mil would not matter in this instance. The other three should be close fits; one of them is almost exact, the others both show a deficiency of nearly one mil, and might with advantage be taken to the second decimal place.

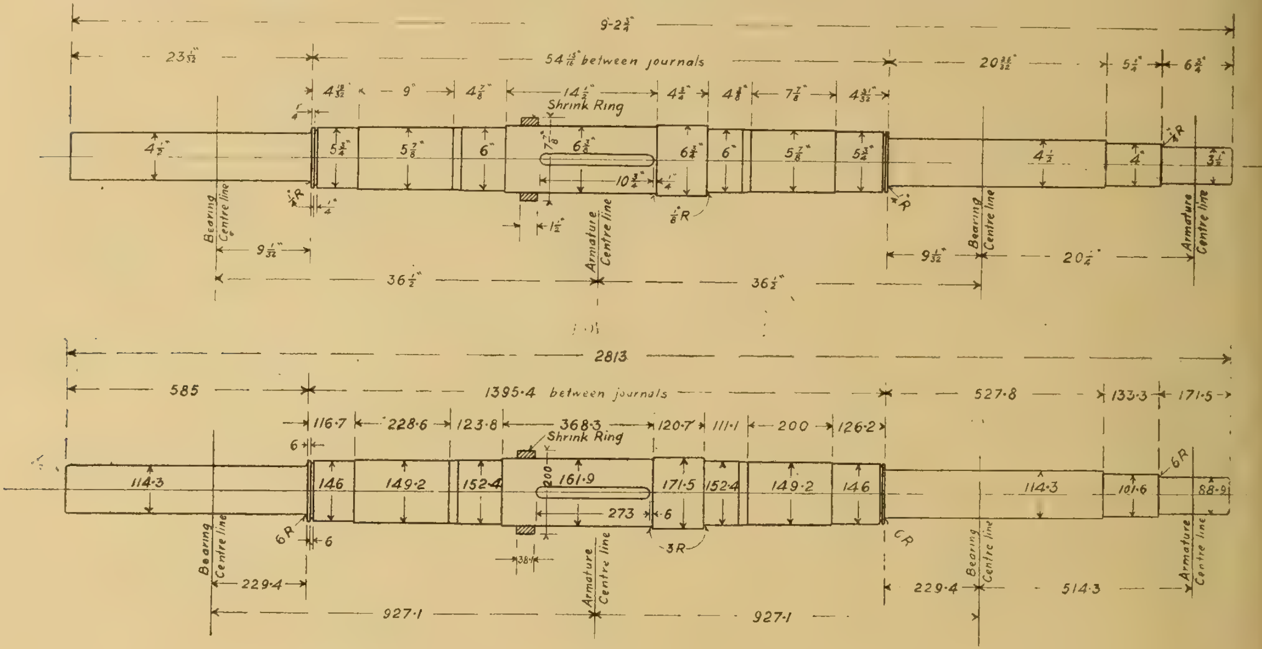


FIG. 1.

Dimension in inches.	Equivalent in mm.	Approx. equiv. in mm.	Error in inches.
$4\frac{1}{2}$*	114 298	114·3	+ ·00008
$5\frac{3}{4}$	146·048	146·0	— ·00189
$5\frac{7}{8}$*	149·223	149 2	— ·00090
6	152·397	152·4	+ ·00012
$6\frac{3}{8}$*	161 922	161·9	— ·00087
$6\frac{3}{4}$	171·447	171·5	+ ·00209
4	101·598	101·6	+ ·00008
$3\frac{1}{2}$*	88 899	88·9	+ ·00004
$4\frac{19}{32}$	116 679	116·7	+ ·00083
9	228·596	228·6	+ ·00016
$4\frac{7}{8}$	123·823	123·8	— ·00090
$14\frac{1}{2}$	368 293	368·3	+ ·00028
$4\frac{3}{4}$	120·648	120·7	+ ·00205
$4\frac{3}{8}$	111·123	111 1	— ·00090
$7\frac{7}{8}$	200·022	200·0	— ·00087
$4\frac{31}{32}$	126·204	126 2	— ·00016
$10\frac{3}{4}$	273·045	273·0	— ·00177
$1\frac{1}{2}$	38·100	38·1	0
$23\frac{1}{32}$	584·983	585·0	+ ·00067
$54\frac{15}{16}$	1,395·386	1,395 4	+ ·00055
$20\frac{25}{32}$	527·833	527·8	— ·00130
$5\frac{1}{4}$	133·348	133·3	— ·00189
9 ft. $2\frac{3}{4}$ in.	2,813 049	2,813·0	— ·00193
$9\frac{1}{32}$	229·390	229·4	+ ·00039
$20\frac{1}{4}$	514 340	514·3	— ·00158
$36\frac{1}{2}$	927 083	927 1	+ ·00067
$\frac{1}{4}$	6·350	6	— ·014
$\frac{1}{8}$	3·175	3	— ·007

* Dimension to fit other part of machine.

It will be noticed that Prof. Follows uses such dimensions as 36½ in. and 9 ft. 2¾ in. on the same drawing. This, however, is nothing to what can be done in inch measurements, as we shall show; but before leaving this drawing, we commend to the notice of our readers the series of dimensions which must add up to 54 15/16 between the journals, and invite them to *perform the addition*, first in inch measurements, and afterwards with millimetres. The latter we have done mentally with ease; we defy any reader to add up the inch measurements in the same way, without a mistake, in twice the time. There is nothing exceptional about the drawing, which was selected merely for convenience, as a typical case, and without the slightest regard to the values of the dimensions.

(To be continued.)

Ozonair. — Messrs. Ozonair, Ltd., have recently received a further order from the London Electric Railway for "Ozonair" plant. The present installation is destined for the Leicester Square station of the Charing Cross, Euston and Hampstead Tube, where it will be in operation shortly. It constitutes the 17th installation supplied to the London Tube Railways by Messrs. Ozonair, Ltd., and this testifies to the success and popularity of their system of purifying air by the addition of small quantities of pure ozone, which can be applied equally to the factory, the office, or the home.

THE RELATION OF SCIENCE TO PRACTICE IN ENGINEERING.

Dealing with this subject as President of the Liverpool Engineering Society, Prof. E. W. Marchant delivered an interesting address, of which the following is an abstract:—

It is to the application of scientific method and the development of technical instruction that Germany owes the position she has attained in engineering constructional work during the past 20 years. There is little doubt that if we are to retain the pre-eminent position we have occupied in engineering manufacture and construction, it will be necessary for us to work by scientific methods, and, by applying the scientific knowledge we have gained of the quality and strength of material, to cheapen and improve the construction of engineering work. To illustrate the effect of scientific study in one direction only, it is sufficient to compare the cost of electrical plant with what it was 20 years ago. A normal figure for static transformers was £2 10s. per KW., now, a large transformer can be built for 10s. per KW. This reduction in price is due to two things; the discovery of alloyed steel, which has a much higher electrical resistance than ordinary transformer iron, and magnetic qualities very little inferior, which has enabled a smaller iron section to be used; and, secondly, to the scientific study of the most effective method of getting rid of the waste heat, which has enabled an enormous increase in the size of unit to be effected.

The laboratory attached to a college or university has usually limited facilities for large scale engineering research; it must deal in principles and theories, which are really fundamental. Researches of this kind naturally divide into three groups:—

1. Investigation of the properties of materials used in engineering.

2. Investigation of apparatus and machines, their origination and design.

3. Investigation of a more physical kind on new phenomena, with a view to their development for practical use.

All these fields of research are vast in extent, and their exploration is only begun.

1. The essential material for electrical engineers is copper, which forms a considerable percentage of the weight of all electrical machinery. The quality of greatest importance is its electrical conductivity, and it is interesting to note that all the copper used nowadays for electrical purposes is of 2 or 3 per cent. better conductivity than the purest copper Mathiessen could produce in his laboratory. The improvement in this material has been due entirely to the careful scientific study of its properties, and to the application of electrolytic purification in the final stages of manufacture. The study of copper conductivity showed that the presence of a very small amount of impurity was sufficient to cause a decrease of conductivity out of all proportion to its amount. For example, traces of arsenic reduce the conductivity by 40 per cent., 0·1 per cent. of phosphorous reduces the conductivity by 30 per cent. Such facts as these showed the way in which the highest conductivity could be obtained. Copper of high tensile strength also (30 tons per sq. in.) is very common with small wires. A similar study is now going on with aluminium, a metal of which the mechanical qualities are comparatively poor, and the result already has been to place aluminium in the field as a serious rival of copper for many purposes. This has partly been due to the reduction in price caused by improved methods of manufacture, which, in turn, are due to the results of scientific investigation, but also to the study of methods of preparing the metal, so that it shall not be corroded by exposure.

The effect of scientific investigation on the manufacture of iron and steel for electrical purposes has already been referred to. A new alloy of silicon and iron called "Stalloy" was produced, as the result of researches by Barrett, Brown and Hadfield on the conductivity and permeability of iron alloys in January, 1900. These researches give us a particularly interesting example of the advantage of co-operation between the manufacturer and the man of science. The work undertaken was a scientific investigation of the properties of iron alloys, in which different substances, tungsten, nickel, manganese, silicon and aluminium, in known proportions, were alloyed with steel. The materials were produced at the Hecla Works of Sir Robert Hadfield at Sheffield, and tested in Prof. Barrett's laboratory at Dublin. The surprising effect of a small percentage of silicon on the electrical conductivity of the iron and on its magnetic softness was the result of greatest interest. It is no exaggeration to say that no other discovery has done more to reduce the size and improve the operation of electrical machinery than this one has done.

The effect of alloying with tungsten pointed to a method of producing a hard steel for permanent magnets. This, and the other important uses to which tungsten could be put, led the Germans to take up tungsten manufacture, and when the war broke out nearly all the tungsten used in tool steel and magnet steel was proved to be of German origin. This position has now been changed, and thanks to the complete control we possess over the supply of tungsten ores, the manufacture of tungsten has been undertaken by the manufacturers here on a large scale, with the result that all the tungsten wanted for magnets and tool steels can be obtained. This result has been achieved not by direct Government action, but by the enterprise of our manufacturers.

Germany has not captured our trade in magnet steel, the steel made in Sheffield is better and harder than any that can be got anywhere else in the world. And we are not standing still. The investigation of the magnetic property of steel is a subject which is now being undertaken by a Committee of the Institution of Electrical Engineers, working in conjunction with the manufacturers, notably Sir Robert Hadfield's firm, and it is hoped that the results of the investigations now being undertaken may prove as useful as those which have been obtained from the earlier experiments.

The discovery of sludging in transformer oils led to the scientific study of the properties of oil, with the result that at the present time, oil manufacturers will undertake to provide oil which will produce no perceptible "sludge" or deposit, after hundreds of hours of heating in contact with copper, even when air is blown through the oil to oxidise it.

The use of high-frequency current has opened up a wide range of investigation on the properties of material, which will require a large amount of time and patient study before the materials can be used to the best advantage.

2. One of the most outstanding examples of the assistance that scientific investigation has given to the construction of electrical machinery is the working out of the principle of the magnetic circuit, by the late Dr. John Hopkinson. Dynamos had been constructed by Edison and others in America and elsewhere, but it was not until Hopkinson had pointed the way to an economical design of the magnetic circuit that any very rapid progress was made.

An example of what scientific design and experiment may accomplish has recently come to my notice through the activity of one of my students. I refer to the practical monopoly that Germany had obtained in the manufacture of magnetos. When the war broke out a company was formed, and Mr. Watson worked out the design of a good magneto. The manufacture was not a mere copy of that which had previously come from Germany; it was worked out on scientific lines, and the result was a machine superior to that which had formerly been imported from Germany. The firm, which is now making 250 machines a week, is extending its works rapidly, and will soon be turning out from 1,000 to 1,500 machines per week, mostly for the British and Allied Governments. This is an excellent example of what may be done by scientific organisation and the use of scientific knowledge. A great deal remains to be done in this direction. A colleague of mine who spent some years with Siemens & Halske, in Berlin, told me that he was one of the staff of a dozen or more technical graduates who spent their whole time testing and experimenting with a line of A.C. motors that the firm was turning out, to see whether it was possible to improve their design and increase their rating. It is to work of this kind that the marvellous progress of German industry is largely due.

Every electrical machine of the present day is an example of what scientific study can produce.

Prof. Miles Walker described at the British Association meeting at Manchester, just recently, a new device he has produced, as the result of experiments in his laboratory, which has enabled him to obtain 1,500 KW. from a rotary converter of only 500 KW. rating, a further advance brought about by scientific investigation.

It is perhaps in the development of machinery and apparatus for the production and use of high-frequency currents that scientific investigation has found, within recent years, its most effective application. The mathematical investigation of Kelvin first showed how high-frequency currents could be produced in an electrical circuit, consisting of a condenser and a coil of wire; the discovery of Hertz, that these oscillations would produce electric waves, was first made possible by the classical electromagnetic theory of Clerk Maxwell, the gradual evolution of this idea to practical ends by Marconi and others led to the design of sparking circuits which can handle and control discharges having an average power of 500 or 1,000 KW., and these discharges are now in regular use for wireless signalling across the Atlantic. The discovery of Duddell that continuous electrical oscillations could be produced by the electric arc and the development of this discovery by Poulsen have led to the design of the "Poulsen" generators, which now develop over 200 H.P., and are used for sending messages from San Francisco to Honolulu. But perhaps the most remarkable instance of the utility of scientific method has been the application of loading coils for increasing the distance over which an audible telephone message can be sent. The idea of using self-induction to improve the speaking capacity of a cable was first suggested by Heaviside as the result of a mathematical analysis. The application of Heaviside's principles by Pupin (a man of Servian nationality) and the installation of Pupin's loading coils has made it possible to send a telephone message from New York to San Francisco; whereas 20 years ago it was thought almost beyond the powers of practical telephone engineers to speak from Holyhead to Dublin.

3. One of the most remarkable developments which has taken place during the past few years has been the equipment by such firms as the General Electric Co., of America, of testing and research laboratories, which are really laboratories of applied physics, and which do not attempt to make themselves of direct use in the testing and examination of electrical or other machinery.*

Dr. Langmuir, the director, states that:—"The laboratory is continually conducting researches of a purely scientific nature. These investigations may be initiated because of their scientific interest without any definite object in view, but every marked advance in science has resulted sooner or later, directly or indirectly, in important effects on industry, and these laboratory investigations have nearly always had practical results." The gas-filled lamp, or "half-watt lamp," had its origin in the result of an academic study of the laws governing the loss of heat in small wires. The metallised lamp resulted from experiments with a high-temperature vacuum furnace. He adds, however, "that it does not follow that all important achievements of the laboratory have thus been brought about. Many of them are the results of persistent resourceful effort directed from the beginning towards a perfectly definite goal."

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* An illustrated description of these laboratories appeared in the Electrical Review of October 22nd, 1915.

One of the most remarkable instances of the application of scientific investigation in industrial purposes that I have seen recently is the application of high-tension electric discharge to the precipitation of dust.* This process, the application of which to the dispersal of fog was first suggested by Sir Oliver Lodge, is now being applied to the purification of blast-furnace gases, to the precipitation of aluminium oxide, to the precipitation of starch dust, sugar dust, and coal dust, and an attempt is being made to apply the process to the destruction of black smoke.

Reference has already been made to the development of wireless telegraphy; in this connection the more physical type of investigation is of the greatest value. The investigation by Fleming of the so-called "Edison Effect," in which he showed the unilateral conductivity between a heated filament and a metal plate enclosed in an exhausted bulb, has been used extensively for detecting signals sent across the Atlantic at Clifden, and in many other wireless stations; it has given us one of the most reliable detectors for this purpose that we have, one that is uninfluenced by atmospheric discharges. This principle has been used in the valves which seem likely to provide telephone engineers with a satisfactory relay, a thing for which they have been vainly searching for years.

If, as seems probable, laboratories for investigations of this kind spring up and develop in connection with many large manufacturing firms, scientifically-trained men will be required to man them. It is one of the functions of the universities and technical schools to supply these men. It is in this direction that there should be the closest co-operation between the engineering schools of the country and the manufacturing firms. The students of universities and colleges are well adapted by their training to occupy positions in such laboratories; but if they are to be obtained, they must receive some financial encouragement.

The war has proved to us that the Germans have made enormous industrial progress, and it has opened the eyes of a good many people who had failed to appreciate the rapidity of their progress. Though I do not wish to hold out as the universal panacea for all industrial evils a closer relation between science and practice in engineering manufacture, I believe that a great deal is possible by a more intelligent appreciation of the benefits that scientic study and investigation can confer on industry. That, in itself, is not enough. In order to enable the manufacturer to equip and maintain such laboratories it will, I believe, be necessary for him to receive protection in some form for his products.

We must be prepared, after the war is over, for a fierce and unscrupulous war of commerce, not only with Germany, but with other countries less highly developed. It will take us all our time, with all the political advantages we hope to gain, to maintain our place in the world's markets. We shall have a powerful commercial competitor in America, a competitor who will not have suffered the devastating capital losses we are suffering through this war. We shall have to use to the full our scientific knowledge, so as to save every penny that we can of unnecessary expenditure in material, or in labour. The manufacturers, as I have already explained, are realising this fact. The Government has already established a Research Council, and, it is to be hoped, may also assist by supporting the institutions which supply the raw material of scientific development.

THE INSTALLATION AND WORKING OF STORAGE BATTERIES.

On November 2nd, Mr. R. Rankin, B.Sc., M.I.E.E., read a paper before the Association of Supervising Electricians presenting a great deal of practical information on the problems of lead accumulator working. Probably the very fact that this subject is often considered hackneyed and rather below the notice of an engineer is chiefly responsible for unsatisfactory results, where these are obtained. It is quite wrong to regard a storage battery as a sort of necessary evil; it deserves and repays careful attention; it is not beneath the notice of an engineer, although it has no wheels about it; and when a battery gives trouble it is generally due to faulty manipulation. Unless a battery is large enough for its work and is regularly inspected it is bound to give trouble. By insisting upon a 100 per cent. maintenance-of-capacity guarantee one can be sure that the battery is of adequate capacity, and the extra cost of a battery room accommodating all the cells in one tier is repaid by the resulting easier inspection and more efficient maintenance. If the cell lugs be bolted together, the bolts must be tightened at frequent intervals, and where wooden separators are employed these should not be placed against the positive plates, otherwise, by impeding acid circulation at this point, they lead to corrosion of the positives.

It is an easy matter almost to ruin a battery by carelessness during the first charge. Charging should be continuous and prolonged until all the cells show constant voltage and specific gravity. If filling with acid takes some time, care must be taken that those cells first filled are completely charged. Cost of energy is of no importance as compared with the importance of a thorough first charge. The latter may occupy 40 to 60 hours, and as it should be continuous for 24 hours at least, it is inviting trouble to start charging from a new generating set without making sure that the latter is in perfect electrical and mechanical adjustment. The charging current must be reduced if the cell temperature reaches 100° F., and, after charging is apparently complete, half the normal charging current should be continued for six hours or so. The specific gravity may not show constancy on completion of charge, unless allowance be made for its being reduced 1 point (water = 1,000) per 3° F. temperature rise above 60° F.

When a battery is first placed in service it should not be worked too heavily for a time, and during the whole of its life its discharge should be reckoned according to the subjoined table. The figures there included show the marked reduction in capacity of cells at heavy discharge rates, and the minimum cell voltages specified must be observed. In this connection the Rankin battery control instrument is particularly useful; there are two pointers, one indicating the actual average voltage per cell, and (on another scale) the total battery voltage; the second indicating the battery discharge current and the permissible minimum voltage per cell which is dependent on the rate of discharge. If the positions of the two pointers coincide, the battery must be re-charged, or the rate of discharge reduced, for the actual cell voltage has reached the minimum permissible at the existing rate of discharge.

Duration of discharge in hours.	Capacity in terms of maximum.	Rate of discharge in terms of 10-hour rate.	Minimum permissible P.D. per cell.
10	1·00	1·00	1·83
9	·98	1·09	1·83
8	·95	1·19	1·83
7	·92	1·31	1·83
6	·88	1·46	1·83
5	·83	1·67	1·83
4	·78	1·95	1·80
3	·72	2·39	1·80
2	·63	3·17	1·78
1	·50	5·00	1·75
·75	·45	5·84	1·70
·5	·37	7·45	1·70
·25	·22	8·95	1·70
Peak	—	12·50	1·60

Complete reliance should never be placed on any instruments in battery working. Intelligent personal supervision is imperatively necessary. A very small error, certainly one within the range of everyday experience, in a battery switchboard voltmeter may lead easily to persistent over-discharge and under-charge, with the result that cells are soon brought into a hopeless condition. It is false practice to give always a certain percentage excess of charge over discharge (as indicated, say, by ampere-hour meters), because the efficiency of charging depends greatly on the charging rate. The familiar "10 per cent. excess" rule is entirely wrong, as will be seen from the following consideration. If the ampere-hour efficiency of a battery be x per cent., the overcharge required is $100\,(100 - x)/x$ per cent., and if $x = 90$ per cent. (which is the maximum sound guarantee figure) at least 11·1 per cent. overcharge is needed, and though this may suffice at the normal charging rate, probably 15 per cent. excess will be needed when charging at a rate 50 per cent. in excess of normal.

Whilst charging at excessive rates is generally recognised to be inefficient and injurious, it is less often realised that cells cannot be properly charged at very low rates. The negative plates are charged, but the positives are simply sulphated, corroded and buckled. This danger is particularly to be guarded against where milking boosters are used; the latter should give the full normal charging current.

Distilled water is best, but is not indispensable for topping-up purposes. If it be proposed to use other local supply, a sample should be sent to the battery manufacturers for approval. Iron is injurious to the negatives and chlorine to the positives, which it corrodes violently. Near the coast, rain water is charged with salt from the atmosphere, and must therefore not be used for topping-up. Water added should be introduced at the bottom of cells by aid of tubing, and preferably during the last stages of charging when gassing facilitates mixing. Corrosion is favoured by accumulation of dilute electrolyte on the surface.

The log sheets kept so religiously in most accumulator installations are of more than doubtful value. Their compilation entails a vast amount of labour and pains unless, of course, a certain practice not unknown amongst attendants is followed, in which case the log sheet is worse than useless. To overcome these several objections, Mr. Rankin suggests a very workmanlike method of control and record keeping. Unless it is very small, the battery is divided into four sections, and in each section a pilot cell is chosen. The latter is given special attention to ensure that it is a true index of the state of its section. The current flowing, voltage, and specific gravity are logged for the pilot cells at the end of each charge and discharge. During a weekly or fortnightly short gassing overcharge, readings are taken at 15-minute intervals on the pilot cells after gassing commences, in order to make sure that charging is really complete; at the same time all the cells are inspected to see that they begin gassing at the same time as the pilot cells, and gas to the same extent. Any sick cell thus discovered should be nursed and full particulars should be logged concerning the defect and its cure. All ordinary troubles are covered, in so far as they

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* See Electrical Review, May 14th, 1915.

are not eliminated, by this simple system of regular inspection and careful logging of an absolute minimum of data. The elimination of special troubles generally needs the experience of a specialist armed with an auxiliary electrode in addition to the ordinary cell-testing equipment.

If a battery is to remain idle for several months, it is best to arrange for charging it at suitable intervals, but if it is to remain out of service for a year or more it should be dismantled by the following means:—After charging every cell completely, discharge the battery at the 5-hour rate to 1·5 volts or less per cell, thus forming a protective skin of sulphate on the negatives (which are the vulnerable part). Care should be taken that no cell reverses during this unusually complete discharge. When discharged the cells should be emptied, covered over and kept clean. A first charge is required when the cells have again to be placed in commission.

THE TRAINING OF AN ENGINEER.

As President of the Birmingham Association of Mechanical Engineers, Mr. A. E. A. Edwards delivered an inaugural address in which he drew attention to three features of an engineer's training which did not usually receive sufficient attention:—

1. The commercial side of the business.
2. The control of men.
3. The power of speech.

There were doubtless others, but here they had three features which were essential to turn a sound technical man into a successful engineer.

To put the matter in a nutshell, an engineer was usually taught the *profession* instead of the *business* of engineering.

An apprentice was not ordinarily admitted into any of the routine of the commercial side of the business; he knew nothing about correspondence or of getting out costs, or of preparing estimates, or of the value of an hour's work by different machine tools, or of the art of selling. This work was often entrusted to men who had no technical engineering training, and the young engineer, to whom this information would be invaluable, was rigorously shut out of those departments on the false assumption, perhaps, that he would learn too much of the firm's business.

If a firm undertook to teach an apprentice engineering, and received money for doing so, they should give him some knowledge of the commercial side of the business, for that was the side which was of first importance. A successful business man said he could get a man skilled in all the technical engineering knowledge required for his business for £500 a year, but that he would give £5,000 a year for a first-class commercial man.

There were some engineering establishments in which it was a practice for every draughtsman to take out his own quantities and make up his own estimate. To do this, it was necessary for the draughtsman to see the foremen of the smiths, boilermakers, fitters and turners, and pattern makers, and to obtain from them an estimate of the time each of the leading items required. Such a procedure gave the draughtsman a chance of altering his design, possibly to suit the processes of manufacture as pointed out by the foremen, instead of such alterations being delayed until the first machine had been made.

Observation proved that comparatively few engineering apprentices rose to the eminence their technical skill merited, because they had not the requisite knowledge of how to manage men. The large and increasing number of industrial disputes was undoubtedly due to the want of tact in the management.

Many industrial disputes arose simply from the fact that large limited companies tended to make the management impersonal, and the men felt, in fact, they knew, that their only remedy was to "come out." There was still far too much distrust between capital and labour.

In the shops of the General Electric Co., he was told, they put an apprentice on a job, and left him at it until he could make his successor at the same job competent to do the work, and thus they had in operation a scheme which helped a youth, at any rate, to be lucid in his explanations, and which gave him some trifling idea of management. Quite trifling, he admitted, but it was just the method to allow a youth to assimilate the elements of management, and he was certain to make later on, other things being equal, a better manager than, say, a University-trained man who had been pitchforked into a manager's job without having been previously brought into really intimate contact with men, and, consequently, without being able to appreciate their point of view. There were, doubtless, men who were born leaders, but these were in a very small minority. The majority of successful leaders had learnt how to lead through hard experience, and had passed many pitfalls on the way.

Probably the reason why America could afford to pay higher wages than we, and yet could undercut us in our own markets, was the fact that her organisation was better.

An efficient co-operation must consist of a controlling head, and a body that obeyed. Discipline was its most essential attribute. Unless we one and all ceased to try to live without a discipline which presupposed leadership, we were doomed to sink into a third-rate people of mediocrities or worse.

All great businesses, all great nations were built up by leaders of men, with others to help by loyal obedience: true union, true co-operation.

Lastly, an engineer was not likely to rise above quite a subordinate place unless he could place his thoughts and ideas readily before those to whom he was speaking.

In order to gain support for his schemes, a man must possess the ability to gain personal confidence and to lead others in the right direction by thoughtful consideration of their prejudices. If he was not able to be their elementary schoolmaster in technical matters, they would search for knowledge among friends, manufacturers' salesmen, or consulting engineers, and would form opinions of their own, which were likelier than not to be wrong ones owing to imperfect knowledge of the requirements of the case.

An engineer's ordinary training required no speech at all, whether in the shops or office, and in this respect it differed from the training required for almost any other business, in which speaking to clients or customers was part of the daily routine. It was, on this account, of more importance to the engineer to take every opportunity of learning to express his thoughts and ideas, which few of them could do clearly without the aid of a pencil or a piece of chalk. Their Association, and all other similar societies throughout the country, formed a means, close at hand, for engineers who wished to practice this essential part of their training.

There was no other trade or profession in which the articled apprentice at the end of his time was rated so low as in engineering, and the reason appeared to be that an engineer's training was at present based on altogether wrong lines. He was not concerned so much that night about the training of men whose sphere of life was to be that of a mechanic as in those youths whose parents payed a high premium for their engineering training, in the vain hope that this training would fit them for some reasonably remunerative post at the conclusion of their apprenticeship.

There was no more necessity for a man of this class to be a first-rate handicraftsman than there would be for a doctor to be specially skilled in washing patients, or a printer expert in setting up type, or a brassfounder adept in pouring metal. A premium apprentice should know much of the manual side of the business, but his training should extend to the commercial side, to the elements of management, and to learning how to clothe his ideas with words.

It was in this direction that our universities and our works and civil engineers should train those who payed to be trained. No one who appreciated the value of money should pay a premium simply that his boy might have the privilege of learning to be a mechanic or a draughtsman, or even to have him instructed at a university in the principles and practice of *technical* engineering alone.

The usual qualifications required of a manager were that he should have commercial experience, be a good organiser, and be of good address. This was the class of man always wanted. There was a demand for them that was never satisfied. Why not train apprentices first in these qualifications, instead of keeping their noses to the grindstone and attempting to grind them into mechanics or draughtsmen, and making them so that they would fit that groove and no other all the days of their life?

THE STAVE FALLS POWER DEVELOPMENT.

In a paper recently read before the Canadian Society of Civil Engineers, by Mr. R. F. Hayward, some particulars were given of the Stave Falls power development of the Western Canada Power Co. The latter concern has the right to store water in Stave Lake and develop 50,000 h.p. there, and to develop a similar amount of power at the mouth of Stave River.

The company is the riparian owner of practically the whole margin of the water from the upper end of the lake to the mouth of Stave River.

Constructional work on the Falls plant for an ultimate capacity of 50,000 h.p. commenced early in 1910, and a standard gauge railway six miles long was built to transport machinery to the site.

The first installation, consisting of two 9,000-kw. units, was put into commission in January, 1912, and in 1913 contracts were placed for the third and fourth 9,000-kw. units, and it became necessary to provide for the construction of a second plant on the Stave River within a few years' time.

The power house at Stave Falls was laid out for four 13,000-h.p. turbines, mean head of water 110 ft., and two 500-h.p. exciter turbines. The double horizontal Francis type of turbine was chosen for the large power, and single-runner machines for the exciters, the turbines being supplied by Messrs. Escher, Wyss & Co.

The author remarks that had the plant been designed three or four years later, the vertical type of single-runner Francis wheel would without doubt have been adopted, not only because of its higher efficiency, but because it would have saved money on the power-house.

The turbine casing is 18 ft. dia., built of ¾ in. steel plates, with a cast-steel end plate designed for a thrust of nearly 1,000 tons, which may come upon it when the governor suddenly shuts the gates under full load and head. The runners are 63 in. diameter, of steel plate cast into steel hubs, and the bearings are water-cooled, 15¾ in. in diameter.

The area of the draft tube gradually increases, so that the velocity of the water is reduced from 14.6 ft. per second at the top to 6.3 ft. per second at the bottom.

The governor is of the hydraulic type, operating with oil at 300 lb. per sq. in. pressure, supplied from a central pumping plant through a ring pipe system.

The turbines were built on a guarantee of 83 per cent. efficiency at full load and 110 ft. head, and have developed 10,000 KW. electrically, under 107 ft. head.

The generators, exciters, and transformers were supplied by the Canadian General Electric Co. The generators are three-phase, 60-cycle, 4,440-volt machines rated at 8,825 K.V.A., with 40 deg. C. rise, and 11,031 K.V.A. with 55 deg. C. rise. The exciters are each of 250 KW. capacity, and there are twelve 3,000-KW. water-cooled oil-insulated transformers arranged in three banks to step up from 4,400 to 60,000 volts.

The oil switchgear for 60,000, 12,000, and 4,000 volts was supplied by the Canadian Westinghouse Co.; the 60,000-volt switches and bus-bars are contained in reinforced concrete chambers, with the 4,000-volt switches in a room above, and lightning arresters on the roof.

From the tail race level to mean tide level at the mouth of the Stave River the total fall is 134 ft., and while a single development of this power near the mouth of the river would be quite economical for the full capacity of plant, the initial cost would be high, as the dam alone would cost a million dollars. As it is important that expenditure on future construction should not be made further in advance of actual demands than necessary, a plan is being considered of developing two plants, each to work with 65 ft. head.

These would use single-runner vertical turbines of 10,000 to 12,000 H.P., and the company can increase its plant in accordance with the demand up to a total of 120,000 H.P.

IMPORT TRADE OF CHINA.

The following figures, showing the value in 1914 of the net imports into China, from foreign countries, or electrical and similar goods, are extracted from the Returns of the Imperial Maritime Customs. Comparative values for 1913 have been added, and the increases or decreases noted:—

Copper.—	1913. Hk. Tls.*	1914. Hk. Tls.†		Inc. or dec. Hk. Tls.
Bars, rods, sheets, plates, and nails	258,000	585,000	+	327,000
Ingots and slabs	6,130,000	6,658,000	+	528,000
Wire	189,000	187,000	–	2,000
Rails	896,000	554,000	–	342,000
Sleepers	1,446,000	2,996,000	+	1,550,000
Belting, machine	268,000	278,000	+	10,000
Cement	608,000	901,000	+	293,000
Electrical materials and fittings	2,322,000	2,726,000	+	404,000
Scientific instruments and apparatus	740,000	872,000	+	132,000
Lamps and lampware ...	1,356,000	1,069,000	–	287,000
Machine tools	50,000	96,000	+	46,000
Engine oil	708,000	985,000	+	277,000
Telegraph and telephone materials	719,000	567,000	–	152,000
Locos. and tenders ...	769,000	2,515,000	+	1,746,000
Railway carriages and wagons, including tram-cars	1,194,000	2,223,000	+	1,029,000

* Average value of Haikwan Tael in 1913 = 3s. 0¼d.

† Average value of Haikwan Tael in 1914 = 2s. 8¾d.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

(Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

15,057. "X-ray apparatus." E. E. Greville. October 25th. (Addition to 21,609/14.)

15,081. "Joint for electric light fittings, particularly applicable to portable electric lamps." H. J. C. Forrester (J. W. Dunham, U.S.A.). October 25th. (Divided application on 2,489/15, February 16th.) (Complete.)

15,082. "Portable lamps or other portable devices." H. J. C. Forrester (J. W. Dunham, U.S.A.). October 25th. (Divided application on 2,489/15, February 16th.) (Complete.)

15,083. "Portable electric lamps." H. J. C. Forrester (J. W. Dunham, U.S.A.). October 25th. (Divided application on 2,489/15, February 16th.) (Complete.)

15,094. "Attachment for miners' electric safety lamps for detecting fire-damp and other combustible gases." T. J. Thomas. October 26th.

15,104. "Electric lock and lighting appliance for miners' safety lamps." W. Price. October 26th.

15,106. "Electric clocks and electric time-indicators." R. Kennedy. October 26th.

15,113. "Dynamo-electric machines adapted for synchronous working." L. J. Hunt & Sandycroft, Ltd. October 26th. (Addition to 24,838/14.)

15,128. "Electric indicators." P. M. Lincoln. October 26th. (Convention date, November 12th, 1914, U.S.A.). (Complete.)

15,142. "Machine for making insulators." P. Simonsen. October 26th. (Convention date, November 13th, 1914, Denmark.) (Complete.)

15,143. "Pressure die for insulator-pressing moulds." P. Simonsen. October 26th. (Convention date, November 17th, 1914, Denmark.) (Complete.)

15,148. "Device for the protection of electric installations against excess voltage." Soc. Generale des Condensateurs Electriques. October 26th. (Convention date, October 26th, 1914, Switzerland.) (Complete.)

15,186. "Alternating-current motors." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). October 27th.

15,196. "Device for the protection of electric installations against excess voltage." G. Giles. October 27th. (Convention date, October 27th, 1914, Switzerland.) (Complete.)

15,209. "Electro-magnetic projectile-transmitting apparatus." E. Bachelet. October 28th.

15,222. "Combined electric lampholder and detachable shade support. G. St. J. Day. October 28th.

15,237. "Wireless signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). October 28th.

15,246. "Electric rotary converters." G. A. Juhlin. October 28th.

15,247. "Electric rotary converters." J. A. Kuyser. October 28th.

15,287. "Automatic and semi-automatic telephone systems." Relay Automatic Telephone Co., Ltd., & W. Aitken. October 29th. (Complete.)

15,303. "Systems of distribution for electrically-operated railway trains." P. S. Turner. October 29th.

15,304. "Controllers for electrically-driven vehicles." P. S. Turner. October 29th.

15,330. "Switching devices for the low-tension induction circuit of automobile engines." F. Bacon. October 30th. (Complete.)

PUBLISHED SPECIFICATIONS.

1914.

14,146. Electric Switching Devices. F. N. Pickett. June 12th.

14,224. Electric Blasting-fuses or the like. V. F. Feeny (Fabrik Elektrischer Zunder Ges.). June 12th.

16,343. Telegraphy. E. C. R. Marks (International Quadruplex Co.) July 8th.

18,511. Transmission of Electrical Impulses over Telephonic Circuits of High Electrostatic Capacity. G. Musso. August 10th. (Patent of addition not granted.)

20,714. Apparatus for Bleaching by Electrolysis. J. F. Webb & Sir W W. Williams. October 8th.

20,721. Electric Heaters for Mining and for other purposes. J. R. Quain. October 8th.

20,776. Electrical Igniting Apparatus for Internal-combustion Engines. F. E. Wilson & W. H. Shepherd. October 9th.

20,805. Ships' Telegraph Apparatus. J. C. Clarke & Chadburn's (Ship) Telegraph Co., Ltd. October 10th.

20,896. Electric Automatic Tumbler Switches. H. C. Heath & J. P. Keith. October 13th.

21,055. Automatic Page Feed for Printing-telegraphs or Typewriters. D. Murray. October 16th.

21,710. Sparking Plugs for Internal-combustion Engines. Electric Ignition Co. (1913) & A. Cox. October 29th.

22,062. Electric Generators for Lighting Mechanically-propelled Vehicles. H. C. H. Smyth. November 5th.

22,199. Electric Signals. A. C. Brown. November 9th.

23,050. Looped-in System of Electric Wiring, and Fittings therefor. F. W. Suter and Baxter & Caunter, Ltd. November 25th.

24,498. Telegraph Systems and Apparatus therefor. British Insulated and Helsby Cables, Ltd., & H. H. Harrison. December 22nd.

24,692. Liquid Rheostats. D. Welge. December 28th.

1915.

884. Arc Lamps. J. W. Allison & T. Hadaway. January 10th. (December 10th, 1914.)

2,636. Electric Ordnance. T. G. Tulloch. February 18th.

2,787. Electrical Press Button Switches. E. Ottinetti. February 20th. (February 23rd, 1914.)

2,865. Electro-magnetic Devices for Extracting Foreign Substances from Paper Pulp. A. J. Newell & R. J. Marx. February 22nd.

5,498. Manufacture of Electric Condensers. Meirowsky & Co., Akt. Ges. April 12th. (July 23rd, 1914.)

5,578. Cable Supports. O. W. Brenizer & D. L. Short. April 13th.

6,457. Electrical Fire Alarm Systems Siemens & Halske Akt. Ges. April 30th (May 1st, 1914).

6,715. Electric Generators for Lighting Mechanically-propelled Vehicles. H. C. H. Smyth. May 5th. (Divided application on 22,062/14, November 5th.)

9,015. Motor-actuated Electric Switches. Landis & Gyr Akt. Ges. June 18th. (July 14th, 1914.)

9,509. Electric Lamp Stands. Wallace Novelty Co. June 29th. (July 13th, 1914.)

9,806. Electric Switches for Controlling Lift or other Motors. J. A. Steven. July 6th.

10,054. Telephone Locks. J. E. Lavalley. July 9th.

10,251. Electrical Condensers. W. H. Wilson. July 14th. (Addition to 19,506/14.)

11,139. Switch Device for Car-lighting and like Dynamos. Albion Motor Car Co. & T. B. Murray. July 31st.

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Vol. LXXVII.] CONTENTS: November 19, 1915. [No. 1,982.

Page
British Electrical and Allied Industries 641
Rubber 643
The Decimal System 643
Copper 643
Decimal Coinage and the Metric System (*illus.*) (*continued*) ... 644
Our Trading Opportunities throughout the World (*continued*) 646
The Production and Properties of Electrolytic Copper, by B. Welbourn 647
Legal... 649
New Electrical Devices, Fittings and Plant (*illus.*) 650
Correspondence—
  Decimal Coinage and the Metric System 652
  The A.E.G. Meeting 652
  Noisy Motor-Generator 653
  Economising on Audits 653
Business Notes 653
News of Prisoners of War at Ruhleben 657
Notes 658
City Notes 661
Stocks and Shares 663
Electric Tramway and Railway Traffic Returns 664
Share List of Electrical Companies 664
Shanghai Electricity Works (*illus.*) (*concluded*) 665
German Business Methods as I knew them 667
Power Station Switchgear 669
The Electrical Industry and the War 670
War Items 671
New Patents Applied for, 1915 672
Abstracts of Published Specifications 672
Contractors' Column ... ... Advertisement page xx

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BRITISH ELECTRICAL AND ALLIED INDUSTRIES.

WE had the privilege on Thursday last week of attending a pleasant and charmingly informal gathering arranged by the British Electrical and Allied Manufacturers' Association, and presided over by Mr. F. R. DAVENPORT, the chairman. Between forty and fifty gentlemen, members, officials and staff of the Association, together with representatives of the electrical Press and a few other guests, were present at the Connaught Rooms, and after dinner there was a quite informal discussion on some matters in which the whole electrical industry is very much interested. Quite irresistibly our memory carried us back to those little meetings held at the Hotel Cecil about ten years ago, when, under another name, with another secretary, with another Davenport in the chair, and with—in war-time we may say it—quite another set of faces on both sides of the table, the Association struggled in its birth-throes, by dint of courage and persistence survived, soon got into useful ways—for an infant—and while doing good work according to its light and age, managed incidentally to accumulate a credit balance of £34, with a reserve of £100 invested in Consols! But we must not indulge in reminiscences—the days are too full of work for that just now—except to say that then, as now, the organisation of British electrical industry was one of the more pressing problems. That much good work has been done in that direction since then goes without saying, and much criticism has been offered, here legitimately, there illegitimately, from which it has been hoped the electrical industry would derive benefit. Last week's informal function, however, was not designed to give the Press an opportunity to review the working of the Association, or to discuss its organisation, its internal difficulties, or its external effects. It was arranged in order that, in conjunction with the Press, there might be a little informal talk on matters of general interest to the electrical and allied industries, more particularly the after-the-war position of those industries.

The subject was opened with a paper contributed by Mr. Wile, of the *Daily Mail*, who dealt with the methods of German business men as studied by himself during some years spent in their Fatherland in the capacity of an American journalist. Those who knew the author missed his personality and accent to some extent, but in his absence there was certainly no one present more capable of giving an appropriate reading of Mr. Wile's notes than Mr. D. N. Dunlop, the Association Secretary. As the discussion was to be on matters of general interest, a newspaper man who did not possess a specialised knowledge of our industries was chosen to give his experiences. He certainly succeeded in interesting those present, and we therefore give a full abstract of the address in our pages. Possibly those who know as much of the internal doings of electrical organisations in Germany as Mr. Wile knows of the German character would not desire to be prominently before the footlights in London. The electrical man does not generally look to the daily newspaper journalist for guidance in regard to his industrial operations, yet it is as well that we should be reminded, even by such, of the devices of the German trader; of the royal patronage of science and engineering industry—as evidenced by the presence of the august Kaiser at a two hours' discourse on a new turbine; of the ability of the German industrial leader to recognise the value of the services of a good Englishman—as evidenced by the engagement of a young man of 31 years of age to develop the A.E.G. export department; and some other things which, though they may not be quite applicable to electrical industry, all go to form the complete picture of a trader of true Prussian character. In whatever respects we might have to differ from some of the conclusions of Mr. Wile, we find ourselves in complete agreement with him in his urgent advice to British traders to be prepared for what is coming after the war. The author, as an American, described himself as a "neutral," but only a neutral in so far as he did not mind by whom or how soon Prussian militarism was effectually crushed. That is just our own neutrality also, and we hope our neutral cousins will hurry forward with those munitions with "some" speed and hasten the defeat of the common enemy of civilisation.

From the conversation that followed we gathered that there was still an inclination on the part of some manufacturing interests to belittle the advice which has been given so frequently for making a closer study of the requirements of particular markets, and a more energetic effort to meet their needs and so forth, but we respectfully suggest that this kind of advice, though it may often be penned by the "daily" newspaper writer, has not its origin in the fertile brain of the imaginative journalist. It is too long a story to tell here (and it is not necessary, for it is already known to readers of the Electrical Review), but though we are not ourselves enamoured of the writings of the lay journalist on electrical matters, we positively assert that many of these things are true; they have been for years, and still are, the subject of very grievous complaints told to us in these offices by British and Colonial electrical engineers who have been long stationed in, or have visited professionally, the colonial and foreign markets. To hide one's head in the sand does not remove the danger—it merely endangers the exposed portions of the anatomy. Of course, such advice is not necessary in all cases—the firms who are not remiss know that they are not. We fear that we shall approach the new foreign and colonial trade position with too restricted an enterprise if we allow ourselves to believe that, because we have only 45 millions of people in the British Isles, and because we have only a certain estimated productive capacity, there is little chance of our succeeding in our efforts to fight German competition, and, to use the much-abused and therefore discredited phrase, to "capture the German trade." We may trust our manufacturers to know what margin of productive capacity they possessed in pre-war times, and from what some of them have told their shareholders, we gather that if they secure a fair share of German electrical trade after the war in addition to holding their normal connections, they will be able to handle it. Whether they do it by extending factories, by altered working hours, by increased efficiency of methods, means and processes, by a larger employment of woman labour, or by utilising premises built for war munitions purposes, is their own internal concern. Perhaps there may be good done by forming a new Association to study means of increasing productivity. Possibly the lessons learned in war-tim respecting that curse, the limitation of output may have a healthy effect in the years that follow Every industrial student has watched with interes and with much anxiety the attitude of organised labour and its detrimental effects upon industry How serious these matters are we fully recognise but we cannot wait for such things to b remedied before we proceed with our trade efforts We believe that there is an ample productive margi to justify whatever movements may be contemplated by members of the Association or by those who, fo various reasons, see fit to stand outside its ranks

The need for specialised skilled labour fo particular departments of industry, the promotio of conditions calculated to more efficiently trai and retain men of the right class or type the adoption of co-operative principles in orde to give workmen and employers a commo interest—all these are matters of extreme importance, and they were very fittingly raised by speakers in the course of the discussion They are really matters for national as well a sectional study, for they undoubtedly fill a larg place in our comparative investigations of th methods employed by us and by our enemies. Bu we do not believe that those who raised them woul favour a policy of long waiting and seeing befor we elaborated measures by means of which our industries could be more equal to the inevitable accentuated onslaught of German traders, concernin whose plans we have been permitted to know something.

On Thursday last week there were those wh ventured to suggest that there was need fo immediate action, and it was gratifying to learn as we subsequently did from the remarks o the Secretary, that the Association is engaged i an exhaustive investigation which will form the basi of a large and elaborate plan which, when know and developed in full detail, will be found to be equa to the new situation. We hope that such will be th case, but here we really shall have to "wait and see. The Association is in touch with Government departments at Home, and has appointed committees overseas; it is employing an increased staff upon thes and other matters; and though the Secretary sounde a warning note against expecting immediate result in the form of increased dividends, he foretold state of things which should give little ground fo pessimism. If only by co-operative effort member can find a way for unity of action in markets wher they have in the past acted individually in competition with each other, each in turn competing singlehanded against strong, consolidated Teutonic forces there will be better times for the industry. It may b true that the fall of Germany will be complete, and that she may be weakened in all parts of the globe but is it not at least fairly probable that th completeness of the defeat will enhance th danger of ruinous competition? We shall impose conditions, and no doubt build fences, but man millions of Germans will still engage in industr in order to earn their daily bread. The policy o the B.E.A.M.A. does not suggest that that organisation is afraid that we shall be handicapped by an shortage of productivity. We recall the joint effor of the German Trade Committee of the Institutio of Electrical Engineers and the B.E.A.M.A., th result of which was the conclusion that the continuance and expansion of British trade afte the war would mainly depend (1) on economi principles, and (2) on the commercial industry and initiative of British manufacturers. Now (1) i perfectly obvious, and (2) is emphatically true With the first we cannot seriously interfere, but initiative and enterprise we can and should employ to the utmost of our power. The larger efforts of the B.E.A.M.A. and the smaller doings of individual private concerns to that end have our heartiest good wishes for success. If it had fears of a shortage of productivity the Association would not be proceeding with any scheme—even at this late date, as we regard it. It probably has greater cause for anxiety when it wonders how it is going to protect British electrical industry against the resumption of importing by British electrical firms.

In contributing a brief and graceful wind up to the conversation, Mr. Davenport, the chairman, showed that it was fully recognised that German after-the-war competition would be a force to be reckoned with, and that gatherings of this character were greatly to be desired.

Rubber. There is a very strong tone in the market for crude rubber, and prices have had a considerable advance, the upward tendency being influenced to some extent, of course, by the intricacies of the shipping position, which have resulted in gradual advances in freights, to say nothing of delayed arrivals and the difficulty in discharging vessels when they do reach port. The demand certainly has been on a broader scale both for the home trade and the United States, and it is noteworthy that a number of forward contracts have been made by producing companies at prices showing a considerable advance upon recent rates. The tone is certainly one of growing confidence, which is evidenced by the fact that the demand for next year's deliveries continues to run upon broad lines, while sentiment has not been at all impaired by the less favourable statistics issued for the past month. There is a growing feeling of restlessness regarding the submarine activity in the Mediterranean, and this has impelled a certain amount of buying which would otherwise have been withheld for a time. Arrivals have been falling below the requirements for delivery, and producers seem to have had less material free for disposal than of late, while at the same time they have had to face a good demand for early stuff. The chaotic conditions of the railways is another point which has led to more active buying, for consumers have been fearful of being caught short of supplies, and have been buying well ahead, therefore, of the dates for which they require the material. As long as abnormal conditions of this kind continue to prevail, the market is bound to remain in a somewhat fidgety mood. Official returns received from the Near East give the exports from the Federated Malay States during October as 4,120 tons, compared with 3,334 tons in September, and 2,987 tons in the corresponding month of last year. The following shows the monthly totals of the export movement during the last three years.

	1913.	1914.	1915.	
January	2,131	2,542	3,473	tons.
February	1,757	2,364	3,411	"
March	1,737	2,418	3,418	"
April	1,626	2,151	2,777	"
May	1,225	2,069	2,708	"
June	2,005	2,306	3,403	"
July	1,781	2,971	3,687	"
August...	2,363	1,850	3,796	"
September	2 000	2,879	3,334	"
October	2,160	2,897	4,120	"
Total	18,785	24,447	34,127	"

The Decimal System. We are pleased to note that we do not stand alone in regarding the reform of our weights and measures as one of the most important steps to be taken in preparation for the impending trade war with Germany. It is reported that the Council of the London Chamber of Commerce is holding a special meeting this week to consider the whole question of trade relations after the war between Great Britain and her Dominions and Allies on the one side, and our enemies on the other, and considers the adoption throughout the Empire of the metric system one of the most pressing questions; every member of the London Chamber has been urged to introduce the system into his own business at once, as it is felt that Germany has an unquestionable advantage over Great Britain in all neutral markets owing to our retention of an archaic and time-wasting method of weighing and counting.

In its October issue the *Mining Magazine* discussed the question of weights and measures, pointing out that the application of the decimal system to amounts less than unity, as it is applied to amounts greater than unity, was not only logical but highly convenient, and advising engineers to use the metric system wherever possible, and always to champion it.

The *Contract Journal* also, in its issue of October 27th, treated of the metric system and foreign trade, and advocated the use in price lists of weights and measures familiar to the customer, as well as quotations in the local coinage. Our contemporary proceeded to quote from our circular, and to indicate the trend of the answers received, offering a welcome to the metric system where its adoption arises naturally out of the needs of trade and commerce.

We are somewhat at a loss to understand why the *Journal* dismisses the question of the general adoption of the metric system and decimal coinage in this country as having "small relevance to foreign trade"; a study of the history of the subject shows that manufacturers, merchants, engineers, scientists, trading associations and other important bodies have consistently held the view that the reform would have a profound influence in facilitating and promoting our foreign trade, as well as our domestic convenience.

An article published by the Chamber of Commerce of the United States exactly a year ago vehemently urged the universal use of the metric system as necessary to the development of foreign trade, and maintained that all commerce and industry would benefit by its adoption.

In the serial article which has been running through our pages during the past few weeks, we have endeavoured to demonstrate the advantages of the decimal system, and to show that the difficulty of substituting it for our existing methods will be far less than its opponents would have us believe.

Copper. Our thanks and congratulations are due to Mr. Welbourn, chairman of the Manchester Section of the I.E.E., for his welcome departure from the stereotyped form of inaugural address. The author is an authority on copper and its applications to the purposes of the electrical industry, and having discovered that no paper on copper—the staple raw material of the industry—had ever been read before the Institution, he decided to make good that remarkable omission. For the adoption of this course admirable precedents could be cited if it were necessary; but in these days precedents have lost their weight, and the stern trials to which the nation is being subjected are sweeping aside our tendency to cling to form and ceremony, and are bringing us face to face with the things that really matter.

As the author points out, our copper standards are at present somewhat out of date, and call for the attention of the Engineering Standards Committee; no satisfactory definition of "hard-drawn copper" exists. There is also ample scope for further research in connection with the properties of copper wire, and the author suggests that this might very well be undertaken by the Research Committee of the I.E.E.

An interesting point is a reference to the behaviour of copper wire when first erected, the process of pulling out the kinks giving the wire a fictitious modulus of elasticity; Mr. Welbourn considers it preferable to strain the conductors to a tension higher than that at which they will be permanently sagged, to get rid of the kinks, after which the normal modulus can be safely employed. Some new information is given on the effect of temperature on the strength of copper, a subject about which little is known. The address forms a valuable supplement to the excellent paper on overhead line construction which the author read last year.

DECIMAL COINAGE AND THE METRIC SYSTEM.

(*Continued from page* 637.)

Now, in modern workshops, in which work of high accuracy is turned out and close limits are prescribed, where a fit is necessary, it is not customary to figure the dimensions in vulgar fractions of an inch, because we should have to deal with such fractions as 1/1,024 in order to attain the desired degree of precision; even the most ardent advocate of inches never goes beyond the 1/64th in figuring a drawing, nor have we heard of a micrometer divided in 1/1,024ths of an inch. The practical man would say such procedure was absurd, and so it would be; unfortunately he does not pursue the matter to the logical conclusion. He adopts decimal fractions, even to the third and fourth places of decimals (as we shall show), but sticks to his halves and eighths and thirty-seconds, even on the same drawings! We give an example (fig. 2) culled from a recent issue of the *American Machinist*.

Be it noted that this is not a case where limit gauges are in question; it is simply due to the impracticability of stating the dimensions in vulgar fractions. Fig. 3, from the same source, representing a tool used in manufacturing British shells, illustrates the same point; but figs. 4 and 5 show the necessity of using decimals in defining limits for gauges. These fine dimensions are only worked to in the tool-room, where there is a staff of highly skilled and well trained workmen; in the shops, the smallest dimension usually worked to is 1/32 in., unless a jig or gauge is used to relieve the workman of the necessity of possessing skill. Now, the millimetre is about 1¼ times as large as 1/32 in., and the half-millimetre, which is, as already mentioned, about the limit for apposition measurements, is approximately 1/50 in., or roughly ⅝ of 1/32 in. Hence the millimetre scale is at least as suitable for use in the shop as the inch scale, and has the enormous additional advantage of being divided decimally.

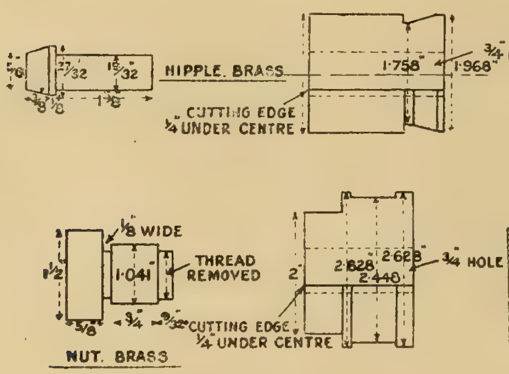
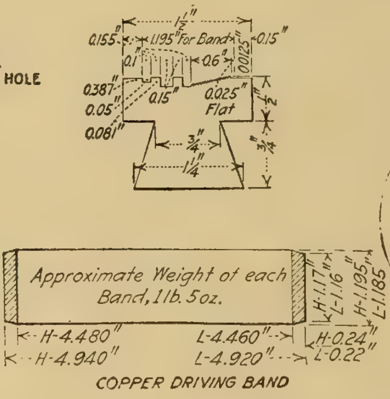


FIG. 2.



FIGS. 3 AND 4.

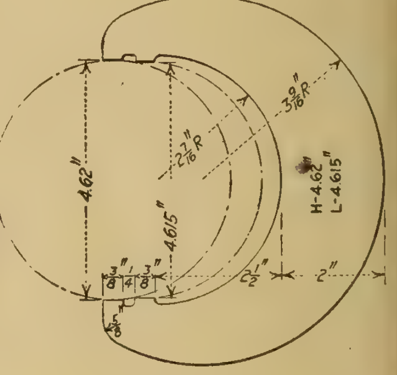


FIG. 5.

We have laboured somewhat to demonstrate that (1) inch men use decimals freely; (2) they cannot dispense with them; (3) metric men achieve greater accuracy with fewer decimal places; (4) it is easy to substitute millimetre dimensions for inches on a drawing, with an accuracy beyond practical requirements, without "strings of decimals"; (5) the manipulation of metric dimensions is easier and quicker than that of inch dimensions. Before leaving this part of the subject, let us see what is the practice of the British Engineering Standards Committee. It has been hinted that the Committee was originally constituted partly to combat the growing demand for the metric system, but this, no doubt, is a libel; not only does the Committee use the metric system upon occasion, but also its tables afford some of the most striking object lessons of the inconveniences of the inch. We reproduce below a portion of the table of "standard tolerances and allowances" for first quality work, given in Report No. 27 on limit gauges for running fits:—

Nominal diameter.	Shaft.			Allowance.	Hole.		
	Minimum diameter.	Tolerance (difference).	Maximum diameter.		Minimum diameter.	Tolerance (difference).	Maximum diameter.
¼	·2495	·0005	·25	·0005	·2505	·0003	·2508
½	·4993	·0007	·50	·0007	·5007	·0007	·5014
¾	·7491	·0009	·75	·0008	·7508	·0009	·7517
1	·9990	·0010	1·00	·0010	1·0010	·0010	1·0020
1½	1·4988	·0012	1·50	·0012	1 5012	·0013	1·5025
2	1·9985	·0015	2·00	·0015	2·0015	·0015	2·0030
4	3·9980	·0020	4·00	·0020	4·0020	·0020	4·0040
8	7·9975	·0025	8·00	·0025	8·0025	·0025	8·0050

The tables for 2nd or 3rd quality work would have illustrated our point equally well; it is perfectly obvious that vulgar fractions have here no place (except in the *nominal* column!), and that four places of decimals are necessary to embody the desired facts in terms of the inch. Let us here repeat that the hundredth part of a millimetre—two decimal places—represents a greater degree of accuracy than can be attained under practical conditions in the workshop. It can, no doubt, be improved upon in the tool-room, by the exercise of the greatest care and skill; but the tool-room is the domain of specialists whose business is to make fine measurements and work to them. In the shops refined methods of measurement are uneconomical and out of place, and are obviated by the use of accurate gauges and jigs made in the tool room. As our contention may be disputed, we cite in support of it the voluminous report, No. 25, of the Engineering Standards Committee on Errors in Workmanship—an extremely interesting document.

This report was drawn up as a preliminary step towards the standardisation of a system of limits, and was based upon an extended investigation of the errors of workmanship incurred in 13 workshops in turning shafts and boring holes—plain cylindrical work, the easiest of all shapes to machine accurately. The measurements were made by the National Physical Laboratory, which reported that "accuracy of measurement beyond 0.0005 in. was seldom attained, owing to the presence of foreign matter and the variation of temperature." Thus, an expert can only hope to measure with an accuracy of *half a mil* under workshop conditions; and half a mil is greater than a hundredth of a millimetre. Hence shop measurements never need be taken beyond .01 mm.

The measured "Error in Workmanship" is defined as the difference between the size aimed at and the actual size of the work, and for the latter the *mean* of many measurements is taken as the actual dimension. We shall return to this point later. In the case of specimens manufactured on the limit gauge system, the "size aimed at" has been taken s the mean between the stated high and low limits. On this basis, the report shows that, in general, the error of workmanship on shafts averages 1.6 mils, varying roughly from 1 mil on a 2-in. shaft to 2 mils on an 8-in. shaft, though the error is not necessarily proportional to diameter, and in the case of holes, the results showed little relation to diameter, but averaged 1.8 mils. When the data were classified, work manufactured to limits came out best, with general averages of 0.85 and 1.2 mils for shafts and holes respectively. Ground specimens showed 1.1 mils, against 1.9 mils for shafts not ground. Work not manufactured to limits gave 2.2 and 2.3 mils for shafts and holes respectively.

Classifying in terms of purpose, we have this table:—

Class of Work.	Average error of workmanship. Shafts.	Holes.
Small tools	.0005 ...	.0010
High speed engines and dynamos	.0011 ...	.0010
Gun mountings	.0012 ...	.0014
Gas engines	.0020 ...	.0028
Locomotives	.0031 ...	.0025
Large machine tools	.0025 ...	.0033

These figures relate to the average diameters of the shafts and holes; but the specimens are generally somewhat taper and often elliptical, 30 per cent. of all the shafts and 46 per cent. of all the holes having a variation of at least .001 in. in diameter, and 13 per cent. of all shafts, 29 per cent. of all holes, being elliptical by that amount.

The committee gave the following formula for limits:—

Limit/2 in mils $= \pm(0.1D + 0.5)$ where D is the diameter in inches. This gives from a minimum of 1 mil total tolerance up to 3.4 mils at 12 in., but from 5 to 12 in. diameter the slope is reduced, to give 3 mils at 12 in. ("Tolerance" is "a difference in dimensions, prescribed in order to tolerate unavoidable imperfections of workmanship.")

It would be a mistake to infer from the statement that the "error in workmanship" is, say, 1.6 mils, that that figure represents the limit of error; on the contrary, as stated above, it is an *average* figure, and when the tabulated details of measurements are examined it is seen that the maximum errors—which are of great importance, for a shaft that would apparently fit a hole on the average basis may actually not enter it at all owing to the maximum errors being greater—are often much more significant. This fact is well illustrated by the circumstance that, although the investigators say they were seldom able to attain an accuracy within half a mil, the bulk of their data are given in tenths of a mil! A few examples, taken from one of the highest classes of workmanship—high-speed engines and dynamos—may be cited:—

Nominal diameter.	Taper mils.	Elliptical mils.	Tolerance mils.	Error mils.
1.502 (hole) ...	1.0 ...	0.3 ...	0.75 ...	0.0
2.375 (shaft) ...	0 ...	1.0 ...	1.0 ...	0.6
2.378 (hole) ...	1.5 ...	0 ...	1.0 ...	0.3
2.375 (shaft) ...	1.0 ...	0.5 ...	1.0 ...	0.2
2.378 (hole) ...	1.5 ...	0.5 ...	1.0 ...	0.3
4.0055 (hole) ...	2.5 ...	1.0 ...	2.5 ...	0.0

Here we see that a bearing is found to be 1 mil taper and 0.3 mil elliptical; yet the "error in workmanship" appears as 0.0! In another case the taper is 1.5 mils; the "error" appears as 0.3 mil; and the last example is still more striking, a taper error of 2.5 mils and an elliptical error of 1 mil being so far neutralised by other errors that the resultant error is 0.0. Even on this peculiar system of reckoning "errors," according to which a shaft journal may be made to appear absolutely correct if it is 2 mils large at one end and 2 small at the other, the average error of all the 500 specimens examined, as stated above, was over 1½ mils.

One of the most weighty objections to the metric system is the theory that jigs and gauges and patterns will have to be altered, at very great expense to engineering works. As regards patterns, a little consideration will show that there is not the slightest necessity to alter these; as we have pointed out, the accuracy with which a casting is produced is not a matter of a thousandth or even a hundredth of an inch. The many sources of error in this work —uncertain shrinkage, enlargement of the mould in withdrawing the pattern, inaccuracy of fit of the flasks, and warping of the casting, render it useless to aim at a result within half a millimetre of the desired dimension. Hence drawings of castings can safely be figured to the nearest whole millimetre without touching the patterns. Neither is there generally any occasion to alter dies for die-casting, or for forming small articles in presses, remembering that what is aimed at is the correct result, and the mere fact that the dimensions of the result are expressed in inches or millimetres has no bearing whatever upon the suitability of the article for its intended purpose, *unless it has to fit some other part.* Articles manufactured by these processes could be figured to the tenth of a millimetre, which would in general be smaller than the error of workmanship.

As for jigs and gauges, these are wholly a matter for the tool-room. There is no need to alter them at all, because, being usually figured in thousandths of an inch, they can just as easily be figured in hundredths of a millimetre—with a gain in accuracy, on paper. Another point which must not be overlooked is the fact that both these types of appliances have a comparatively short life—not that they necessarily wear out quickly, but changes in design, which are always occurring or impending, put an end to their usefulness. With few exceptions, the life of jigs can be put at not more than two or three years—a writer in the *American Machinist* recently estimated it at not over one year—and therefore, if it is judged essential to alter a jig because it is to be measured in millimetres instead of inches—surely a curious reason—it is grossly unfair to charge all the cost to the metric system.

Gauges, if of standard dimensions, might have a longer life than jigs, but it must be remembered that they are liable to wear, and must be checked and readjusted from time to time; the slight alterations that might be necessary to bring them to convenient metric dimensions could be made on these occasions, and though they would not be inexpensive, they would, at any rate, involve only the adjustment of existing gauges, and not the construction of entirely new gauges. That new micrometers and other fine measuring appliances would be needed in the tool-room must be admitted; but these would not involve a cost that could be regarded as prohibitive.

The fact that, when the need arises, work is done to metric measurements, without the least difficulty, knocks the bottom out of the allegation that the room must be admitted; but these would not involve immense cost. It is not true. Neither the workmen nor the machines offer any difficulties; there is no need whatever to alter jigs and gauges, or to change shop standards. Only the drawings require redimensioning, and anyone familiar with shop methods in a progressive works knows that to alter a drawing is an everyday proceeding. In this connection we wish especially to emphasise the following points:—where interchangeability is necessary, the measurements usually must be taken to the thousandth of an inch (which is fully covered by the hundredth of a millimetre)—and are effected by means of gauges—limit gauges or otherwise. These gauges are prepared and adjusted in the tool-room, and the workman who uses them does not need even to know the dimensions to which they are made; only the tool-room mechanics are concerned with them. The workman, in fact, does not work to inch measurements or millimetre measurements; he works to his gauges, and nothing else, except in the case of dimensions the accuracy of which is of no importance. The latter can, therefore, be taken to the nearest millimetre or, at the very most, to the tenth of a millimetre (0.004 in.). Where standards have been prescribed by the Engineering Standards Committee, there is usually no need to alter them; they can be expressed in terms of millimetres to the necessary degree of accuracy, *with fewer decimal places* than the inch measurements. To illustrate this point we give an example based upon the table given on p. 644 in inch measurements. It will be seen that the millimetre table, although not originally drawn up in mm., presents no difficulties.

Nominal diameter.	Minimum diameter.	Tolerance (difference).	Maximum diameter.	Allowance.	Minimum diameter.	Tolerance (difference).	Maximum diameter.
inches	mm.	mm.	mm.	mm.	mm.	mm.	mm.
¼	6·337	·013	6·350	·013	6·363	·007	6·370
½	12·682	·018	12·700	·018	12·718	·018	12·736
¾	19·027	·023	19·050	·020	19·070	·023	19·093
1	25·375	·025	25·400	025	25·425	·025	25·450
1½	38·069	·030	38·099	030	38·130	·033	38·163
2	50·761	·038	50·799	·038	50·837	·038	50·875
4	101·547	·051	101·598	·051	101·619	·051	101·700
8	203·133	·064	203·196	·064	203·260	·064	203·324

As regards the objection raised on the score of screws, this is a bogey which has long been laid. In the first place, it is well known that metric threads can be cut with English leading screws, and English threads with metric leading screws. We have before us an advertisement of an American lathe, in which this is referred to.

In the second place, when screws are cut on different lathes, they are never accurately interchangeable unless the leading screws were both cut with the same original leading screw. It was for this reason that the National Physical Laboratory some years ago erected a special lathe for the express purpose of cutting leading screws for British engineers. Screws and nuts are only truly interchangeable when thus produced from a common origin, either the same leading screw or the same taps and dies. Hence here again the workman is not concerned with the system of measurement in use, but only with ready-made tools.

(*To be continued.*)

OUR TRADING OPPORTUNITIES THROUGHOUT THE WORLD.

(Continued from page 614.)

The Trade of China.

Germans Pushing British Goods!

We have so recently reprinted the excellent address of Mr. Riddle, delivered at Birmingham, that it may seem that the British firms have enough advice and information to go on with in regard to China as a market. But we are hearing so much about the ways of the German in worming his way into that country that we must place a number of statements on record. Mr. Ainscough, our British Trade Commissioner, is addressing British business people in this country on impressions gained during his investigation of the China market. He has shown that the pushing of British manufactures there has been left largely to German merchants. To those who say, "What does it matter who sells the goods so long as they are British made?" Mr. Ainscough replies that the German will not sell British goods one moment longer when he can find ways of getting the same sort of thing made cheaply in the Fatherland. It is common knowledge that the German did a big sale of British goods in Warsaw, because the people there insisted on having them, but his sense of patriotism in trade is unquestionably strong, and he won't sell anything British if he can help it. Mr. Ainscough advises British traders to co-operate more generally with British distributing houses in China. There is, from what we have just heard, energetic work being done by some British firms operating here and in China. We have been told of a firm of merchants not unconnected with the engineering trade who, finding their occupation more or less gone at the outbreak of the war owing to the operations in Northern France, and to the stoppage of German exports by our Fleet, dispatched a small army of travellers to a certain foreign market to book "after the war" contracts. The firm is British, and its enterprise is highly commendable, but of course the business will be placed where it is most convenient to get it executed—perhaps here, perhaps in the States, perhaps with suspected neutrals, perhaps even in enemy countries. Is it not preferable that British manufacturers should themselves, through their own representatives or organisations, be securing the business for British works?

German Methods.

H.M. Consul, V. L. Savage, in his report for the year 1914 on the trade of Changsha, refers to the steady growth year by year of the recorded value of that trade, but he says that it is more an index to the extent to which such trade is steamer-borne than of the actual increase in the volume. He states that the overwhelming preponderance of British shipping is due to the energy and enterprise of British shipping firms long established in China, but the lack of enterprise on the part of British merchants in general (with two or three exceptions, and these are youthful importing firms) has left the development of the valuable trade of Hunan to be done almost entirely by their German competitors. He says that the latter have done most of the pioneering work with characteristic patience and perseverance. "They have earned the profits they have made and the advantages they have acquired." But, he adds, the methods adopted by Germany cannot be reckoned as sound in all respects, and they are demoralising to the Chinese. "These methods are based to a certain extent on economic factors and conditions which do not apply, on the whole, to British trade and manufactures, even of a parallel order." The engineering trade is quoted as affording a good instance of the differing conditions and methods. Consul Savage continues:—

Germany's Big Output.

"The enormous output of the large German engineering works demands outlets in many markets, in order to secure continuity of production. Temporary sacrifices may have to be made, in consequence, with a view to obtain and preserve a hold on those markets. These take the shape of low initial prices, long credits, and even loans to purchasers of German machinery, on the sole security of contracts under which the latter are more or less tied down to obtaining any further supplies of machinery they may require from the same source, during a term of years; or to provide a *quid pro quo* for the loan, which may not carry payment of interest, in the shape of raw or partly manufactured products, delivered at profitable rates to the German purchasers thereof. In the meantime, it may be noted, the Chinese clients have to pay heavily for accessories and fittings, which, being especially adapted to the plant sold to them, have to be obtained from the same or affiliated manufacturers, whereby the latter make excellent profits. I have good authority for saying that British manufacturers do not, as a general rule, produce on the same scale as the Germans. Their capital, their works and their output are usually smaller. While they may be able to supply articles of equal and sometimes even better quality at approximately the same price, they may not wish to cut down their profits or wait for them; or they may prefer to sell in other markets where they need not do so. These are some of the principal reasons for the predominance of the German over the British engineering trade in China. It is due as much to different economic conditions as to the lack of the necessary organisation and enterprise on the part of British engineering manufacturers."

Modernised Methods Succeed.

The success of a number of younger British firms trading in general manufactures on modern lines is quoted as proving beyond question "that an increase in expenditure on a larger European staff and more agencies is amply warranted by results." But this system is not followed by the old-established merchants, who have hitherto preferred to centralise their trade at the few large importing centres and to deal only in large quantities of goods at a time, and have been content to leave the distribution at long range, entirely in the hands of native middlemen. Consul Savage says that there is no necessity for maintaining this system, indeed, there are good reasons for discarding it. Competition among oreign merchants themselves enables the shrewd Chinese rader to cut down their profits more and more, not infrequently to a minimum. While they are keen enough to make use of the foreigner and his money, the Chinese readily combine together against him. The effects of such a combination are easy to bring about, and extremely deadly where large interests are concentrated at one spot. "The remedy is clearly to adopt a more open formation." In the case of a highly centralised trade, the Chinese middlemen can and do combine together to control the trade, and make too many profits for its welfare and vitality. Any attempt on the part of Europeans to introduce useful innovations calculated to secure better results or an expansion of business is apt to be met by the threat, or the reality, of a boycott, if the middlemen's profits are at all jeopardised. German business houses have a number of European agents up-country for the sale or purchase of goods, most of them able to converse with the natives, study their requirements, and make bargains with them if necessary—having realised the great value of a knowledge of the Chinese language on the part of their agents and salesmen. The report later shows that it is due to the efforts of German firms that the former native prejudices and other factors which raised great difficulties in the way of the successful exploitation by Europeans of the vast mineral wealth of China have been overcome.

The Travelling Hun.

"The export of certain ores and metals is now a principal feature of the trade of Changsha. . . . British enterprise has had practically nothing to do with it." In considering the golden prospects of Changsha, Mr. Savage asks: To what extent is British trade represented at Changsha? "The answer is that, including two shipping companies, there are two British firms having European agents at Changsha; seven more, including two non-European insurances companies, are more or less inadequately served by native agents. That is all! As against that, a year ago, there were here 11 German firms represented by 14 Germans, one Briton, and two Chinese agents. Owing to trade depression and the war, four of these firms have now closed down and four Europeans only remain at present to represent the more important houses. But it must be noted, on the other hand, that the mineral trade of the province is still predominantly in German hands, as well as its produce trade, the main outlet of which is the neighbouring port of Changteh, now about to be opened to foreign trade and residence. Branches of several German exporting firms are already established there, but no British firms are represented except by native agents. Two British mining engineers who have lately been travelling in the interior of Hunan report that, at almost every place where the prospect of mineral produce shows especial promise, the Germans have already entered into relations with the mine owners and established some sort of a hold. In addition to the Germans, there are also at Changsha agencies of five important Japanese firms and about a dozen smaller ones, and the number of Japanese subjects is greater than that of any white race, excluding missionaries. From this it will be seen that our wide-awake and enterprising commercial rivals are taking advantage of good opportunities for the expansion of their trade which, while equally open to the British merchant, are not receiving from him the attention which they should command. The real fact of the matter is, there is plenty of room for more British firms than now exist in China. New capital and new blood are wanted to rejuvenate our trade. The newcomers, if any, will no doubt have to build up their trade connections; but this is an easier task in China than in any other country. New firms will have to engage men of local experience, and train others; but they will not, like the older firms, have to break through the opposition of their old-established connections among the Chinese and institute new and unpopular methods, while they will have less, or nothing, to lose, and much to gain. As regards Changsha, a warning is needed. The place has a great future before it, but space for residential and business quarters is very limited. The value of land is already high and tends to increase rapidly. In a few years' time costs of installation will be such as to require a very considerable outlay. The first in the field will score heavily in this respect."

Plenty of Room for the British.

Lead and zinc metals are exported in the form of ore, the output of lead during 1914 being close on 4,000 tons and that of zinc 12,894 tons. The producing source is the Shui K'ou Shan lead and zinc mines, the output of which is controlled by three German firms, while the machinery used is either of German or local make. For it is the fact, however remarkable, that a foreign-trained Chinese mechanical engineer, assisted by a staff of foreign-trained Chinese fitters and mechanics, turns out on the spot, in a remote district of Central China, a number of articles of modern machinery which serve their purpose excellently.

Several years ago the output of the Shui K'ou Shan mines was pledged for six years to a German firm, in return for an advance of 1,000,000 taels (about £150,000) wtihout interest. By this arrangement the firm in question, although probably unable at present to finance this branch of its trade, has nevertheless continued to take delivery of the supplies of ore, the value of which goes to repay the loan. The ore itself is stored in the firm's warehouses at Wuchang until circumstances allow of its disposal.

The Demand has to be Cultivated.

In the present comparatively undeveloped state of the Hunan market it is not possible to gauge to what extent it might be made to absorb particular items out of the vast range of British-manufactured goods. Cheap but serviceable tool steel and tools, machinery, electrical fittings, lamps and lampware, caps and hats, enamelled ware, needles, and a number of other articles of common use and low cost, already find a considerable market. Among the restricted class composed of the Hunanese gentry there is much wealth, and certain luxuries, the nature of which would be required to be ascertained, would no doubt find an ever-increasing number of purchasers. It is rather a question of educating the market up to a higher standard of requirements. But to obtain this object personal enterprise is a *sine quâ non*. Trained travelling agents could do much useful work in this direction. But more effective, perhaps, would be some kind of an emporium, in which a large variety of goods could be exhibited and sold at reasonable rates under foreign supervision. In the case of articles not suitable for a retail trade, show-rooms are indicated.

(*To be continued.*)

THE PRODUCTION AND PROPERTIES OF ELECTROLYTIC COPPER.

By B. WELBOURN.

(*Abstract of Chairman's Address, delivered to the* Manchester Local Section of the Institution of Electrical Engineers, *November 16th*, 1915.)

Nearly everyone of us is a user, in some form or another, of electrolytic copper. A search of the Institution records for twenty years discloses no paper devoted to it, although it is a prime necessity of every electrical engineer.

The world's output of copper in normal times is about 1,000,000 English tons per annum, the highest production being that of approximately 1,006,000 tons for 1912. Of this, the U.S.A. alone produced 55 per cent. (against 572 tons only in 1850), the whole of North America produced 66 per cent., and North and South America together produced 73 per cent. As this huge quantity is mainly controlled from the U.S.A., it is easy to see how the copper prices of the world are regulated from there.

Japan is the next biggest producer with 65,000 tons. Spain and Portugal gave 59,000 tons, Russia 33,000 tons, Australasia 47,000 tons, while the combined production of Germany, Hungary, Turkey, and Bulgaria on a peace footing is about 35,000 tons. The British Isles produce 300 to 400 tons only now, whereas the native production was 15,968 tons in 1860.

The world's production in 1850 was 52,400 tons. It had reached 334,565 tons in 1895, and this had trebled by 1912. In the same period, the output of the British Empire was more than quadrupled from 23,495 to 99,440 tons. The increasing production and consumption correspond with the development of the applications of electricity.

The statistics for 1912 show that the principal manufacturing countries absorbed copper as follows:—

	Tons.		Tons.
North America	365,922	Austria-Hungary ...	50,590
Germany	243,173	Russia	38,818
England	147,551	Italy	34,378
France	106,753		

Copper is nearly always associated with gold and silver, which can be electrolytically separated from it, and are now recovered instead of being lost, as was usually the case until electrical methods were available. About 70 per cent. of the world's output of copper is refined electrically, and from the 461,583 tons refined in the U.S.A. in 1907, 13,995,436 oz. of silver and 272,150 oz. of gold were recovered by electrolytic separation.

Most of the ores have to be calcined before smelting, in order to get rid of part of their sulphur, and this is done in mechanical calciners. After partial calcination, the ore is smelted (usually in a cupola furnace) to extract the earthy matter and to concentrate the copper, etc., with part of the sulphur and iron into a matte. This matte will run from 45 to 50 per cent. of copper, and then it is transferred to a Bessemer converter, which blows it up to 97 per cent. to 99 per cent. with the gold and silver contents, and is the result of treating ores which have sometimes only 3 per cent. to 4 per cent. of copper originally. The copper is run from the converter into slabs about 18 in. by 28 in. by 3 in., which are then transferred to the refinery, where they are again melted for 24 hours in a reverberatory furnace with a capacity of 150-200 tons of copper for further purification. The copper from this furnace is run into moulds to form the cast anodes, which are usually 36 by 36 by 1½ in. thick, and weigh 500 lb. each.

Under good conditions, in the U.S.A. works the cost of converting a 50 per cent. matte to metallic copper is about ½d. per lb. of refined copper.

Most works employ the multiple system, in which anodes of cast copper and cathodes of electrically deposited copper strippings 36 by 36 by 1-32 in. thick are hung in lead-lined vats. The space between the electrodes is 1½ to 2 in., and the pressure employed is about 0.3 volt for every pair of electrodes in series. The electrolyte is an acidulated solution of cupric sulphate, and contains 1½ to 2 lb. of $CuSO_4$ and from 5 to 10 oz. of H_2SO_4 per gallon of water, and is maintained at a temperature of 130 deg. F. The current density is usually 7½ to 12 amperes, and should not exceed 18 amperes per sq. ft. of anode surface, as it has been found by experience that the mechanical properties of the metal depend on the current density used. With this latter density a high temperature and rapid circulation of the electrolyte must be maintained.

In practice, 1½-in. thick anodes decrease in thickness in ten days to ½ in. thick, and pure electrolytic copper is deposited on the cathodes until they are just over ½ in. thick, while the precious metals settle as slime at the bottom of the vat. The ½-in. thickness of anode which is left is returned to the anode furnaces for re-melting and further casting.

Theoretically, with a 100 per cent. current efficiency and 0.3 volt between electrodes, 1 lb. of copper should require about 0.115 KW.-hour, but, in practice, the gross KW.-hours required for refining and for power and lighting in the largest works is 0.14 to 0.15 KW.-hour. The overall cost of the electrolytic refining of copper is not published by the refiners, but it is believed to vary from a farthing to three-eighths of a penny per lb. The finished cathodes are melted down, blown with air, poled, and then cast into wire bars, the average weight of which is 140 lb. in England, and 220 lb. in the U.S.A., but if required by the wire manufacturers, special bars up to 800 lb. in weight can be produced.

For the transmission of electricity two varieties only are required :—

1. Hard-drawn copper, which comprises all conductors in which mechanical strength is required; and
2. Soft or annealed copper, which comprises all conductors which are to be continuously insulated, and in which the highest obtainable conductivity is required.

Bus-bars for switchboard work may either be hard-drawn or annealed as required.

The actual manufacture of wire from wire-bars is a straightforward process, and wires can be successfully drawn from 1 mil. in diameter, of very considerable lengths, up to 0.2 sq. in. sectional area in lengths up to 7,000 ft. The wire-bars are heated in furnaces to a bright red heat and are then "broken down" in rolls, and afterwards rolled in the rod mill into rods which are coiled up while still hot. In this process the copper oxidises rapidly, and it is necessary to remove the scale by acid pickling and by washing. The removed scale is readily convertible back to copper by an electrolytic process. The clean coils are taken to the wire-drawing machines, in which the rod is drawn into wire by means of chilled iron and/or diamond dies according to the size. Wires of No. 17 S.W.G. and under are usually drawn through diamond dies only.

The number of dies or "holes" through which the wire is drawn down to the required diameter depends on whether the wire is to be used "hard" or "soft," and, if the former, on what tensile strength and other mechanical properties are needed. Generally speaking, the greater the number of holes or dies, the higher is the resultant tensile strength.

Drawn Specimen (Mr. T. Bolton).

Diameter in inches.	Tensile strength, tons per sq. in.	Elongation p.c. in 10 inches.
0.500	23.68	3.8
0.400	25.62	3.0
0.300	28.30	2.6

When hard-drawn wire is needed, it is now ready for use either as a single wire, *e.g.*, a trolley wire, or it can be stranded into a more flexible conductor for use on an overhead transmission line.

If soft copper is needed, the hard-drawn copper can be treated in a number of ways. The modern process most used for annealing copper and other non-ferrous metals is that known as the "Bates and Peard," or some variation of it. The system consists essentially of a cast-iron retort which is heated externally, and which is sealed by water at both ends to prevent the entry of air through the descending mouthpieces. The retort is filled with water vapour under pressure at a temperature of about 800 deg. F. for small wires, and 1,100 deg. F. for larger wires, and the copper which is to be annealed is carried slowly through the heated tube by means of an endless conveyor. When the copper comes out of the retort, it is found to be perfectly annealed and to be as bright in colour as it was before treatment, while there has been no loss of weight. The heat remaining in the coils of wire is sufficient to cause the water from the seals to evaporate and leave quite dry wire, which is then ready for stranding and insulating.

Where long lengths of wire are required, it is frequently necessary to joint wires together during manufacture. In the smaller sizes which are used in the construction of insulated cables this may be done conveniently and economically by the use of electrical butt-welders.

For trolley wires, some engineers prefer that copper wire bars of suitable weight should be used to ensure getting the lengths required without any joints. An alternative to this is to joint the rolled rods (from which the wire is to be drawn) by means of scarfed joints which are brazed together with silver as the solder, and extensive experience of this method shows that it is entirely successful. Both this and the electrically-welded joint referred to earlier will stand drawing down through the dies, and, in the finished wire, the joint cannot usually be detected by the eye, nor is its tensile strength any less than that of the rest of the wire. In fact, it is usually higher.

British Standard for Copper Conductors.

The first attempt to standardise copper conductors was made by an I.E.E. Committee, whose report was published in January, 1900.

The standard at present in use is the one issued by the Engineering Standards Committee (No. 7, revised March, 1910), but it is understood that this is under revision, which is certainly needed, in view of the International Electro-Technical Commission's Publication No. 28, *International Standard of Resistance for Copper*, March, 1914, which has already been adopted in the new standardisation rules of the American Institute of Electrical Engineers, dated July 1st, 1915, as follows :—

1. At the temperature of 20 deg. C. the resistance of a wire of standard annealed copper 1 metre in length and of uniform section of 1 sq. millimetre is 1/58 ohm = .0172414 ohm (20 deg. C. = 68 deg. F.).
2. At a temperature of 20 deg. C. the density of standard annealed copper is 8.89 grammes per cubic centimetre (554.985 lb. per cubic foot).
3. At a temperature of 20 deg. C. the "constant mass" temperature coefficient of resistance of standard annealed copper measured between two potential points rigidly fixed to the wire is .00393 = 1/254.453 per deg. C. (.00218333 = 1/458.016 per deg. F.).
4. As a consequence, it follows from (1) and (2) that, at a temperature of 20 deg. C. the resistance of a wire of standard annealed copper of uniform section, 1 metre in length and weighing 1 gramme is 1/58 × 8.89 = 0.15328 ohm.

Paragraphs (1) and (4) define "volume resistivity" and "mass resistivity" respectively. This may be expressed in other units as follows :—Volume resistivity = 1.7241 microhm-c.m. (or microhms in a cm. cube) at 20 deg. C., = 0.67879 microhm-inch at 20 deg. C. and "mass resistivity" = 875.20 ohms (mile, pound) at 20 deg. C.

In the interests of uniformity, it is to be hoped that the Engineering Standard Committee will adopt the above standards, and will further provide that—

5. The resistance of hard-drawn copper shall be considered 2.7 per cent. greater than that of annealed copper of the same size at the same temperature (*i.e.*, 20 deg. C. or 68 deg. F.).
6. The legal standard wire gauge as fixed by Order in Council, dated August 23rd, 1883, shall be adopted as the standard gauge, as in the existing standards.

In the meantime, it should be noted that the Engineering Standards Committee defines hard-drawn copper wire as wire which does not elongate more than 4 per cent. on a gauge length of 10 in. when broken by tension, and that the standard resistance for it is just 2 per cent. higher than that for annealed wire at 60 deg. F. (15.6 deg. C.).

It may also be noted that the Board of Trade's existing regulations for overhead lines require that the elongation of hard-drawn copper wire will not be less than 2 per cent. in a length of 10 in., so that wires for such lines naturally fall between elongation limits of 2 per cent. and 4 per cent.

The British Engineering Standards for Trolley Wire is contained in Report No. 23, issued in August 1905, but it needs revision in view of the subsequent experience gained in the manufacture of such wires and of the common use of grooved sections of trolley wires.

The testing of annealed copper conductors is very simple, and is confined to gauging the wires with a micrometer gauge and measuring the ohmic resistance, and sometimes to the weighing of samples or coils. In the case of hard-drawn copper, additional tests are necessary to determine :—

1. Tensile strength.
2. Extension as a test of hardness.
3. Limit of proportionality (elastic limit).
4. Absence of brittleness.

Tests (1), (2), and (3) are usually made simultaneously on a specimen which is exactly 10 in. long between the grips of a Dennison, Buckton, Avery or other suitable testing machine. Modern testing machines are arranged so that autographic records of the extension of the wire may be taken, which are sufficiently accurate for commercial work. If, however, *exact* extension measurements are needed, then they must be made carefully by an experienced worker, with an extensometer. In practice, it is found that the actual tensile strength increases in proportion to the diameter, and not to the sectional area, as one would expect, although the tensile strength in tons per square inch increases with a decrease of diameter. After analysing a number of tests made by Mr. Thomas Bolton, Mr. A. P. Trotter found that the tensile strength could be expressed as follows :—

$$\mathrm{T} = a - b\,\mathrm{D}.$$

Mr. D. R. Pye and other investigators have found from a large number of tests that the value of *a* is approximately 30.

and that of b is 20, on all sizes of conductors up to 0.5 in. diameter.

It is not, however, sufficient to define the strength of the wire; it is also necessary to have some check on its hardness and absence of brittleness by ascertaining that it does not fall below a stated *minimum* extension per cent. Tests on wires from 0.075 to 0.5 in. diameter show that the minimum extension can be expressed by

$$E = 5\,D.$$

On these results, Mr. Pye has suggested (*Journal of Institute of Metals*, No. 2, 1911, Vol. VI) the following as the basis of a satisfactory definition of hard-drawn copper:—

"Hard-drawn copper, when in the form of circular wires, shall have a tensile strength *not less than* that given by the formula—

$$T = 30 - 20\,D.$$

and an extension per cent. on a marked 10-in. length, including point of fracture, of *not less than* that given by the formula—

$$e = 5 \times D.$$

where in the foregoing formulæ:—

T = tensile strength in tons per sq. inch of original section.
e = extension per cent.
D = diameter of the circular rod in inches.

An examination of the standard figures prepared by the Wire Committee of the American Society for Testing Materials (1909) for wires ranging from 0.04 to 0.46 in. diameter shows that they agree closely with the above specification for strength, while the minimum extension figures agree closely with the formula:—

$$e = 4\sqrt{D}.$$

The Engineering Standards Committee might, therefore, consider the adoption of Mr. Pye's specification on the grounds that—

(*a*) It calls for a high standard which can easily be obtained by the leading manufacturers throughout the world;

(*b*) Tables of the minimum tensile strength and extension per cent. can be prepared for use for all the usual sizes of wires; and

(*c*) It is easily applied to all intermediate sizes.

Test (4) is almost wholly covered by Test (2), and probably could be displaced by it, but the British Post Office and other users specify the following ductility test for wires which range in diameter from 0.0791 to 0.2237 inch:—

"The wire shall be capable of being wrapped in six turns round wire of its own diameter, unwrapped, and again wrapped in six turns round wire of its own diameter in the same direction as the first wrapping, without breaking; and shall be capable of bearing the number of twists set down in the Table without breaking. The twist test will be made as follows:—

"The wire will be gripped by two vices, one of which will be made to revolve at a speed not exceeding one revolution per second. The twists thus given to the wire will be reckoned by means of an ink mark which forms a spiral on the wire during torsion, the full number of twists to be visible between the vices:—

Weight per statute mile.			Approximate equivalent diameter.			Minimum breaking strain.	Minimum number of twists.	Maximum resistance per mile at 60° F. when reduced to standard diameter.	Weight of each piece or coil.	
Required standard.	Minimum.	Maximum.	Required standard.	Minimum	Maximum.				Minimum.	Maximum.
lb.	lb.	lb.	in.	in.	in.	lb.		Standard ohms.	lb.	lb.
800	784	816	0·2237	0·2215	0·2259	2,400	In 6 in. 15	1·0984	100	140
600	588	612	0·1937	0·1918	0·1956	1,800	20	1·4645		
400	392	408	0·1582	0·1566	0·1598	1,250	25	2·1968		
300	294	306	0·1370	0·1356	0·1384	950	30	2·9291		
200	196	204	0·1119	0·1108	0·1130	650	In 3 in. 20	4·3936	75	130
150	147	153	0·0969	0·0959	0·0979	490	25	5·8582	75	120
100	98	102	0·0791	0·0783	0·0799	330	30	8·7873		

To show how this works in practice, three standard 600-lb. wires were taken at random and the following results were obtained:—

G.P.O. Specification.	Breaking strain 1,800 lb.	Twists in 6 in. 20 minimum.	Wraps, 6 on, 6 off, 6 on.	Ohms per mile 1·4645
Sample I	1,895 lb.	28	66663	1·4590
„ II	1,880 „	30	666662	1·4540
„ III	1,900 „	28	66664	1·4591

An extraordinary and unexpected result has been that the 600-lb. wire had a breaking strain of 1,850 lb. after 20 twists had been applied, but there was no measurable extension. It would seem that the work done on the wire in twisting had increased its hardness and brittleness until it became useless for any practical purpose.

The General Post Office tests for brittleness give a rough measure of the quality of the wires, and their value lies in the ease with which they can be applied; but it should be noted that the Department does not specify any extension test. It may be stated, however, with considerable confidence, that wire which complies with Mr. Pye's specification will also automatically comply with the Post Office specification. Apart from this, it does not seem clear why a wire which is to be erected and subjected to longitudinal strain only should be tested by wrapping and twisting, and the extension test would seem to be a more scientific way of determining the toughness of the metal. This opinion is confirmed by the action of the Wire Committee of the American Society for Testing Materials in offering explanations of their omission of these wrap and twist tests from their specification for hard-drawn copper wire.

(*To be continued.*)

LEGAL.

Electrical Worker Fined at Tynemouth.

At Tynemouth Police Court, on the 12th inst., George E. Horler, 30, described as an electrical worker, was charged under the Defence of the Realm Regulations with having failed to answer questions on October 26th.

Detective Mason said that, acting on instructions from the Chief Constable, he visited Tynemouth electricity works on October 26th, to see Horler, who was employed there, but the man was absent. He then went to the accused's lodgings, and questioned him. Asked where he was born, accused said he was born at Hull, and, later, said at York. He refused to answer other questions that were put to him, and he was taken to the police station. Having obtained authority, witness searched accused's boxes, and he found a motor and cycling map of the Wembley District of London, a manual of military engineering, and a bank-book. Witness made further inquiries, and found that in the early part of the year Horler went to work with Messrs. Holmes, electrical engineers, at Newcastle-on-Tyne, but left after three days, without notice, and without drawing the wages due to him. The man next worked at Hull as a switchboard attendant for six months, and then secured a situation in the power station of the London and North-Western Railway Co. at Wembley. While there he secured a place at the Tynemouth electricity works, and left Wembley without notice and without drawing his last week's wages.

In reply to Mr. B. C. K. Snagg, who defended, Witness said they had obtained a birth certificate. This was produced, and showed that Horler was born at Yeovil, in Somerset, in 1885, that his father was a native of Somerset, and his mother of Durham.

Mrs. E. F. Green, with whom accused was lodging, spoke to conversations which the accused had with a Mr. Kenway and herself. On one occasion he said he would close down the Tynemouth electricity works. Accused: I did not. Witness added that when Horler came home on October 25th, earlier than usual, he said he had been dismissed. He said that he had burnt out the works, and that they would hear more of it in the morning. Mrs. Green added that accused was always running England down and sticking up for the Germans.

Francis Batey said that he was in charge of the Tynemouth electricity works on the night of October 25th, and Horler was assistant switchboard man. While witness was in the telephone box the lights went out, and on rushing back to the switchboard he found that Horler had been turning the regulator. There was no reason why he should have touched it. Witness re-adjusted it, and told Horler not to interfere with it. Witness went back to the telephone box, and immediately the lights went out again. He then found that, despite his warning, accused had again interfered.

Mr. E. Turnbull, electrical engineer, said he was at home when the lights went very low, and then came back. A few minutes afterwards they went very high and then very low. He at once rang up the works, and from what he was told he gave instructions that Horler must leave the works at once and see him next morning. Horler did not turn up in the morning. Some damage was done and some people were frightened.

Horler, in evidence, denied any malicious intention in connection with the regulator. It was a patent type, which he had never seen before, and he turned it, inadvertently, the wrong way. He told a lie about his birthplace, so that no inquiries might be made at Yeovil to distress his mother, who was old and feeble.

Mr. Snagg suggested that the magistrates should dismiss as "trimmings" the evidence as to the alleged conversations, and the incident of the power station.

Mr. T. Young, the presiding magistrate, said they found the accused guilty of not answering questions put to him legally. They did not propose to go into anything else. The offence was a serious one in times like these. Taking into consideration that Horler had been in prison 16 days, they ordered him to pay a fine of £25 and the costs of the witnesses.

Osram Lamp Works, Ltd., v. Pope's Electric Lamp Co., Ltd.

This case came before the Court of Appeal, composed of the Master of the Rolls and Lords Justices Bankes and Warrington on November 11th, upon the appeal of the plaintiffs from a judgment of Mr. Justice Joyce, in the Chancery Division, giving judgment for the defendants in the action which was brought against them to restrain the alleged infringement of Letters Patent, No. 23,899 of 1904, granted to Dr. Alexander Just and Franz Hanaman, for "Improvements relating to the manufacture of incandescent electric lamps."

The improvements claimed consisted in making filaments of pure tungsten by mixing finely divided tungsten or its compounds with an organic binding material, forming the filaments from the mixture in the usual manner, and then carbonising them in some cases after dinitration had been effected. The filaments were then raised to a high temperature by passing an electric current through them in an atmosphere of steam and hydrogen, and were rendered uniform or equalised by submitting them to the action of the current in an atmosphere of volatile tungsten compounds in the presence of a quantity of hydrogen. Plaintiffs also, by the action, claimed that the defendants had also infringed Letters Patent (of which they were the owners) granted to Phillip Middleton, Justice in 1906 (No. 18,622) for an "Improved method of providing metallic incandescence bodies for electric glow lamps," but at the trial in the Court below the plaintiffs did not open their case as to this patent.

Defendants contended that they did not infringe, because they did not carbonise the filaments, and did not pass an electric current through them, but heated them in an electrically-heated furnace, and that they did not use an atmosphere of steam and hydrogen, and did not equalise the filaments.

Plaintiffs, however, contended that the purpose of passing the current through the filaments was only to raise them to a high temperature, and that the defendants' heating apparatus was equivalent to the plaintiffs'; plaintiffs also said that the defendants produced steam by the reaction taking place inside the tubes in which the filaments were heated, and so in effect used an atmosphere of steam and hydrogen.

The defence was that the plaintiffs' patent was bad for want of subject-matter and utility, and for insufficiency of directions in the specification; that the idea of making filaments of tungsten was old, and that the only evidence that it was possible to carry out successfully the directions was not to be accepted. Mr. Justice Joyce decided that the plaintiffs' patent was not for making filaments of tungsten, but only for making them by the particular process specified; that the defendants did not use an atmosphere of steam and hydrogen in the sense in which it was used in the plaintiffs' specification, and, further, that the defendants had not been guilty of infringement. His Lordship further held that if it had been necessary to decide the question of validity of the plaintiffs' patent, it was doubtful if the subject-matter and the directions were sufficient. Upon these grounds his Lordship dismissed the action, and from this decision the plaintiffs now appealed.

Mr. A. J. Walter, K.C., Mr. Colefax, K.C., Mr. J. H. Gray, and Mr. Lunge appeared in support of the appeal, and Mr. T. Terrell, K.C., Mr. Hughes, K.C., and Mr. Russell Clarke for the respondents.

Mr. Walter, in opening the case for the appellants, said it was an appeal from a judgment of Mr. Justice Joyce on July 20th, who had dismissed the action on the ground of non-infringement by the defendants. Questions of validity were raised, but not decided by the learned judge. Various issues were raised, some of which were the same as in action tried before Mr. Justice (now Lord Justice) Warrington. That action was brought by the present plaintiffs against the "Z" Electric Lamp Co.

Lord Justice Warrington: I suppose the issue of validity may be raised here?

Mr. Walter: Oh, clearly.

Continuing, the learned counsel said, in 1898 the demand for a metallic filament was a pressing one. Osmium was a very expensive thing, costing about £100 per lb. In 1904 the present invention came along, and it was the first time that anybody had produced a coherent tungsten filament. Since the date of the plaintiffs' patent other patents had been taken out. Before 1904 no method was known by which you could so use tungsten. Messrs. Just and Hanaman discovered that if you took one of the atmospheres by which Welsbach had treated osmium and metals of that group, you could make a filament of tungsten. Defendants had raised several defences. They said first of all that they had not infringed. Then they alleged want of novelty and want of subject matter, insufficiency of directions and want of utility.

The Master of the Rolls: You have opened a very large field Mr. Walter. Would it be possible for us to deal with the question of infringement or non-infringement first?

Mr. Walter replied that he thought that course would be convenient, but he thought it desirable that the Court should have a full statement as to the nature of the plaintiffs' invention.

Continuing, Counsel said that what Welsbach did was to teach the world that certain defined metals could be used for the manufacture of coherent filaments, these metals being osmium and the metals of the platinum group. He taught the world nothing except what would happen with regard to the metals of the platinum group. He thought the evidence of the plaintiffs was to that effect, and no questions were asked of any witness by the defendants at all that that specification had taught the world anything more. Tungsten was a well-known metal, worth only some shillings per lb., whereas osmium cost several sovereigns. At the time of Welsbach's specification tungsten was a well-known metal, and was largely used for hardening steel. Notwithstanding Welsbach knew about tungsten in 1898, it occurred to nobody for six years afterwards to experiment and try to make a coherent tungsten filament by a process which was one of the three processes indicated by Welsbach. Tungsten for the purpose of filaments had been suggested long before Welsbach for electric lighting. It had been suggested as long back as 1889 by Bottom, but all that he had done was to produce an incandescent filament composed of metallic tungsten and carbon in varying proportions.

Continuing his address, Mr. Walter referred to the specification of Siemens & Halske, No. 277, of 1904, and also to Gulcher's specification. He (Counsel) pointed out that Welsbach's experiments did not lead him to suggest that tungsten could advantageously be used for making filaments. Defendants' process consisted in taking a mixture of finely divided tungsten and an oxide of it, mixing it with a carbonaceous binding material, and then squirting the mixture. The filaments so produced were put into an iridium furnace heated by electricity and filled with hydrogen and passed slowly from the cool lower part of the furnace to the hot upper part, and then back to the lower part—steam was formed in the furnace, and the process was in effect that of the plaintiffs. Electricity as used by the plaintiffs had no function other than heating. Counsel also explained the defendants' alternative process before the final heating. By that process it appeared that the defendants put the filaments on holders in a quartz tube heated in an electric furnace to 950° C. and exhausted by an air pump, chemical action successively took place, and hydrogen, steam and carbonic oxide were formed. The filaments were then cooled, heated in air to 220° to oxidise the tungsten, heated again in the quartz tube to 950°, cooled, and finally heated to 850° in hydrogen. He (Counsel) contended that there had been clear infringement by the defendants, and that there was subject-matter in the plaintiffs' invention. Counsel then proceeded to read at great length the evidence given in the Court below.

(*To be continued.*)

Dexter v. Aldershot Urban District Council.

This claim for an injunction to restrain the defendants from working the plant at their electricity works at Laburnham Road in such a way as to cause a nuisance or injury to the plaintiff, was opened in the Chancery Division on Tuesday. We shall report the matter next week.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Insulator Bracket.

Pole-line brackets of pressed steel have recently been developed by Messrs. Hubbard & Co., of Pittsburg, Pa. The Peirce bracket, as it is called, is said to be of unusually strong construction, and is provided with rounded surfaces which cannot scrape the insulation from the wires. The bracket is equipped with a spring thread, as shown in the illustration, which, it is claimed, cannot lock the insulators. The spring thread yields and adjusts itself to the insulator.—*Electrical World.*

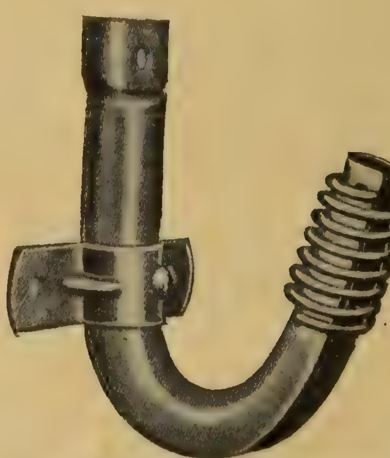


Fig. 1.—Pressed-Steel Bracket with Spring Thread.

Tree Insulator.

In order to prevent damage to shade trees and eliminate dangerous grounds, the insulator shown herewith has been developed for use on city transmission lines. The device consists essentially of two pieces of semi-tubular galvanized iron which are fitted together and held in place by circular screw clamps. The ends of the tube are equipped with porcelain insulators as shown. The insulator is being made in lengths of from 1 ft. to 6 ft. When over 1 ft. long, porcelain-mica insulators are inserted in the tube 1 ft. apart. The device is being made by the Frank Ridlon Co., Boston, Mass.—*Electrical World.*

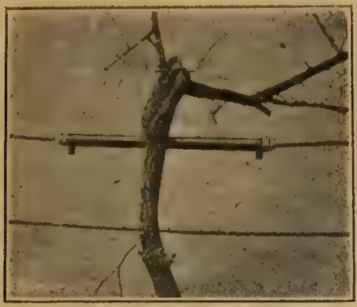


Fig. 2.—Insulator for Protecting Shade Trees.

Corrosion-Proof Fittings.

We have received from the St. Helens Cable and Rubber Co., Ltd., of Warrington, samples of their most recent patent corrosion-proof lampholder and ceiling rose. The former, which we illustrate in figs. 3 and 5, consists of an interior fitted with the lamp socket below and wiring terminals above; this is enclosed in a barrel, the upper end of which is closed by a specially formed cap, and the lower end by a screwed gland carrying the shade ring, the gland being adjusted to fit closely over the shoulder of the lamp when in position in the holder. The cap is chambered out to allow for the wiring terminals, the two wires being introduced through separate holes leading to the bottom of the cap and bent upwards to the terminals; a small screw plug allows of a special fluid compound being introduced, which fills the interior of the cap and completely seals it.

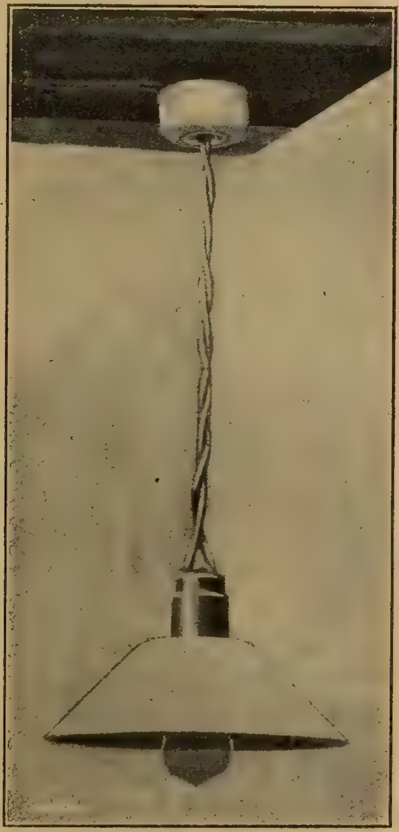


Fig. 3.—Corrosion-proof Lampholder and Ceiling Rose.

We understand that samples of these lampholders have been tested immersed in double strength battery acid for a period of 20 hours, and after that placed under water with the lamp burning for 24 hours.

The corrosion-proof ceiling rose, figs. 3 and 4, is very similar in principle to the corrosion-proof ceiling type junction box described in our issue of February 12th last, p. 204, but it has the additional advantage that the pendant leads pass down through the centre of the fitting instead of over the side of the sealing cup, and it is secured to the ceiling by three screws instead of one, as shown then.

It may be mentioned that this fitting consists of a porcelain interior provided with internal sealing chambers divided by partitions, to contain the junction terminals between ceiling and pendant wires, and this interior is screwed to the ceiling; a porcelain sealing cup, which is filled with fluid compound, screws over the interior, and the fluid seals the contents against moisture or vapours. The wires are led through the cup to the interior, and pass out through the cup and down through the central hole to the pendant.

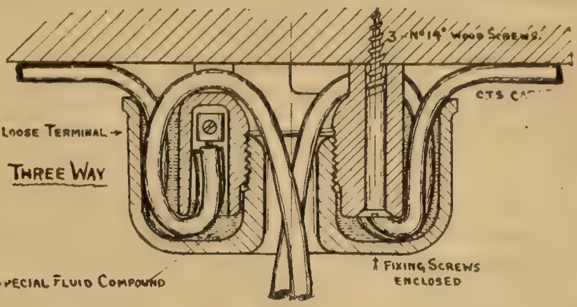


Fig. 4.—Sectional View, Corrosion-proof Ceiling Rose.

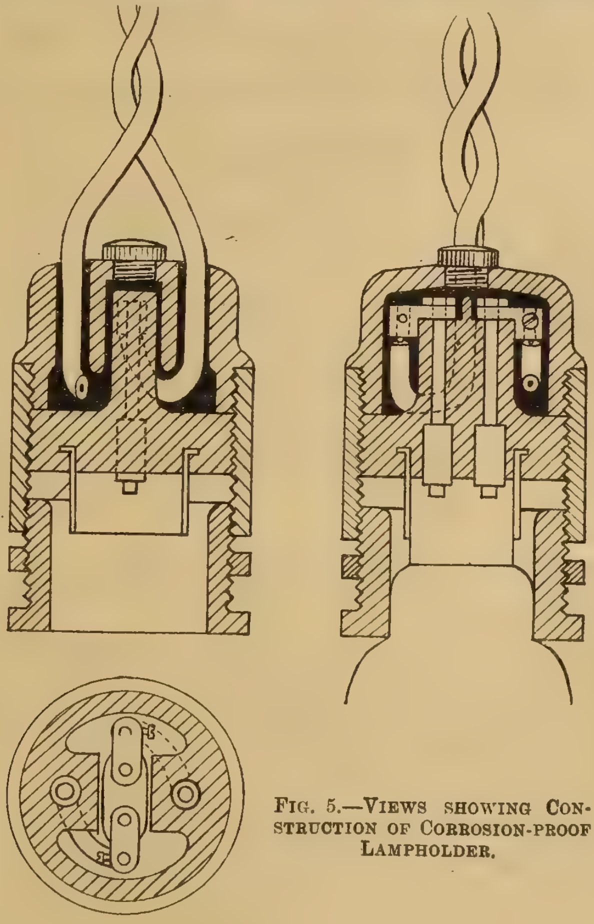


Fig. 5.—Views showing Construction of Corrosion-proof Lampholder.

Conduit Spacing Support.

We have received from Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, a mailing card, No. 604, describing the firm's conduit supports, for use on the surface of brick or similar walls where the conduit should be supported free of the wall. The rag bolt is intended to be grouted into the wall with Keene's cement up to the shoulder, and the conduit will then be spaced out ¾ in. clear of the wall surface. These supports are made for ⅝ to 2 in. conduit.

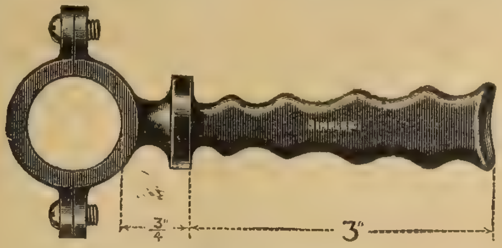


Fig. 6.—Conduit Support.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Decimal Coinage and the Metric System.

In all reports coming from abroad dealing with our foreign trade, greater stress than ever is laid upon the fact that the most serious hindrance to the extension of our commerce with metric countries is the retention by us of our antiquated weights and measures.

For years the Decimal Association has been urging without ceasing the adoption by the British Empire of the metric weights and measures and a system of decimal coinage. The country is now very much alive to the need for a thorough awakening from our past trade methods if we are to hope to succeed in the struggle for commerce which will ensue when the war is over. The accomplishment of our aims is therefore hopeful, but if we are to succeed in bringing about this reform, we require the help and co-operation of all who are in favour of our object. I shall be pleased, therefore, to hear from any who are in agreement with us, and will gladly send further particulars of our work if application is sent to the Decimal Association, Finsbury Court, Finsbury Pavement, London, E.C.

E. Merry,
Acting Secretary, The Decimal Association.

London, E.C., *November 10th*, 1915.

[Other letters on this subject have been received too late for insertion in this issue.—EDS. ELEC. REV.]

A.E.G. Meeting.

I note the correspondence in your issue of November 5th, relating to the above, but in spite of this correspondence it is very evident that the Electrical Co. is being supported by English manufacturers.

I have in front of me a price list issued by this firm dated November, 1915, which they have had the effrontery to send through the post, and which I assume has been distributed broadcast. I notice that they claim to hold large stocks of the Osram, Mazda and Wotan lamps. Here we have the names of three firms in the Tungsten Lamp Association who are supporting the Electrical Co.

In view of the repeated claims that the Tungsten Lamp Association is one of German inspiration, the supply of Tungsten Association lamps certainly does not go to disprove such feeling.

November 9th, 1915. **Vigilant.**

"Inquisition" is striking the right note in his letter of the 6th inst. If the movement is to be of benefit to British trade we must have a definite programme.

In spite of the letter of "Anti-Humbug," our technical Press has the confidence of the majority of the electrical industry, and we can look to them to initiate the proper steps to give effect to the wishes of the electrical trade. We can be justly proud of the broad-minded views and lofty ideals of the technical Press, and any movement that hopes to succeed in this matter must work on a clean issue with clean methods, or else we cannot rely on the proper support in the country.

Thousands of our best brains are now abroad, in many cases for the first time, leading a strenuous life in defence of the old flag, adapting all types of machines to the most novel conditions, endeavouring to get the utmost value in work from whatever machine or instrument is in their charge, gaining experience in the severest school, with their lives and the honour of the flag at stake. When these men return at the conclusion of the war, they will be a most formidable barrier to German trade in this country, both because of the invaluable experience gained and by reason of their acquaintance with German methods at close quarters in all their ugliness. The technical Press is in touch with the views of the country, and we hope to see the matter take a more solid form than correspondence.

Union Jack.

We note with pleasure Mr. Marryat's statement in your current issue that the Electrical Contractors' Association has taken action respecting trading with the enemy, but his protest would have had very much greater force if he had given your readers a specific example of the success of its action. "Inquisition" suggests that we should call a meeting of contractors. We are sorry to think a meeting should be required to instil the first principles of patriotism in the ranks of electrical contractors; but if it is necessary, here is a task ready to hand for the E.C.A., and although we are not members, we should be delighted to give the Association all the help in our power.

The E.C.A., moreover, need not confine themselves to the Electrical Co., Ltd.; there is, for example, the Schorch Electrical Co., of Basinghall Street, not a limited company, but an integral part of the German firm. These people, before the war, were busy supplying loom motors, and not only supplied German-made machines, but also imported electrical Huns to wire and fix them. These workmen, together with the general manager, are now interned, but the business is being kept "warm" under the ægis of our benevolent Government.

There are also several firms of contractors and manufacturers with German managers and directors of military age still carrying on business in London. One director, we are informed, actually holds a commission in the German Army.

E. P. Allam & Co.
E. P. ALLAM.

I have delayed replying to the correspondents who have commented on my letter which appeared in the ELECTRICAL REVIEW of October 29th, in the vain hope that there would have been at least a small percentage of the 3,000/5,000 contractors in the Kingdom who would have taken up their own cudgels.

As it is, only one firm has been good enough to show its colours, but I do not forget that several—quite six—have previously written you in the same proper spirit.

I do not retract one single word of what I have written; on the contrary, I have still more reason for knowing that what I have written is fact.

You, Sir, have taken my remarks regarding the technical Press in too personal a manner, although I am glad it has given you the opportunity of such an honest disclaimer. But the fault I find is that you do not as a rule hit out strongly enough. You might remember that it is of very little use to handle such a subject as the one I am trying to arouse interest in, with too much delicacy. At times it is expedient to talk to the gentlemen of Billingsgate in their own language. But I am glad to read how you are improving.

I am glad to see the chivalrous letter of Messrs. Allam & Co. They cannot think that the average contractor is unlike themselves. This thought does them credit, and I would that it were so. I do not deny that there are many firms and individuals like Messrs. Allam, but, in the aggregate, they form but a small proportion of the whole. The very existence at the present time of concerns like the Electrical Co., who live on factoring goods to contractors, is a proof, *ipso facto*, that contractors are behaving unpatriotically by supporting such concerns. Any profits that such merchant factors make must be at the expense of the fools, or worse, who deal with them. "They toil not, neither do they spin," but batten on the ignorance or cupidity of their customers. Only two or three firms of contractors have, so far, had the courage or decency to write and disclaim any trading with such concerns. I have failed to notice the name of Mr. Marryat's firm.

It may be taken, therefore, in this case of trading with these fine old British concerns, that "He who is not for us is against us."

Quite apart from the above obvious and logical arguments, and in spite of Mr. Marryat's bluff and mock heroics, it is notorious that the majority in number of electrical contractors in this country are men of very small means, who have no backbone, either in regard to finance, business methods, or chivalry in their trade rivalry. Many of these persons who have barely made a living in the past by buying and selling the cheapest kind of German rubbish, are supporting concerns like the one in question, because they find it of advantage to do so, having in mind past favours and the hope of future ones.

Mr. Marryat admits that trading with the enemy has received drastic treatment at various meetings of the E.C.A. Surely no greater proof of my contention could be produced. It must be borne in mind that the E.C.A. controls only a minority of the contractors of Great Britain. Can Mr. Marryat assure you that the Council of the E.C.A. have taken any definite steps to dissuade the members from trading with such concerns?

The correspondence in your columns this week (November 12th) is very instructive. It would appear therefrom that despite the 10 years' membership of Mr. Marryat on the Council of the E.C.A., the position of the average electrical contractor, in regard to this matter, is somewhat worse that it was, say, 10 years ago. As the advertisements say: "They (the Council) want more Bovril."

Now, Sir, there is a very simple and inexpensive means of proving or disproving the truth of what I have written. There are some 3,000 to 5,000 electrical contractors in Great Britain. It would be an easy matter to put the question before each one in a straightforward manner, and in such a way that there could be no question as to the issue and no hesitation needed as to a plain and honest "yes" or "no" answer.

A circular letter could be sent to each, and the reply (postcard or letter) sent to you with the understanding that the name of the contractor, if desired, should not be divulged. Such a plebiscite would cost for postage and printing some £15 to £20. I am willing to make myself responsible for addressing the envelopes, and will also contribute 10 per cent. of the cost of the postage and printing. No doubt nine other public-spirited men will quickly volunteer, Mr. Marryat being number one. Twenty-one clear days after the last of the list has been sent out, the number of answers received, with the proportion to those sent out, to be published in the next issue of the REVIEW. I shall be delighted to find I must eat the leek, but I have no fear.

As to the personal element—I always try to avoid this if possible, and am sorry Mr. Marryat has introduced it. I do not think it affects this subject in the least, but for Mr. Marryat's information I may say that reasons of a very personal nature prevent me at the moment from disclosing my identity. I am not attempting to sling mud; I am writing very seriously on a subject about which I feel very deeply, and I have nothing to gain directly or indirectly if the contractors of this country do or do not take up the matter in a serious manner. Moreover, I am writing with a little more than average knowledge of the subject.

November 15th, 1915. **Anti-Humbug.**

Noisy Motor-Generator.

In reply to "Troubled" on the above subject in your issue of 12th inst., I had an exactly similar case to deal with about 15 months ago, the only difference being oil-ring bearings instead of ball-bearings.

When the set was tested at the manufacturer's works, the supply was obtained from a polyphase motor-alternator, the motor-generator under these conditions running very smoothly; the set was again tested on site under actual working conditions (supplying D.C. to cinematograph arc), but to our surprise the surging noise which "Troubled" complains of was very noticeable.

After further investigation, it was discovered that the singing was due entirely to electrical causes—the source of supply. In this part of the city the single-phase current was supplied from a reciprocating set, as in most cases of S.P., where the plant was put down in the early days.

The magnetic field of the S.P. motor being an oscillating one against a rotating field in the case of the polyphase motor, the reciprocating motion of the engine is superposed on this oscillating field, giving rise to the surging phenomena, the resultant period of the superposed oscillation synchronising with the natural period of vibration of the revolving parts.

It was found that this trouble only occurred at the high speed, 1,500-1,400 R.P.M. The noise being objectionable, it was decided to put in a six-pole set, giving a synchronous speed of 1,000 R.P.M.

When this set was tested on site, the trouble had entirely disappeared.

D. D. Rayner.

Wolverhampton, *November 15th*, 1915.

[Other letters have been forwarded to our correspondent.—Eds. Elec. Rev.]

Economising on Audits.

At the present time, when we are being instructed to economise in all ways possible, and when legislation can be put through at lightning speed, it seems to me that it would be an opportune time for our Legislature to pass a small Act accepting the audit of a firm of recognised chartered accountants for the accounts of electric supply companies, so as to avoid duplicate auditing, as at present. To many of us the present arrangement seems a farce, and this would certainly be a method of economising without sacrificing efficiency.

Is this matter too commercial for the Institution to deal with or can we look to it to give us a lead?

Urban Electric Supply Co., Ltd.
J. E. Edmundson, *Resident Engineer.*

BUSINESS NOTES.

Bankruptcy Proceedings.—A. F. Hawdon, electrical engineer, Gosforth.—A first dividend of 2s. 6d. in the £ is payable November 22nd, at the Official Receiver's office, 30, Mosley Street, Newcastle-on-Tyne.

J. Wright Dewhurst, electrical engineer, 52, North End Road, Fulham.—The creditors met on Monday, at the London Bankruptcy Court, when a statement was submitted showing debts £152, against assets valued at £24, and Mr. E. Leadam Hough, Senior Official Receiver, reported that the business was commenced by the debtor's father some 15 or 16 years ago, and was taken over by the debtor in August, 1912. He purchased the stock and tools for £38, and carried on the business until October 30th last, when he closed it in consequence of the war. The receiving order was made on the petition of the Sloan Electrical Co., Ltd. In the absence of any proposal the case was left in the hands of the Official Receiver to be wound up in bankruptcy. The following are the principal unsecured creditors, viz.:—

Cockerell Bros.	£20
Harris, B.	83
Langdon-Davies Motor Co.	22
Sloan Electrical Co., Ltd.	51

Tom Arthur Flather, electrical engineers, Leeds.—First and final dividend of 4s. 6d., payable November 24th, at the Official Receiver's office, 24, Bond Street, Leeds.

For Sale.—The borough electrical engineer of St. Helens has for disposal one Babcock & Wilcox water-tube boiler, with superheater and underfeed mechanical stoker; the Urban District Council of Denton has a Mather & Platt turbine pump and 6½ B.H.P. motor, with switchgear and self-starter, for sale. Particulars are given in our advertisement pages.

Board of Trade Inquiries.—Australia.—The representative of a firm of machinery importers and agents in Melbourne, at present in the U.K. who brings a letter of introduction from H.M. Trade Commissioner, Australia (Mr. G. T. Milne), is desirous of making arrangements for the representation in Australia of United Kingdom manufacturers of electrical and other machinery. The name, &c., of the firm can be ascertained on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

Liquidation.—Central Wireless Co., Ltd.—A meeting is to be held on December 13th, at 45, Newhall Street, Birmingham, to hear an account of the winding up from the liquidator, Mr. R. B. Earle.

Catalogues and Lists, &c.—The Park Royal Engineering Works, Ltd., of Cumberland Avenue, Park Royal, N.W., have sent us a note pad, with fitting for attachment to the telephone; also a spare refill pad. Friends and customers of the firm can have similar pads by making application to the above address.

Messrs. Dick, Kerr & Co., Ltd., Abchurch Yard, Cannon Street, London, E.C.—Eight-page price list of Britannia metallic-filament lamps. We have also received samples of the Britannia lamp shades that have been issued for use while lighting restrictions are in force. Such shades, which bear an appropriate Britannia design let in in white on a black background, can be obtained on application. The inner side is white, so that the shade is a reflector also.

Messrs. Landis & Gyr, Elgee Works, Stonebridge Park, Willesden, N.W.—Circular of standard scales for wattmeters.

Messrs. Gillespie & Beales, Amberley House, Norfolk Street, W.C.—Illustrated list, showing the "Nilfisk" electric suction cleaners in two types. One of these, type B, is a new model which the firm have recently placed on the market to meet the demands for a cleaner at a medium price, between that of the Broomstick class of cleaner and the largest types.

Messrs. Ferranti, Ltd., Central House, Kingsway, London, W.C.—Twelve-page attractive pamphlet, entitled: "The House Beautiful," and containing illustrations showing the convenient application of Ferranti electric fires in the various parts of the modernly appointed household. Prices are shown. The pamphlet is for circulation among consumers.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—New price list of Osram drawn-wire lamps of standard type, round bulb, spiral-filament type, and Axial type. Also a small folder giving price information regarding the lamps. Both of these lists are supplied over-printed to electrical contractors, dealers, and ironmongers.

We have received from the County of London Electric Supply Co., Ltd., a specimen copy of the illustration which has been designed for use in their electric heating circular announcing the terms on which they hire-out electric fires. It is of quite topical interest, and is certainly a credit both to the artist and to the company.

Book Notices.—"Electric Arc Phenomena." By E. Rasch. Translated by K. Thornberg. London: Constable & Co. Price 8s. 6d. net.

"Handbook of Technical Instruction for Wireless Telegraphists." By J. C. Hawkhead and H. M. Dowsett. London: The Wireless Press, Ltd. Price 3s. 6d. net.

"Scientific Papers of the Bureau of Standards." No. 257. "Note on the Resistance of Radiotelegraphic Antennas." Washington: Government Printing Office.

LIGHTING AND POWER NOTES.

Australia.—The North Sydney (N.S.W.) Council has been informed by the general manager of the city electric light department that the submarine cable ordered in England for the supply of electricity to North Sydney would not be ready for the final tests until early in November, and he was afraid the supply would not be available until February next. An overhead transmission to North Sydney, crossing the Parramatta River, was also being provided, but would not be ready till February.

Additional generating plant has recently been installed at the Ipswich shops of the Queensland railways department, consisting of a 1,000-KW. Willans-Siemens turbo-alternator with condensing plant. The turbine is of the mixed-pressure type, of disk and drum construction, and runs at 3,600 R.P.M.; the alternator supplies two-phase current.

The power house at the new Federal capital, Canberra, has now been equipped, the plant including four Babcock boilers, with chain grates, economisers, and induced-draught plant, &c., supplying steam to two 600-KW. Belliss-Brush generating sets and one 150-KW. Robey-Hall set, with condensing plant, switchgear, and transformers.

The South Brisbane (Queensland) Council has agreed to support the application of the City E.L. Co. for electric lighting powers in the city.—*Commonwealth Engineer.*

Aylesbury.—The U.D.C. has accepted the offer of Lloyds Bank, Ltd., to renew the E.L. loan of £21.233 for another year, the rate of interest to be 5 per cent. for the first three months, and to be reconsidered after that period in view of any rise in the bank rate.

Beckenham.—The U.D.C. has decided to grant a free supply of current to the war hospital supply depôt.

Bradford-on-Avon.—Under the Special Acts (Extension of Time) Act, 1915, the B. of T. has extended the time for making the transfer of the Bradford-on-Avon electric lighting order, 1914, for one year from January 30th, 1916.

Broadstairs.—Price Increase.—The U.D.C. has agreed to pay for a period not exceeding 12 months the increase of 10 per cent. charged for current supplied by the Isle of Thanet Tramway and E.L. Co. A similar advance has been made in the case of private consumers.

Canterbury.—Street Lighting.—Owing to restricted lighting during the past half-year there has been a saving of £578 on the cost of public lighting by electricity. If the restrictions remain in force until March next, the saving for the present half-year will be over £700.

Continental.—Holland.—The Special Commission which was appointed some three years ago to investigate the question of the national supply and use of electric current has concluded its labours. The consumption of current for lighting purposes in the next five years for the whole country is expected to be 84,787,000 KW.-hours per year. The annual consumption of current by the large industries is calculated to amount to 170,850,000 KW.-hours and by the small industries to 12,151,000 KW.-hours. The current needed for agricultural purposes is estimated at 5,660,000 KW.-hours, but a larger amount is considered necessary for the pumps, sluices, &c., peculiar to Holland. The power furnished by windmills, steam engines, motors and various electric stations, requires to be augmented, the first-named by 6,700 KW., and the steam engines, &c., by 18,740 KW. These figures will be largely increased if the work of draining the Zuyder Zee is carried out, in respect of which about 54,000,000 KW.-hours would be required. Electric current is now employed in the working of the Hague to Rotterdam Railway and for eight tramways, but some half-dozen other lines are to be electrified which are now worked by steam power.—*Industria e Invenciones.*

Italy.—The Società Elettrica Calabra Tirrena has been formed at Paola, with a capital of 150,000 lire, for the distribution of electric energy for lighting, power and other purposes.

Darlington.—Loan Application.—The T.C. has decided to make application to the L.G.B. for sanction to the borrowing of £15,600 for generating plant, coal-handling plant, cables and switchgear.

The Electricity Committee recommends that subject to the engineer's report and the receipt of a certificate from the Minister of Munitions, tenders for the supply of a 3,000-KW. turbo-generator and for the condensing plant be accepted.

It was mentioned that the Committee had entered into an agreement with the North-Eastern Railway Co. to supply a 1,700-KW. demand, and an extra 800 KW. was required for the Government demand; in addition 400 KW. was required for Messrs. Summerson's works. The 3,000-KW. generating set ordered last year would probably not be ready until the end of the year, and it was essential the new set should be ordered at once.—*Darlington Times.*

Dodworth.—Prov. Order.—Subject to certain alterations, the application of the Electrical Distribution of Yorkshire for a prov. order is to be supported by the U.D.C.

Durham.—Sanatorium Lighting.—The C.C. has decided to proceed with the electrical installation at the extensions at Hollywood Hall Sanatorium, at an estimated cost of £820.

Edinburgh.—New Power Station.—The Corporation Electric Lighting Committee has agreed to recommend the acceptance of estimates for the sea-water plant of the Portobello electric power station. The amount involved is between £24,000 and £25,000.

Farsley.—The Council has given its consent to the Leeds Corporation providing a bulk supply of electrical energy to Cape Mills, in view of the fact that the premises are partly in Leeds and partly in Farsley, but this concession is without prejudice to the electric lighting powers obtained by the Farsley Council and leased to the Electrical Distribution of Yorkshire, Ltd.

Farnham.—The U.D.C. has decided, in view of the failure of the Farnham Gas and Electricity Co. to supply electrical energy within Hale Ward, that the Hale Lighting Committee be authorised to expend a sum not exceeding £50 in obtaining such technical and legal advice as will enable it to report upon the advisability of powers being sought by the Council to supply energy within the district.

Gravesend.—The T.C. has deferred a suggestion by the engineer that sanction to loans of £1,500 and £1,000 for mains extensions and house services respectively should be applied for. A proposal to supply free current for the X-ray apparatus at the V.A.D. Hospital, provided the cost of the cable is met, has been referred back to the Committee, there being a feeling that, as the cable would cost £75, and as the installation cost has been met by public subscription, the hospital should not be burdened with the cost of the cable.

Greenock.—The Director of Munitions in Scotland has taken up the question of water shortage at the electricity works with the Water Committee, pointing out that certain firms were willing to allow their water to be diverted to the electricity works conditionally on the Committee granting them privileges in the use of metered water. The Committee, after discussion, decided to express no opinion on the matter.

Huddersfield.—Year's Progress.—A report relating to the electricity department of the Corporation during the past year shows that some extensive additions were made to the plant. A new 4,000-KW. turbo-alternator was started last June, and lately the first of the new boilers has been started; new overhead coal bunkers and elevating plant are also being erected. There have been 2,446 H.P. of three-phase motors connected to the mains, bringing the total to 8.706 H.P.; 118 H.P. of additional motors have been added to the single-phase system, bringing the total to 2,628 H.P. These two systems gave a total of 11,334 H.P. of motors. In regard to lamps, the connections during the year equalled 20,368 lamps of 8 C.P., bringing the total of lamps connected to the mains to 292,159. The motors connected during the year are about double the power of those connected in any previous year, and there are applications at present in hand representing a further addition of 3,000 H.P. Extensions of mains have been made to Milnsbridge. Mention is made of the difficulties which have had to be met in regard to the supply and price of coal, and these have been met, in part, by an increase of the charges to consumers. The demand upon the works for electrical energy is so great that it is almost certain that some steps will have to be taken to further increase the generating plant so as to provide the necessary output of energy.

Hindley.—The U.D.C. has intimated its willingness to allow the Wigan Corporation to supply electricity to Mersrs. E. Whalley & Co., on the understanding that the Council will undertake the supply when in a position to do so.

Holme.—E.L. Scheme Inaugurated.—The Holme U.D.C. controls one of the smallest urban areas in England, including in its district only 400 inhabitants and 90 houses, the ratable value of the place being £1,660. The villagers have promoted a private company of over 100 subscribers—the largest of which holds £18 worth of shares—with a total capital of £800. They have secured an old mill in the village, and themselves have transformed it into a power station. The electricity scheme has cost £750, and has been carried out by Messrs. J. W. and R. Graham, of Huddersfield, and the opening ceremony took place last Saturday, when Mrs. Mary Howard, aged 89, and the oldest inhabitant of the village, officiated in the chief capacity. Already 56 houses are taking electric current, and there are, in addition, 20 street lamps lighted by electricity.

Leeds.—At the last meeting of the Hunslet B. of G. approval was given to a recommendation of a Special Committee that new and adequate machinery should be provided in the Board's bootmaking and repairing department, and that it should be driven by electric power.

London.—Hackney.—The Finance Committee of the B.C. has decided to amend its application to the L.C.C. for sanction to borrow £2,950, estimated expenditure on house services to March 31st last. The actual expenditure for this period has now been ascertained at £3,031, and it is necessary that the proposed loan should cover the latter sum. The Establishment Committee has recommended the B.C. to make an addition of 2s. per week to the ordinary pay of all workmen on the weekly pay roll of the electricity and refuse destructor undertakings, such increase to be regarded as a bonus dependent on abnormal conditions.

Shoreditch.—The B.C. has received the L.C.C.'s sanction to borrow £1,500 for the purposes of the electricity undertaking.

Price Increase.—The South London Electric Supply Corporation will advance its charges for electricity by 9 per cent. from the first quarter of 1916.

Malvern.—The U,D.C. has decided with regard to current supplied to theatres and cinema shows, that provided electricity for the cinema machine is taken off the lighting supply, a discount of 1½d. per unit shall be allowed if the account is paid within 28 days from the date of demand. A similar discount affects current used for stage lighting.

Nuneaton.—Wiring Scheme.—The Electricity Committee of the T.C. has had under consideration details of a scheme to introduce electric light in new property which would not, in the ordinary way, have the light, and the engineer was authorised to carry out installations in six or eight houses through a contractor. The charge to a consumer through a prepayment meter will be fixed, for the present, at 5½d. per unit, the ordinary rate to come into force when the cost of the installation has been repaid.

Sandgate.—Public Lighting.—The Folkestone E.L. Co. has informed the U.D.C. that it cannot allow any further rebate than at the rate of £210 per annum during the total time of extinction of public lighting.

Swinton and Pendlebury.—Bulk Supply.—The U.D.C. has agreed to take steps to extend the present agreement with the Lancashire Electric Power Co., under which electricity is supplied in bulk.

Tunbridge Wells.—Public Lighting.—The T.C. has agreed, owing to restricted lighting, that the cost of street lighting by electricity from May 17th, 1914, to May 31st last, shall be reduced by £1,697. The Council has agreed to the electrical engineer acting as hon. secretary to the local Munitions Committee.

West Bromwich.—Proposed Loan.—The Electricity Committee has decided that application be made to the L.G.B. for sanction to the borrowing of £8,850 for generating plant, owing to the increased demand for power.

The sales of current for the quarter ended September 30th amounted to £5,876, an increase of £1,360, as compared with the corresponding period of last year.

Warminster.—The B. of T. has extended the time for making the transfer of the Warminster electric lighting order, 1914, for one year from January 30th, 1916, under the Special Acts (Extension of Time) Act, 1915.

Wigan.—During the election of Corporation Committees for the ensuing year, Councillor Roscoe expressed the view that it was inadvisable that members of the Gas Committee should serve also on the Electric Light Committee, his reason being that these committees were competitive. Other members expressed disagreement with this view, declaring that the committees were in friendly rivalry, and that it was advantageous that members should be on both committees, because they were then able to compare notes and agree upon questions of policy. The matter was allowed to drop.

Yorkshire.—E.L. Orders.—The Otley U.D.C. has decided to support the application of the Electrical Distribution of Yorkshire, Ltd., for a provisional order for the district; the Sharleston P.C. is holding a special meeting to discuss a similar proposal; while the Penistone U.D.C. desires the insertion of a purchase clause in its case.

TRAMWAY and RAILWAY NOTES.

Ashton.—Tramway Wages.—The Tramways Committee, along with the Stalybridge Joint Tramways Board and the Oldham, Ashton & Hyde Electric Tramways Co., recently made an offer of a ½d. per hour advance in the wages of the tramway men, but this has not been accepted, and the Committee has agreed to the matter being submitted to the Committee on Production.

Birmingham.—Tramway Accident.—On Friday, last week, a workmen's car on the Lozells and Gravelly Hill route overturned, causing the immediate death of one passenger and injuries to 30 others, of whom 11 are seriously injured. Owing to the greasy condition of the rails, following rain, the brakes did not act while the car was going down a hill, and it subsequently crashed into a tramway standard and turned over on its side.

Emergency Traffic Staff.—The volunteer motormen who offered their services to the tramway department, to take the place of those men who have joined the Forces, are receiving training, and it is expected that some of the most proficient will be given charge of cars on the various routes of the city during the next few weeks. About 600 applications have been received, and about 10 per cent. have been dealt with up to the present. The 350 lady conductors of cars are giving every satisfaction, and another 200 are training for similar positions.

Bury.—The storm on Friday last caused damage to the wires on the L. & Y. electric railway between Bury and Holcombe Brook, and on Saturday the trains on the branch were run by steam.

Continental.—Spain.—The inauguration of the electric tramways at Las Palmas on the island of Majorca will probably take place in March next. The date of the inauguration has had to be retarded somewhat on account of the war, as the plant has only been obtained with difficulty.

Portugal.—Railway Conversion.—It is proposed to transform to electric traction the line between Lisbon and Cascaes belonging to the Royal Portuguese Railway Co., a work which has been sanctioned by the Government. The company at first proposed to carry out the work on its own account, but after examination it was decided to throw open to competition the construction of the section and its working on lease. The only practical offer was received from the Estoril Construction Co., which undertook to proceed with the conversion on its own account, on condition that the section was leased to it for 50 years. As rental the sum of 75 contos (£16,800) is to be paid for the first year of working, which represents the maximum net receipts hitherto obtained on this line in any year, and the rental will increase to 80 contos in the succeeding four years, whilst the Portuguese Railway Co. will also participate to the extent of 10 per cent. of the gross receipts in future years.

France.—The *Industrie Electrique* learns that the Orleans, Toulouse, Lyons Railway Co., which had equipped two suburban lines at Lyons with an alternating high-pressure equipment, being the first to make the experiment, has decided to abandon this system and to return to the D.C. system. One of the two lines, the Miribel to Lyons, has already been converted. The newly equipped line receives current at both ends, being supplied by a provisional sub-station at Miribel, pending the installation of a battery with which each end will be finally equipped. The other line, that between Lyons, Meyzieu, Pont de Cheruy and Cremieu, will probably be shortly fitted with similar equipment.

Italy.—Representations have been made to the Italian State Railway Administration by the railway section of the "Pro Turin" Association, urging the completion and extension of electrification on the Piedmontese railway network, and in particular, the early completion of the electrification of the line Turin to Bussoleno is called for, with the laying of a second track in view of the saving of time and expense; also the supply of electric current for the working of the completed section to Modane of the Mount Cenis Railway, and the discontinuance of steam working on the Bardonecchia to Modane section, in the interest of this already installed electric plant. The absence of the co-operation of the engineers of the Paris, Lyons, and Mediterranean Railway is recognised to be a cause of the delay, but the Association seems to think the Italian Railway Administration should proceed, with or without their co-operation, in the interest of the future trade prospects of these regions. The Association also urges action with regard to the line Turin-Pinerolo-Torre Pellice. Either the Administration should take over this line, or give help to the company owning it to complete its conversion to electric working. The Association finds it absurd that on the flat section of this line, from Turin to Pinerolo, electric working has been initiated, whereas steam working is still retained on the other section of Torre Pellice, which is of a mountainous character.

Application has been made for a concession for an electric tramway from Biella to Pollone, a distance of 7·238 km. It is proposed to work the line by continuous current at 750 volts. The estimated cost of the undertaking is put at 572,000 lire. The company working the existing Biella-Oropa tramway will take over its working.

The Società Anonima Orobia, of Lecco, has applied for a concession to construct and work five lines of electric tramways in the city of Lecco and suburbs, of a total length of 7,070 metres. The gauge of the line will be one metre. It is proposed to use continuous current at 1,000 volts pressure, transformed from three-phase current at 40 cycles and 3,300 volts, derived in part from the Orobia's own station and partly from certain supply companies. The equipment of the transformer sub-station will consist of two 300-H.P. motor-generators.

Progress is being made with the construction of the electric railway connecting Turin with Lanzo. Extensive construction works have been required, five tunnels being built, of which four are already finished. Six bridges have had also to be built over the Tesso and the Stura. Further, a 16-arched viaduct and a 200-metre viaduct from Procaria to Ceres, are included in the scheduled works. The last-named is the only undertaking which has not yet been taken in hand.

Glasgow.—Six women tramway drivers have been undergoing training, and last week had a preliminary two days' trial on the street traffic, accompanied in each case by a skilled motorman.

Halifax. — Tramway Extensions. — The T.C. has applied to the B. of T. for an extension of time for the completion of tramways in the borough, Queensbury, Shelf and Brighouse until August 18th, 1917.

Huddersfield.—Tramway Statistics.—Some interesting figures are contained in a report on the working of the Corporation tramways during the year ended September 30th. The total receipts were £124,387 (an increase of £14,630, as compared with the previous year), and included £122,333 receipts from passengers; £1,176 from parcels; and £778 from coal haulage. There was an increase of 140,627 in the car-mileage run, the figure being 2,586,213 car miles (including coal trucks), and the number of passengers carried (23,429,259) represented an increase of 2,253,813 on the figures of a year ago. At present there are 106 cars and two electrically equipped coal trucks in the rolling stock; the total mileage of the tramways is 34.

Hyde.—The Council is to ascertain from the Manchester Corporation on what terms it would provide a through service of cars to Hyde Town Hall; to ask the Stalybridge, Hyde, Mossley and Dukinfield Tramway and Electricity Board to submit any proposals it may have to make as to the user of tramways in Hyde and the terms and conditions of such user; and to ascertain what suggestions the Joint Board has to make with respect to the use of the tramways within the borough.

London.—Women conductors were employed for the first time on the London United Tramways last week; they are to be paid 4s. 6d. a day for a six-day week, with a war bonus of 2s. 6d., making 29s. 6d. a week.

According to the *Times*, there was a shortage of tramway cars in the metropolitan area on Monday, due to the number of drivers and conductors who left the South London depôts to enlist in the Army.

Lowestoft.—Women Conductors.—The employment of female conductors on the tramcars has been sanctioned by the T.C. Four of the employés who have been at the Front have been wounded, one three times.

New Zealand.—According to the *Commonwealth Engineer*, it is now proposed to duplicate the mile and a-half tunnel between Christchurch and Lyttelton, at a cost of £125,000, which would result in the abandonment of the proposed electrification of this line.

Good results have been obtained with a trial petrol-electric coach on a Wellington suburban line, and an endeavour is being made to obtain a sufficiently powerful petrol-electric car, for 3 ft. 6 in. gauge, to draw two large passenger cars up the North Island suburban gradients.

Electric train lighting installations are to be fitted on local stock for trial purposes, with a view to their future use instead of gas on the principal express trains.

Rochdale.—The T.C. has approved the recommendations of the Tramways Committee that the wages of the tramway employés be increased, as mentioned last week.

Wharfedale.—RAILLESS TRACTION.—Friction seems to have arisen between the Burley-in-Wharfedale District Council and the Leeds Corporation in regard to the railless trolley system in Wharfedale. According to statements made by members of the Burley Council, it is thought that some injustice is being done to the users of the vehicles by making them pay 3d. to travel from Burley to Guiseley and 4d. to Otley, when the railway fares are, in both cases, only 2½d. The Corporation has intimated that it cannot permit any interference with its policy in regard to fares.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—A concession has been granted to Don Ramon Tarrio Demaria for the establishment and working of a public telephone service in the districts of Bernascom, Villa Alba, and Jacinto Arauz, in the Central Pampa Territory, for a period of 30 years.—*Board of Trade Journal.*

Australia.—A charge against the Amalgamated Wireless (Australian), Ltd., E. T. Fisk, C. P. Bartholomew, and H. R. Denison, of trading with the enemy, was part heard in September, at Sydney. It related to the execution of an indenture of licence by which, it was alleged, the Telefunken Co. would have been placed in a strong position with regard to the patent rights of wireless telegraphy throughout Australasia while the war was in progress.

Hull.—Mr. T. Holme, manager of the Hull Corporation Telephone Department, attended a special meeting of the Telephone Committee on Saturday and applied, on his own behalf and on behalf of all the employés of military age, for permission to enlist. It was stated that if all the eligible men enlisted the system would be brought to a standstill; nevertheless, the desired permission was accorded by the Committee.

Italy. — The Consigliore Superiore dei Telefoni has authorised the acquisition by private tender of the following:—10,037 metres of Patterson telephone cable for the city of Piacenza; 68,292 metres of telephone cable for Bologna, and 60,000 metres of rubber-insulated bronze wire. It has also sanctioned the extension of various telephone networks.

Paraguay.—Asuncion, the capital of Paraguay, has been provided with a wireless station, constituting the second military zone. It was opened to public service at the beginning of October.

Spain.—A concession has been granted to the Mancomunidad de Cataluna (Union of Catalona), to install and work an interurban telephone network in the Province of Catalona. The network reverts to the State in 1957.

Uruguay.—The Government has under consideration a proposal for the erection of a high-power wireless station similar to that projected by the owners of the Poulsen patents in Argentina, and likewise presented by them.—*Review of the River Plate.*

Wireless in Territorial Waters. — At East Ham Police Court, on Saturday, Jakob Veenhoven, 43, a Dutch subject, captain of the s.s. *Roepat*, was charged with using on board his ship wireless telegraphy in territorial waters. The defendant was proceeding from the Dutch East Indies with a general cargo to London. The ship had called at Deal and was going round the North Foreland, up the mouth of the Thames, on November 5th. On that morning a naval officer, stationed at Ramsgate, heard the s s. *Roepat* calling on her wireless Scheveningen, from 8 o'clock until 8.35, when a message was sent in Dutch. There was no evidence that it was anything but a perfectly innocent message. The calls were very loud, and were interfering with Admiralty wireless communications.

The Court imposed the maximum penalty of £10, and allowed £2 2s. costs.—*Times.*

Wireless on Board Ship.—The value of wireless telegraphy to ships is well exemplified in the report of the U.S. Bureau of Navigation for the fiscal year 1915, which shows that 26 vessels leaving American ports met with accidents requiring the use of wireless telegraphy to call assistance. Except in the case of the *Lusitania*, which was torpedoed, the assistance thus rendered resulted in but two lives being lost. Since the period covered by the report the steamship *Sant' Anna*, carrying 1,700 souls, caught fire at sea, but all were saved, and the *Athinai* was entirely destroyed by fire, the passengers and crew, numbering 470, being rescued, in both cases through wireless calls.—*T. and T. Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—November 25th. G.N. of Scotland Railway Co. Six or twelve months' supply of telegraph material. Forms of tender from the Stores Superintendent, 80, Guildford Street.

Athy.—December 6th. U.D.C. Tenders are invited for lighting the town with electricity. Particulars from Mr. J. A. Lawler, Town Clerk.

Australia. — December 7th. P.M.G.'s Department (various States). Non-encrusting zincs, carbon and manganese powder, manganese chloride, chloride of ammonia, porous pots (2 in.), outer jars for cells, carbon blocks, resistance boxes of 5,000 ohms, &c. See "Official Notices" October 15th.

December 20th. P.M.G.'s Department, N.S.W. 4,250 telephones (Schedule 454).*

January 5th, 1916. P.M.G.'s Department, Queensland. Copper wire and accessories (Schedule 356). January 26th.—Telephone instruments (Schedule 344).

January 19th, 1916. P.M.G.'s Department, S. Australia. One common multiple switchboard, Telephone Exchange, Adelaide (Schedule 405).

ADELAIDE.—January 19th. P.M.G. Common-battery switchboard. See "Official Notices" to-day.*

January 26th. Deputy P.M.G. Twenty tons of galvanised-iron wire, 400 lb. to the mile.*

BRISBANE. — P.M.G. January 26th. — Galvanised-iron wire. December 1st.—Measuring instruments. January 5th.—Jointing sleeves and copper-clad steel wire. See "Official Notices" to-day.

January 26th. Deputy P.M.G. Telephone instruments, parts and accessories.*

GOULBURN. — December 15th. Council. One 200-KW. direct-coupled generating set, gas or steam driven. Specification, 10s., from the Local Government Association, 103-4, Queen Victoria Markets, Sydney, or the Town Clerk.

SYDNEY.—December 6th. Municipal Council. 33,000-volt outdoor transformers and switchgear. Specifications (10s. 6d.) from Electric Light Department, Town Hall.

December 20th. Metropolitan Board of Water Supply and Sewerage. Three centrifugal pumps and electric motors, each to pump 6,300 gallons per minute, and one to pump 15,100 gallons per minute, together with switchboards, starters, &c., for the pumping station at Marrickville, N.S.W. Deposit £10. Tenders to the Board, at 341, Pitt Street, Sydney, N.S.W.*

January 12th, 1916. N.S.W. Railway and Tramway Department. Two water-tube boilers, &c., for the Zara Street power house, Newcastle. See issue of October 8th for further particulars.

January 31st, 1916. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

MELBOURNE.—December 14th. Deputy P.M.G. Eleven sections of a lamp-signalling trunk-line switchboard, and other material necessary for increasing the equipment of Melbourne Trunk Exchange from 108 to 240 lines. Schedule 1,207.*

January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

PERTH.—December 8th. 294 accumulators, and power board complete, for P.M.G.'s Dept. See "Official Notices" October 8th.

Canada. — November 23rd. Dominion Government Department of Naval Service, Ottawa. Electric cable and wire for H M. Canadian dockyards.*

Chatham. — November 24th. T.C. Twelve months' supply of incandescent electric lamps. Specifications from the Borough Surveyor's office, Town Hall.

Enniskillen. — December 1st. Sligo, Leitrim and Northern Counties Railway Co. Twelve months' supply of telegraph materials. Forms of tender from Mr. J. Duff, Secretary's office.

Ilford. — November 23rd. U.D.C. Triple-concentric cable and boxes. See "Official Notices" to-day.

Manchester.—November 23rd. Tramways Committee. Hard-drawn copper trolley wire. Mr. J. M. McElroy, General Manager.

Salford.—November 29th. Manganese steel crossings for the Tramway Department. General Manager, 32, Blackfriars Street.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Aylesbury. — The U.D.C. has decided to accept the tender of Messrs. Johnson & Phillips, Ltd., for a cable for Bicester Road, at £384.

Broadstairs.—Mr. Vernon Hill, Broadstairs, has secured the contract for the electric light installation at the new Christ Church now being erected.

Glasgow.—The Cleansing Committee recommends the acceptance of the offer of Messrs. Woodward & Co. for the supply of carbons, &c., from December to May next.

Great Yarmouth.—The T.C. has accepted the tender of Messrs. Cleeves & Co., London, for 9,000 tons of slack coal and 500 tons of hard steam coal for the electricity works.

London.—The Education Committee has received the following tenders for installing electric light in the Thornfield Road School, Hammersmith :—

James Whitaker & Sons	£421
A. Hawkins & Sons	429
G. Weston & Sons, Ltd.	483

The Committee proposes to accept the first-mentioned tender.

Metropolitan Water Board.—The tender of Simplex Conduits, Ltd., has been accepted, at £53, for electric fittings in connection with the installation of the electric light at the Central Buildings, Battersea ; also the tender of the New Phonopore Telephone Co., Ltd., at £168, to supply brass receiver cases with diaphragms, spacing rings, and ebonite ear-pieces.

New Zealand.—The Public Service Stores Department, Wellington, has received tenders for the following supplies :—

20 miles of paper-insulated, lead-covered telephone cable, 26 pairs.—**Turnbull & Jones, Ltd.** (accepted), £2,960 ; Tolley & Son, Ltd., £3,000 ; A. D. Riley & Co., Ltd., £3,020 ; P. R. Baillie & Co., £3,055 ; Richardson, McCabe & Co., Ltd., £3,080 ; Lawrence & Hanson Electric Co., £3,140.

3 miles of paper-insulated, lead-covered telephone cable, 39 pairs.—**Turnbull & Jones, Ltd.** (accepted), £576 ; Tolley & Son, Ltd., £591 ; A. D. Riley & Co., Ltd., £591 ; Richardson, McCabe & Co., Ltd., £591 ; P. R. Baillie & Co., £591 15s. ; Lawrence & Hanson Electric Co., £630.

13 miles of paper-insulated, lead-covered telephone cable, 52 pairs.—**Richardson, McCabe & Co., Ltd.** (accepted), £4,410 ; Turnbull and Jones, Ltd., £4,374 ; Tolley & Son, Ltd., £4,428 ; A. D. Riley & Co., Ltd., £4,446 ; P. R. Baillie & Co., £4,509 ; Lawrence & Hanson Electric Co., £4,572.

8 miles of paper-insulated, lead-covered telephone cable, 78 pairs.—**Turnbull & Jones, Ltd.** (accepted), £1,020 ; Tolley & Son, Ltd., £1,035 ; A. D. Riley & Co., Ltd., £1,041 ; P. R. Baillie & Co., £1,053 ; Richardson, McCabe & Co., Ltd., £1,071 ; Lawrence & Hanson Electric Co., £1,104.

13 miles of paper-insulated, lead-covered telephone cable, 104 pairs.—**Richardson, McCabe & Co., Ltd.** (accepted), £5,408 ; A. D. Riley and Co., Ltd., £5,473 ; Tolley & Son, Ltd., £5,486 ; P. R. Baillie & Co., £5,582 ; Turnbull & Jones, Ltd., £5,616 ; Lawrence & Hanson Electric Co., £5,850.

1 mile of paper-insulated, lead-covered, armoured telephone cable.—**Richardson, McCabe & Co., Ltd.** (accepted), £182 ; Tolley & Son, Ltd., £185 ; Turnbull & Jones, Ltd., £187 ; A. D. Riley & Co., Ltd., £188 ; Lawrence & Hanson Electric Co., £188 ; P. R. Baillie & Co., £189.

15 miles of paper-insulated, lead-covered, armoured telephone cable, 26 pairs.—**A. D. Riley & Co., Ltd.** (accepted), £3,675 ; Tolley & Son, Ltd., £3,645 ; P. R. Baillie & Co., £3,719 5s. ; Richardson, McCabe & Co., Ltd., £3,720 ; Lawrence & Hanson Electric Co., £3,735 ; Turnbull and Jones, Ltd., £3,825.

11 miles of paper-insulated, lead-covered, armoured telephone cable, 52 pairs.—**Lawrence & Hanson Electric Co.** (accepted), £3,982 ; Tolley and Son, Ltd., £4,037 ; A. D. Riley & Co., Ltd., £4,037 ; Turnbull and Jones, Ltd., £4,092 ; P. R. Baillie & Co., £4,113 9s. ; Richardson, McCabe & Co., Ltd., £4,180.

1 mile of paper-insulated, lead-covered, armoured telephone cable, 78 pairs.—**Richardson, McCabe & Co., Ltd.** (accepted), £469 ; A. D. Riley & Co., Ltd., £473 ; Tolley & Son, Ltd., £474 ; P. R. Baillie & Co., £484 ; Turnbull & Jones, Ltd., £490 ; Lawrence & Hanson Electric Co., £505.

7 miles of paper-insulated, lead-covered, armoured telephone cable, 104 pairs.—**A. D. Riley & Co., Ltd.** (accepted), £4,333 ; Richardson, McCabe & Co., Ltd., £4,340 ; Tolley & Son, Ltd., £4,340 ; Turnbull and Jones, Ltd., £4,396 ; P. R. Baillie & Co., £4,419 ; Lawrence & Hanson Electric Co., £4,622.

100 miles of insulated, twin-twisted wire.—**Lawrence & Hanson Electric Co.** (accepted), £1,375 ; Richardson, McCabe & Co., Ltd., £1,387 10s. ; Turnbull & Jones, Ltd., £1,500 ; A. & T. Burt., Ltd., £1,585.

New Zealand Shipping and Commerce.

The Wellington City Council has accepted the tender of the National Electric Co. for transformers, and that of Messrs. Richardson, McCabe & Co. for insulated wire.

Sunderland.—The T.C. on the 10th inst. accepted the following tenders :—

Ferranti, Ltd.—Meters.
E. Cleaton, Rees & Co.—Lubricating oil.

FORTHCOMING EVENTS.

University College, London.—Fridays, November 19th and 26th. At 5 p.m. Third and fourth Lectures on "Electric Heating and Electric Furnaces," by Prof. J. A. Fleming, F.R.S.

Institution of Mechanical Engineers.—Friday, November 19th. At 8 p.m. At Storey's Gate, S.W. Papers on "The Chemical and Mechanical Relations of Iron, Molybdenum, and Carbon," by Prof. J. O. Arnold, F.R.S., and Prof. A. A. Read, and "The Cause and Effect of 'Ghost Lines' in Large Steel Forgings," by Prof. J. O. Arnold, F.R.S.

Greenock Electrical Society.—Saturday, November 20th.—Visit to the Glasgow Sewage Works at Shieldhall.

Friday, November 26th. At 7.45 p.m. At Temperance Institute, 19, West Stewart Street. Paper on "Land Diesel Installations," by Mr. J. Richardson.

Post Office Telephone and Telegraph Society.—Monday, November 22nd. At 6.30 p.m. At the I.E.E., Victoria Embankment. Paper on "Telegraph Experiences in India," by Mr. J. J. Tyrrell.

Illuminating Engineering Society.—Tuesday, November 23rd. At 8 p.m. At the Royal Society of Arts, John Street, Adelphi. Discussion on the first Report of the Departmental Committee on Lighting in Factories and Workshops. Opener, Mr. Leon Gaster.

Royal Society of Arts.—Wednesday, November 24th. At 4 30 p.m. At John Street, Adelphi. Paper on "Constantinople, Ancient and Modern," by Sir Edwin Pears.

Institution of Electrical Engineers.—Thursday, November 25th. At 8 pm. At Victoria Embankment, W.C. Paper on "Some Difficulties of Design of High Speed Generators," by Prof. A. B. Field.

(Birmingham Local Section).—Wednesday, November 24th. At 7 p.m. At the University, Edmund Street. Paper on "Some Difficulties of Design of High-Speed Generators," by Prof. A. B. Field.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 26th. At 7.30 p.m. At Bolbec Hall, Newcastle. General Meeting.

Manchester Association of Engineers.—Saturday, November 27th. At Grand Hotel, Aytoun Street. Paper on "Design and Application of Ballbearings," by Mr. H. J. Moysey.

NEWS OF PRISONERS OF WAR AT RUHLEBEN.

We have received the following interesting communication too late for inclusion in our "Correspondence" columns :—

The following extract from a letter I have received from an engineering friend interned as a civil prisoner of war at Ruhleben, Berlin, may be of interest to some of your readers :—

"There are a number of fellows here in our trade, for instance :
Dreyfus, of Brunnenstrasse (A.E.G.).
Trinks, Jepson & Mendelsohn, of Adnil.
Hotopf, Wuest & Ball, of Morganite.
Kindersley, Stokes, North, Scholes, and Dewhurst, of Mather and Platt.
Graham and Lucas, from Tudors.
Kapp, son of Dr. Gisbert Kapp.
Heather and Beurle, late of Vicfalco.
Plowman (A.E.G.), back from Mexico.
Swale, from Mannheim.
Swift, Clement, Rodger, Lane, and Pink, formerly with Siemens, Stafford.
Cooper, of Mirrlees, Watson.
Murray, late of Worthingtons.
Copping, of Blackmans.
Spencer, Nicholson, and Roberts, of Heap & Digby.
Johnson, A.E.G. (formerly Siemens-Schuckert).
Jenkins, formerly of the Westinghouse.
Saul and Messent, formerly with the Brush.
Kemp, Ibbetsen, Upward, Squire, Burgoyne, Hecht, Nicolls, and Klein, of A.E.G.
C. W. Hatt, of Duisburg.
Lamb, formerly of Richardsons, Westgarth ; and many others.

"My time has been spent largely in loafing, reading the paper, and discussing how long we shall be here. Interned civilians other than those of the engineering profession seem to be singularly incapable of logical thought or honest reasoning, and, where two or three are gathered together, you may be sure that they are belching forth the most blithering optimistic bilge. I am afraid I shall emerge with impaired faculties of reasoning and discussion, but wonderfully developed powers of invective and repartee. Nevertheless, it is a vulgar fallacy to suppose that time is not easily killed. Washing up and other domestic functions can be made, with skill, to last from one meal to the next. As a matter of fact, too, I am attending six course of lectures by first-rate men on various subjects.

"The Ruhleben Camp School does marvels with the facilities at its disposal, and teaches almost every subject and language imaginable, including even Chinese and nigger dialects. Then there are the Banking, Science, Technical, and Marine Engineering circles, which hold profitable discussions. Kemp holds forth on turbines, Ibbetsen on India, Heather on gold-mining, Jenkins on rotaries, Copping on fans, and Lane on patent law before the technical circle, and some of the Marine people's evenings have been most excellent even for the laity. They had a fine evening of breakdown anecdotes and a lecture on gyroscopes by Venables, but their general desire seems to be for lectures on electricity by landsmen. U—— seems to lead a life of dignified leisure, B—— wields tools for the alleged purpose of putting his sleeping box in order, while they both scrape fiddles intermittently. I—— is a budding "Chef," L——, I——, J—— and N—— wear out deck chairs during the greater part of the day, though J——, L—— and U—— have taken to boxing. S—— has made an electric clock out of meat tins, and W——, I fancy, runs a young Exchange and Mart."

My correspondent never fails to enlarge on the pleasure extracted from letters from home, and I venture to suggest that those of your readers who may find the names of any of their friends in the above list might spare a few minutes to write them cheering letters from time to time, selecting their subject matter, of course, with due consideration for the feelings of the Censors, British and German. They will probably not receive replies, as the restrictions on outgoing letters at Ruhleben are somewhat rigorous, but the knowledge of the pleasure that they are giving should be ample compensation. The correct form of address is :—

A. B. Smith, Esq.,
Engländerlager,
Ruhleben,
Spandau.

Baracke No. ——
Box No. ——

British Civil Prisoner of War,
Interned in Germany.
c/o General Post Office,
Mount Pleasant,
London, E.C.

The correct "Baracke" and "Box" numbers can, of course, only be obtained after correspondents have got into touch with their interned friends. I understand that though it is not essential to give the Baracke and Box numbers, their omission causes a certain amount of delay in delivery at Ruhleben.

Letters should be posted in unsealed envelopes, and they do not require a stamp. The letter itself should bear the full address of the recipient, as given on the left-hand side above, and also the full address of the sender,

Sympathiser.

NOTES.

Electric Lorries ?—"Unable to purchase horses under £110 each, the Shoreditch Council is considering the advisability of purchasing motor lorries."—*Times.*

Alderman Sentenced.—According to the *Times*, Alderman James Hodgson Rodgers, chairman of the Newcastle Corporation Tramways, has been sentenced to 12 months' imprisonment in the second division for misappropriating moneys of the Tyneside Bank, Ltd., of which he was manager and trustee.

The Generators.—Owing to the war, this Society will not carry out its full programme this year, but in order to meet the wishes of a great majority of the members, the Boosters have arranged for one dinner only, in order to keep the Society together. It will be held at the Trocadero Restaurant at 6.15 p.m. for 6.30 on Friday, December 3rd. Mr. Victor Marmont has charge of the arrangements.

Renewing Lapsed Policies.—In the City of London Court, on Friday, before his Honour Judge Rentoul, K.C., C. E. Heath & Co., Ltd., insurance brokers, 3 and 4, Royal Exchange Buildings, E.C., made a claim against Mr. C. R. Belling, Derby Road, Edmonton, for £10 0s. 3d., premium on a policy of insurance effected.

Mr. Gamble, plaintiffs' solicitor, said that the policy was to insure the defendant against claims under the Workmen's Compensation Act. Defendant had been insured, and the policy lapsed on September 9th. By an oversight it had not been renewed, and in March last defendant telephoned the plaintiffs and said a claim was going to be made upon him for an accident, he being under the impression that the policy was still in existence. It was pointed out that the policy had lapsed, and plaintiffs offered either to issue a new policy at once from that day and to give no attention to the claim which the defendant said had been raised against him, or to renew the policy as from the previous September, and to deal with the claim on the defendant's behalf. Defendant said he would rather the policy was renewed as from the previous September, and that had been done, the premium for which was now sued for.

Judge Rentoul said he thought if a policy was not renewed it lapsed as a matter of course.

Mr. Gamble pointed out that that was so, unless as an act of grace plaintiffs chose to renew the policy and to date it back to the time when the renewal premium should have been paid. Plaintiffs were simply carrying out the business on behalf of the Excess Insurance Co.

Judge Rentoul said that the plaintiffs were backed up by a document which defendant had accepted. He must find for the plaintiffs, with costs.

War Munitions Cases.—At a sitting of the Oldham Munitions Tribunal, last week, Walter Thomas, a foreman in the switch department of Messrs. Ferranti, Ltd., Hollinwood, applied for a leaving certificate. He declared that, although the firm were engaged on munition work, he himself was not actually working on munitions, and he desired a leaving certificate because he had had the offer of a post to take supervision of a shell factory. He was a skilled engineer, and had the experience to qualify him for the position offered. In view of the country's urgent need of munitions, he contended that his abilities were not at present being used to the greatest advantage, but when he applied to the firm for his release it was refused.—For the firm, Mr. Thomas said that for the past six weeks the applicant had been substantially employed on munition work.—The applicant said that he had been engaged on switchgear, and that was not munitions work. Moreover, there was no difference in the work he was now doing and that he was doing prior to the war.—The Chairman (Mr. W. Sellars) said that Sec. 3 of the Munitions Act referred, in addition to direct munitions, to the making of substances or articles for war purposes.—The applicant said his contention was that switchgear work did not come under the description of articles used in war. Some of the switches he had made, he alleged, were for private firms.—Mr. Whittaker put in a list of firms to whom the firm had supplied switchgears, and said that practically all those named were engaged in the manufacture of munitions of war.—The Chairman said he and his colleagues were satisfied that the applicant had been employed substantially on munitions work, and refused the certificate.

At the same Court, Frederick Jones, of 12, George Street, Dukinfield, a chemical plumber in the employ of the Tudor Accumulator Co., Dukinfield, applied for a certificate to enable him to take up munition work at Queensferry. On behalf of the firm, it was stated that they had been engaged on Post Office contracts in connection with telephone exchanges and in making batteries for ambulance trains. The firm was now a controlled establishment. For the making of lead boxes and lead linings chemical plumbers were necessary, and owing to enlistments the number of chemical plumbers employed by the firm had been reduced from 13 to nine.—The Chairman said he was doubtful whether Post Office work could be called munition work, and, personally, he would say that ambulance train work was not munition work also. He had been instructed, however, that ambulances were articles used for war purposes, and therefore came within the scope of Sec. 3 of the Act.—It was admitted that up to a week prior to the application the applicant had not been engaged on munitions work, and the Chairman said the certificate would be granted

L.C.C. Electrical Employés : War Wages.—The L.C.C. Highways Committee considers that the increased rates of pay under the Award of August 11th, 1915, should be paid to the men in the electrical section of the tramways department, and recommends :—

That the rate of pay of wiremen in the electrical section of the tramways department engaged on wiring tramway depôts be increased from 10d. to 10½d. an hour.

That wiremen in the electrical section of the tramways department engaged on wiring tramway depôts be granted an advance of ¾d. an hour in addition to the increase specified in the foregoing resolution : that wiremen's labourers in the electrical section engaged on wiring tramway depôts be granted a *pro rata* advance ; and that such advances be regarded as war wages, and recognised as due to, and dependent on, the existence of the abnormal conditions prevailing in consequence of the war.

The General Purposes Committee of the L.C.C. recommends that the rates of pay of the undermentioned skilled staff at the Thames tunnels shall be as follows :—

	Weekly rate of pay.
Blackwall Tunnel.	
Leading wireman and fitter	45s. 6d. and emoluments valued at 18s. a week.
Electrical wireman and fitter	42s. 6d.
Switchboard attendants (perm. and temp.)	42s. 6d.
Greenwich Tunnel.	
Leading machinery attendant	52s. 6d.
Relief and shift engineer (temporary)	45s. 6d.
Electrical fitter	42s. 6d.
Rotherhithe Tunnel.	
Leading electrical fitter and machinery attendant	52s. 6d., rising to 56s. 6d., and 8s. in lieu of rent.
Electrical fitters	45s. 6d. and 42s. 6d.
Relief electrical fitter and motor pump attendant	39s. 6d., rising to 42s. 6d.
Woolwich Tunnel.	
Leading electrical hand	45s. 6d.
Wiremen (permanent and temporary)	42s. 6d.
Switchboard attendant and electrical fitter (temporary)	42s. 6d.

The Government and Inventions.—A letter has been addressed by the Comptroller of Munitions Inventions to the Institution of Electrical Engineers, drawing attention to the fact that the department, which was recently constituted by the Minister of Munitions for the purpose of dealing with ideas, suggestions, and inventions for appliances in connection with the prosecution of warfare on land, has been authorised by him to receive projects of this nature, or any matters appertaining thereto. An advisory panel, appointed by the Minister, of scientific and other experts, a number of whom are members of the Institution, is assisting in the task of dealing with the large number of cases that have been received, every one of which is given consideration by the panel. They are glad to consider also suggestions with regard to simplification and improvements either in the manufacture or in the materials of existing munitions, or, indeed, in any other respect. The Institution is invited to make known to its members, as widely as possible, the existence and functions of the department.

Dr. Macnamara, replying to a question in Parliament recently, stated that the Admiralty Board of Inventions had received proposals from some 8,000 inventors, many of whom had sent in several different proposals. The proportion of possibly useful inventions was small.

Electrically-heated Soldiers.—It is reported from Austria that a method of weaving electric heating wires into soldiers' pants and connecting the garments with a battery at from 100 to 500 metres distance has been devised by an electrical engineer. It is claimed that the current can be regulated, and that any number of soldiers in the trenches can be kept warm simultaneously. Electric carpets and bed-warmers are quite practical and useful devices, and there is no insuperable difficulty in carrying out this proposal, extraordinary as it may appear at first sight. Complications would arise, however, if the men were stationed in a flooded trench !

A Kite and a Transmission Line.—On a three-phase, 11,000-volt transmission line on Long Island, considerable trouble was experienced from the frequent opening of the oil switches at both ends, apparently caused by momentary short-circuits. This trouble always occurred on windy days, which led to the belief on the part of the maintenance crew that something was swinging into the line. A careful inspection of the whole line failed to disclose any tree branches or other objects that could possibly touch the conductors, and it was purely by accident that the real cause of disturbance was later discovered. It consisted of two small boys and a kite with a picture-wire tail. Two of the linemen noticed the boys in a vacant lot through which the line passed, and stopped a minute to watch them get their kite up. Once in the air the kite was manœuvred toward the line by the boys, and when directly over the wires the boys cut the string, causing the kite to drag its wire tail over the conductors, short-circuiting two. The fireworks which resulted were greeted with howls of delight from the boys, but after persuasion of a most practical character from the linemen, the young Franklins decided to seek safer fields for flying their kite.—*Electrical World.*

Institution and Lecture Notes.—Royal Society of Arts.—At the opening meeting of the Session, held on Wednesday afternoon, Dr. Dugald Clerk, F.R.S., delivered an address on "English and German Methods Contrasted." In the list of future events are the following:—"The Economic Development of Russia," by Mr. Leslie Urquhart; and four Fothergill lectures on "Vibrations, Waves, and Resonance," by Dr. J. Erskine-Murray (May 1st, 8th, 15th and 22nd).

The Royal Society.—The following is a list of officers recommended by the President and Council of the Royal Society for election into the Council for the year 1916 at the anniversary meeting on November 30th:—

President.—Sir Joseph J. Thomson.
Treasurer.—Sir A. B. Kempe.
Secretaries.—Prof. Arthur Schuster and Mr. W. B. Hardy.
Foreign Secretary.—Mr. D. H. Scott.

Other members of the Council include Dr. Dugald Clerk, Sir William Crookes, Prof. R. Meldola, and Mr. Richard Threlfall.

Junior Institution of Engineers.—In a paper read on Monday, at Manchester, Mr. E. Dinsdale Phillips expressed the opinion that electric tramways will be replaced by motor-'buses, and that only the immense capital interests involved delay this. According to the *Manchester Evening Chronicle*, in the discussion which followed, Mr. Phillips's contention was not upheld.

The Faraday Society.—At the annual general meeting of the Society, held on October 19th, the following officers and members of Council were elected to serve for the year 1915-16:—

President: Sir Robert Hadfield, F.R.S.

Vice-Presidents: Prof. K. Birkeland, Bertram Blount, W. R. Bousfield, K.C., Prof. F. G. Donnan, F.R.S., Dr. Eugene Haanel, Prof. A. K. Huntington, Dr. T. Martin Lowry, F.R.S.

Treasurer: F. Mollwo Perkin, Ph.D.

Council: W. R. Cooper, Dr. C. H. Desch, Dr. J. A. Harker, F.R.S., Emil Hatschek, Cosmo Johns, Prof. Alfred W. Porter, F.R.S., E. H. Rayner, A. G. Salamon, Dr. G. Senter, Cav. Magg. E. Stassano.

The Report of the Council states that although the Society's activities were seriously affected by the war, it was found possible to hold four meetings in the period under review, at which 27 papers were read.

The Institute of Metals.—Prof. W. H. Bragg, who (jointly with his son) has just been awarded the Nobel prize for Physics, is to deliver the 1916 May Lecture before the Institute of Metals, and is now devoting attention to the structure of metal crystals as revealed by X-rays; it is expected that he will have an important pronouncement to make on this subject. Non-ferrous metals being of such enormous importance in the production of munitions, it is not surprising to learn that the Institute of Metals (which takes within its purview all metals except iron and steel) is very closely concerned with the production of the metal articles required for the successful prosecution of the war, and is in daily touch with many of the munition factories throughout the country, and with certain Government departments requiring metallurgical information. Large shipments of the *Journal* of the Institute, in which are recorded the latest scientific methods of dealing with the non-ferrous metals, are being dispatched to Japan and the United States for use in works engaged in producing munitions for the Allies. Copies can be purchased by non-members from the offices of the Institute. The war activity in the metal industries tends strongly to reinforce the membership of the Institute, and a ballot for the election of new members has, therefore, been arranged for December 15th. Those wishing to join the Institute should at once write for particulars to Mr. G. Shaw Scott, M.Sc., Secretary, Caxton House, S.W.

North-East Coast Institution of Engineers and Shipbuilders.—The report of the Council for the year ended July 31st, 1915, shows that the membership numbered 1,159, a net increase of 48. The average attendance at meetings was 260. The accounts showed a balance of income over expenditure of £222, and the "general capital and endowment fund" stood at £7,372.

Nobel Prizes.—The Swedish Royal Academy of Science has awarded the Nobel Prize for Physics for 1914 to Prof. M. van Laue, of Frankfort University, for the discovery of the diffraction of X-rays in crystals.

The Academy has decided that the Nobel Prize for Physics for 1915 be divided between Prof. W. H. Bragg, of University College, London, and his son, Mr. W. L. Bragg, of Cambridge, for their researches into the relation of crystals and X-rays.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER CORPS.—The first meeting of the General Committee of this body took place on Friday last, when there were present Mr. Alexander Ross (Pres. Inst.C.E.), Prof. Unwin (Pres. I.Mech.E.), Mr. C. P. Sparks (Pres. I.E.E.), Sir John Snell, Sir John Gavey, Dr. Tudsbery, Mr. Highfield, Colonel Le Rossignol, R.E., Major Henrici, R.E., Captain Sankey, R.E., Mr. L. B. Atkinson, Lieut.-Colonel C. B. Clay, V.D., Commandant, Mr. E. G. Fleming, Adjutant.

The meeting was the occasion of some enthusiasm, and an Executive Committee was formed, consisting of Sir John Snell (retiring President of the I.E.E.), as chairman, Sir Maurice Fitzmaurice, C.M.G. (a Vice-President of the Inst.C.E.), Colonel Le Rossignol, R.E., Lieut.-Colonel C. B. Clay, Mr. L. B. Atkinson, hon. secretary and treasurer, Mr. Fleming, and a representative of the Institution of Mechanical Engineers, to be nominated by the President.

The report of the Commandant as to the progress of the Corps was most encouraging. To this report he added that an arrangement had been made for sharing headquarters with the 4th Battalion City of London Regiment (Architects' Corps). The premises comprise a spacious drill hall and the necessary offices for mess rooms, common room, orderly room, canteen, &c. Through the kindness of Mr. A. Campbell Swinton, F.R.S., the Corps has received a present from Messrs. Crompton & Co. of a new Admiralty pattern searchlight, of which it is justifiably proud. This is being erected on the premises of the London Electrical Engineers (T.F.), where the necessary instruction will be given. Several men have already qualified in this branch, and parties are engaged each week-end on important work in connection with the defence of London. Under these auspicious circumstances, and with these comfortable and excellent premises for headquarters, the Corps should prove attractive to all suitable men who wish to serve their country.

The Corps will only accept as new members those who are over military age, or disqualified by reasons of health, or who are engaged on war work, and who are not allowed by the Government on that account to enlist in the Forces, but whose training in this Corps would fit them to take part in the defence of the country in the event of a raid by the enemy, or any other emergency; and would also fit them to volunteer as trained men for service overseas if such a necessity arose at a later period in the war. Good men are acceptable whether members of the Engineering Institutions or not.

Orders for week commencing November 22nd, 1915, by Colonel C. B. Clay, V.D., Commanding:—

Drills, 5.25 to 7.25; 7.25 to 8.25 p.m.

Saturday, November 20th.—Uniform Parade, 3 p.m.

Monday, November 22nd.—Sections 1 and 2, Technical; Sections 3 and 4, Squad, Signalling Section and Recruits.

Tuesday, November 23rd.—School of Arms with Architects' Corps, 6 to 8 p.m.

Thursday, November 25th.—Sections 1 and 2 and Signalling Section, Shooting.

Friday, November 26th.—Sections 3 and 4, Technical; Sections 1 and 2, Squad, Signalling Section and Recruits.

Sections for Technical Parade at Headquarters, London Electrical Engineers, 46, Regency Street.

Sections for Shooting Parade at the Miniature Range.

Unless otherwise ordered, all Parades at Chester House.

The opening meeting of the new Headquarters will be held on Wednesday, December 1st, 6.30 p.m. All members should make a special point of attending in uniform.

E. G. FLEMING,
Acting Adjutant and Company Commander.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, November 18th, 1915:—

Week-end Parades.—Saturday.—The Battalion will parade at Baker Street Station at 2.30 p.m., and proceed by train to Willesden Green Station, where they will alight. North London and Blackheath Platoons, under the command of Mr. Marples, will proceed to Hendon under special instructions issued to that officer. A, B, C and D Companies, under the command of Mr. King, will march viâ road south of Metropolitan Railway to Neasden, and thence to bridge over Brent stream on Kingsbury Lane.

Sergt.-Major's Parade. Handling of Arms, 5.30 to 6.30 p.m., at Wembley Camp.

Sunday.—The Battalion will parade at Liverpool Street Station at 8.55 a.m. and proceed by train for Entrenching, returning to London about 6 p.m.

The Quartermaster will make the necessary arrangements for Lunch.

Instruction Class.—The Instruction Class which is being held for members of the Corps takes place at the Yeomanry Hall, Henry Street, on Mondays and Fridays, at 5.30 p.m., and not as previously arranged.

Musketry.—Saturday next, the 30th inst., there will be shooting at both Acton and Bisley Ranges, as usual. Members proceeding to Acton must parade there at 2 p.m. punctually. Those shooting at Bisley must report themselves to Sergeant Cotter at the barrier of No. 9 Platform, Waterloo Station, at 12.45 p.m.

Tuesday, November 23rd.—Shooting at Acton, as usual, at 2 p.m.

A. G. JOINER, *Major and Adjutant*, O.B.C.

Legal.—PEMBROKE U.D.C. *v.* THE DIESEL ENGINE CO.—In the King's Bench Division of the Irish High Court, Mr. Justice Kenny gave liberty to the Pembroke (Co. Dublin) Urban Council to serve out of the jurisdiction a writ of summons against the Diesel Engine Co., claiming damages for breach of contract in the erection for £2,977 of an engine for generating electric current, together with all accessories, including cable connections and switchboard alterations. Plaintiffs alleged that the engine was defective in design and construction. The company was stated to be in voluntary liquidation, with Sir W. B. Peat as liquidator, upon whom service was directed to be made.

Electric Power Stations to be "Controlled" Establishments?—In the House of Commons, on Wednesday, a member asked whether the Minister of Munitions intended asking Parliament for powers to make electric power stations controlled establishments, on the ground that they were essential to munitions work. In reply, it was stated that the matter would be dealt with in a Bill shortly to be placed before Parliament.

America and Export Trade.—A Reuter dispatch from Washington states a canvass of American manufacturers, producers, exporters, and others interested in the foreign trade has been undertaken by the Federal Trade Commission in an effort to secure a "broad referendum on the advisability of export combinations." It is announced that agents will be sent abroad to study conditions on the spot. The Commission will also receive assistance from the Department of State through United States Consuls, and from the Department of Commerce through the Commercial Attachés.

The Hughes Induction Balance.—We have already mentioned the use of the Hughes induction balance in military hospitals for localising metallic projectiles; hitherto this application has been confined to the exterior of the body. M. A. de la Baume Pluvinel has carried it a step further by mounting a tiny coil on the tip of the surgeon's finger, so that in exploring the interior of a wound the user is guided by the sound towards the foreign object, and is thus enabled to find the best direction in which to cut down upon it.

Appointments Vacant.—Generating engineers (£3), assistants (£2), for the Hackney B.C. electricity department; station superintendent (£150) for the Walthamstow U.D.C. electricity department. Particulars are given in our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Swinton and Pendlebury U.D.C. has consented to Mr. H. C. Busbridge, electrical engineer, joining the Forces on terms granted to other employés who have enlisted.

Mr. H. A. Barraclough, generating engineer at the Hackney B.C. electricity works, has resigned his appointment.

General.—Mr. Wm. T. Taylor, of Burnley, who, as our readers know, has been for some years connected with Mexican and South American hydro-electric schemes, has been gazetted captain in the Loyal North Lancashire Regiment, a military engineering unit.

The King has granted to Prof. F. P. Purvis, of the College of Engineering of the Tokio Imperial University, licence and authority to wear the Insignia of the Third Class of the Order of the Sacred Treasure conferred upon him by the Emperor of Japan in recognition of valuable services rendered by him.

Alderman G. J. Allen, J.P., has been re-elected chairman of the Croydon Corporation Tramways Committee for 1915-16, and Councillor A. A. Thomson has been elected vice-chairman.

Alderman G. H. Robinson has been elected chairman of the Bradford City Council Electricity Committee, and Councillor J. Haley vice-chairman.

Councillor Hugh Lupton has been appointed chairman of the Electricity Committee of the Leeds Corporation, and Alderman R. A. Smithson has been appointed chairman of the Tramway Committee, with Alderman H. Brown vice-chairman.

Councillor Cyril M. Vincent, the new Mayor of Oxford, was chairman of the Tramways Committee when the question of adopting an electrical system of traction was first considered by the Council.

Alderman G. Weeks, of Messrs. G. Weeks & Sons, electricians, has been appointed Deputy-Mayor of Bromley (Kent).

The Birmingham City Council have re-elected Alderman Jephcott chairman of the Electricity Supply Committee.

Mr. J. W. Lawton has been elected chairman of the Huddersfield Town Council Electricity Committee, with Alderman Marsland vice-chairman; and Alderman Aston chairman and Mr. E. H. Sellers vice-chairman of the Tramway Committee.

Councillor W. J. Stapleton has been elected chairman and Councillor H. A. Manger vice-chairman of the Electricity Committee of the Hackney B.C. for the ensuing year.

Alderman Bowes and Alderman Dr. Chapman have been re-elected chairman and deputy-chairman respectively of the Manchester Tramways Committee; and Councillor Dagnall and Alderman Walker have been elected chairman and deputy-chairman of the Electricity Committee.

A number of municipal bodies in Lancashire have elected their committee chairmen for the ensuing year. The following are among the appointments:—*Wigan.*—Electric Light Committee: Ald. J. T. Grimshaw, chairman; Ald. A. Higham, vice-chairman. Tramways Committee: Ald. R. T. Fletcher, chairman; and Coun. J. Walkden, vice-chairman. *Accrington.*—Electricity and Tramways Committee: Ald. Higham, chairman, and Coun. Morley vice-chairman. *Bolton.*—Electricity Committee: Ald. Longworth chairman, and Coun. Cooper vice-chairman. Tramways: Ald. Miles chairman, and Coun. P. Higson vice-chairman. *Haslingden.*—Tramways and Electricity Committee: Coun. Waddington chairman, and Coun. Haworth vice-chairman. *Burnley.*—Electricity Committee: Ald. Grey chairman, and Coun. T. W. Hargreaves vice-chairman. Tramways Committee: Coun. E. Heap chairman, and Coun. Irving vice-chairman.

Coun. W. M. Wiggins, chairman of the Middleton Electricity Committee, was last week re-elected Mayor of the Borough and elevated to the aldermanic bench.

Roll of Honour.—Private Harold Hornbrook, of the 6th Battalion Manchester Regiment, who was previously reported missing, and is now officially reported killed in action at the Dardanelles, was 21 years of age, and prior to the outbreak of war was in the employ of Messrs. Eckstein, Heap & Co., Ltd., of Salford.

Captain P. M. Moon, 4th Black Watch, has been wounded. He left for the Front about five weeks ago. Prior to the war he was in the service of Messrs. Balfour, Beattie & Co., London, as an engineer.

Corporal Jas. Jones, of the 2nd Worcestershire Regiment, who is officially reported missing in France, was prior to the war engaged with the Kidderminster Electric Light Co.

Sapper J. E. Hughes, one of the victims in the sinking by collision off the Dardanelles of H.M.S. *Hythe*, was before enlistment in the 3rd Kent Field Co., Royal Engineers, on the staff of the Corporation electricity works at Tunbridge Wells.

Gunner W. A. Billingham, of the Royal Field Artillery, lately with the British Thomson-Houston Co., Ltd., of Rugby, is unofficially reported to have been killed in action on October 21st. He was 22 years of age, and joined his regiment soon after the outbreak of war.

Private Robert Alfred Sullivan, of the 10th Battalion Royal Fusiliers (City of London Regiment), who has been killed by shell fire in France whilst endeavouring to save the life of a comrade, was formerly engaged at Charlton with Messrs. Johnson & Phillips, Ltd., and was later an electrician with the City & South London Railway Co.

The D.S.O. has been conferred upon Major B. I. Rolling, R.E., for services rendered in Gallipoli. Major Rolling, who at the commencement of the war was a lieutenant, is the Igranic Electric Co.'s Glasgow manager, but since the war began his place at Glasgow has been filled by Mr. J. H. Enion, of the firm's London office.

Private Boult, of the Grenadier Guards, and formerly with Messrs. Siemens, of Stafford, has been killed in action.

Sapper Geo. Filewood, of the 3rd Kent Field Company, Royal Engineers, reported lost by the sinking off the Dardanelles of H.M.S. *Hythe*, had been trained as an electrical engineer with Messrs. G. A. Cross, Ltd., of Tunbridge Wells.

Obituary.—Mr. C. E. Moore.—The death has taken place of Mr. Chas. Edward Moore, for 20 years in business as an electrician in Silver Street, Doncaster. He was 45 years of age.

Mr. H. Barnes.—The death occurred on November 9th, at the Middlesex Hospital, London, where he had been under treatment for some time, of Mr. Harry Barnes, electrician, Chatham. Deceased, who was 44 years of age, had been in business in High Street for a number of years.

Mr. W. B. Kingsford, chairman of the West India and Panama Telegraph Co., Ltd., passed away on Tuesday, aged 74 years.

Will.—Lieut. T. L. Bainbridge, of Eshott Hall, Felton, described as an electrical engineer in the firm of Swan, Hunter & Wigham-Richardson, who was killed in April last, left £32,443.

NEW COMPANIES REGISTERED.

W. Sanders and Co. (1915), Ltd. (142,057).—This company was registered on November 5th, with a capital of £2,000 in £1 shares, to take over the business of an electrician, metal worker, mechanical engineer, and manufacturer, carried on by L. G. Russell, at 7, Oxford Street, Digbeth, Birmingham. The subscribers (with one share each) are: L. G. Russell, The Cottage, Gravelly Hill North, Birmingham, brassfounder; Mrs. L. Russell, The Cottage, Gravelly Hill North, Birmingham; W. Sanders, 35, Lyndon Road, Olton, Warwick, engineer; A. E. Skidmore, 55, Newhall Street, Birmingham, chartered accountant; G. P. Locker, 71, Temple Row, Birmingham, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are L. G. Russell (permanent director and chairman), Lucy Russell, and W. Sanders. Secretary: Lucy Russell. Registered office: 7, Oxford Street, Digbeth, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hexham and District Electric Supply Co., Ltd.—Capital, £30,000 in £5 shares. Return dated May 17th, 1915. 1,521 shares taken up; £7,605 paid. Mortgages and charges: £7,350.

Hydro-Electric Power and Public Services Trust, Ltd (121,598).—Capital, £500,000 in £5 shares. Return dated December 31st, 1914 (filed November 3rd, 1915). Seven shares taken up; nothing called up Mortgages and charges: Nil.

L. J. Healing and Co., Ltd. (97,137).—Capital, £100,000 in £10 shares (5,000 pref. and 5,000 defd.). Return dated October 11th, 1915 1,301 pref. and 5,000 defd. shares taken up; £10 per share called up on 1,301 £13,010 paid; £50,000 considered as paid on 5,000 shares. Mortgages and charges: Nil.

Manaos Tramways and Light Co., Ltd. (101,081).—Capital, £900,000 in £1 shares. Return dated September 14th, 1915. All shares taken up; £100 paid; £899,900 considered as paid. Mortgages and charges: £203,900.

Marconi International Marine Communication Co., Ltd. (65,759).—Capital, £350,000 in £1 shares. Return dated July 21st, 1915. 306,084 shares taken up; £201,084 paid; £105,000 considered as paid. Mortgages and charges: £121,880.

Fredk. Jones and Co., Ltd. (110,247).—Capital, £15,000 in £1 shares. Return dated September 17th, 1915. All shares taken up; £7 paid; £14,993 considered as paid. Mortgages and charges: Nil.

London Electrical Trading Co., Ltd.—Issue on November 8th, 1915, of £600 debs., part of a series of which particulars have already been filed.

Electric and General Investment Co., Ltd. (31,506).—Capital, £201,500 in 20,000 ord. shares of £5 each, 40,000 defd. shares of 1s. each, and 19,900 pref. shares of £5 each. Return dated August 10th, 1915. All shares taken up; £1 per share called up on the ord., 1s. per share on the defd., and £5 per share on the pref.; £121,500 paid. Mortgages and charges: £27,813 10s.

Llangollen and District Electric Light and Power Co., Ltd. (75,384).—Capital, £6,000 in 3,500 ord. and 2,500 pref. shares of £1 each. Return dated September 21st, 1915. 2,114 shares taken up; £2,110 15s. paid; leaving £3 5s. in arrears. Mortgages and charges: £2,800.

Electro-Mechanical Brake Co., Ltd. (98,276).—Capital, £30,000 in 2,500 pref. and 27,500 ord. shares of £1 each. Return dated August 12th, 1915. 987 pref. and 17,317 ord. shares taken up; £1 per share called up on 987 pref. and 11,282 ord.; £12,269 paid; £6,035 considered as paid on 6,035 ord. Mortgages and charges: £7,500.

Edmundson's Electricity Corporation, Ltd. (52,013).—Capital, £640,000 in 80,000 ord. shares of £3 each, 40,000 cum. pref. shares of £5 each, and 40,000 non-cum. pref. shares of £5 each. Return dated July 22nd, 1915. All shares taken up; £600,400 paid on 66,800 ord., 40,000 cum. pref., and 40,000 non-cum. pref.; £39,600 considered as paid on 13,200 ord. Mortgages and charges: £467,683.

Brimsdown Lamp Works, Ltd. (101,306).—Capital, £5,000 in 5s. shares. Return dated September 29th, 1915. 12,580 shares taken up; £855 10s. paid on 4,292, leaving £217 10s. in arrears; £2,072 considered as paid on 8,288. Mortgages and charges: £40,000.

Evershed and Vignoles, Ltd. (43,206).—Capital, £30,000 in £10 shares. Return dated July 9th, 1915. All shares taken up; £30,000 paid. Mortgages and charges: £15,000.

Henley's (South Africa) Telegraph Works, Ltd. (77,781).—Capital, £2,000 in £1 shares. Return dated September 10th, 1915. All shares taken up; £2,000 paid. Mortgages and charges: Nil.

Cryselco, Ltd. (58,218).—Capital, £15,000 in £1 shares. Return dated July 8th (filed August 5th), 1915. All shares taken up; £10,007 paid; £4,993 considered as paid. Mortgages and charges: £8,800.

Lancashire Electrical Engineering Co., Ltd. (56,992).—Capital, £5,000 in £1 shares. Return dated June 25th (filed July 21st), 1915. 1,879 shares taken up; £50 paid; £1,829 considered as paid. Mortgages and charges: Nil.

Lancashire Power Construction Co., Ltd. (77,202).—Capital, £300,000 in £10 shares (18,000 "A" and 12,000 "B"). Return dated June 24th, 1915. 18,000 "A" and 11,836 "B" shares taken up; £283,360 paid; £15,000 considered as paid. Mortgages and charges: £300,000.

International Dowsing Electric Heating and Appliances Co., Ltd. (83,693).—Capital, £20,000 in £1 shares. Return dated December 31st, 1914 (filed August 11th, 1915). 18,107 shares taken up; nothing called up on 7 shares; £18,100 considered as paid. Mortgages and charges: Nil.

Salford Electrical Instruments, Ltd. (112,599).—Capital, £20,000 in 10,000 pref. and 10,000 ord. shares of £1 each. Return dated September 29th, 1915. All shares taken up; £10,000 paid; £10,000 considered as paid. Mortgages and charges: Nil.

W. R. Sykes Interlocking Signal Co., Ltd.—Capital, £50,000 in 87,500 "A" and 12,500 "B" shares of 10s. each. Return dated October 6th, 1915. 42,297 "A" and 12,500 "B" shares taken up; 3s. 9d. per share called up on 42,297 "A"; £7,936 18s. 9d. paid, including £6 5s. in advance of calls; £6,250 (10s. per share) considered as paid on 12,500 "B" shares, and £10,574 5s. (5s. per share) on 42,297 "A." Mortgages and charges: £13,000.

Carville Site and Power Co., Ltd.—Issue on October 29th, 1915, of £10,000 debs., part of a series of which particulars have already been filed.

Maxim Lamp Works, Ltd. (108,013).—Debenture dated October 18th, 1915, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Imperial United Lamp Co., Ltd.

Malaga Electricity Co., Ltd. (48,076).—Capital, £57,000 in 10,000 ord. shares of £5 each and 7,000 defd. shares of £1 each. Return dated September 24th, 1915. All shares taken up. £50,000 paid; £7,000 considered as paid. Mortgages and charges: £34,131.

CITY NOTES.

Cape Electric Tramways, Ltd.

The annual meeting was held on November 10th at the offices, London Wall Buildings, E.C. Mr. Ludwig Breitmeyer, who presided, said that their financial year began on July 1st last year, so that practically during the whole of the period covered by the accounts the war had been proceeding in Europe and other parts of the world. South Africa had not escaped either, but had been more fortunate inasmuch as the rebellion was soon suppressed, and the expedition for the conquest of German South-West Africa was brought to a speedy and victorious conclusion. Both these two signal successes had quickly restored public confidence, and the operations of the company during the year were not affected as a whole in an adverse manner. On the contrary, the tramways had maintained the same ratio of their steady progress experienced since the last four or five years, and had carried 21,680,070 passengers, earning £206,123, as against 20,886,146 passengers, earning £200,409, in the preceding year, an increase of 793,924 passengers, and £5,714 in receipts. The net profit earned in South Africa on the year's operations was £86,332, against £81,794 in 1913-14, an increase of £4,538. In arriving at the satisfactory result shown in the balance sheet they had had to contend against a considerable increase in certain items of expenditure, entirely due to causes created by the war. For instance, allowances had been made to employés who had enlisted and gone on active service; a war bonus had been granted to the remaining employés, and all supplies, owing to the rise in prices, had cost more, and it had only been by the exercise of the most rigid economy in every direction that the satisfactory results shown in the accounts had been achieved. It was unwise in times like these to prophesy about the future of the undertaking; difficulties must be dealt with as they arose, and it was perhaps quite unnecessary to anticipate any falling off in their profits. At present the commercial and agricultural outlook in South Africa was very bright, but it was impossible to tell what the aftermath of the war might bring forth. Expenditure was undoubtedly further on the up-grade; on the other hand, any marked increase in the traffics was not probable under prevailing conditions. Although he thought they would be able to maintain the present dividend, further increases were problematical. Of course, they never knew what might happen, but for himself he took a very rosy view of the position at the Cape.

Mr. W. B. Rommel seconded the motion, which was carried unanimously.

West India & Panama Telegraph Co., Ltd.

Sir A. F. King presided, in the absence of Mr. Kingsford through illness, on November 10th, at Winchester House, E.C., over the annual meeting. He said that in addressing them at the meeting in May, the Chairman referred to the unusual conditions under which they were obliged by force of circumstances to carry on their enterprise, and mentioned that, in order to comply with the requirements of the Home and Colonial Governments, it had been necessary to keep their stations open day and night, instead of merely during the ordinary business hours of normal times. This incurred considerable outlay, and this additional outlay, together with the increased cost of the more than usually lengthy bulletin news, was reflected in the accounts presented. Supplying the Colonies daily with a free bulletin of news had been found by them at all times to be a burdensome and costly operation. Nevertheless, they had thought it right to give, during the war, a much more extensive bulletin. The additional expenditure under these two items amounted to over £7,000. It would be observed, however, that, as a partial set-off to this extra cost of working, the expenses attending the maintenance of cables were, fortunately, much below average. He said fortunately because, but for this circumstance, the half-year's profits would have been considerably less than the balance of £9,229 shown in the revenue account. As regarded the increase in the expenses of their stations, the principal item being salaries, wages and overtime, nearly the whole of this increase was due to the Government requirements to which he had already alluded. When the special circumstances which they were now rendering to the Government were no longer necessary, it was their intention to apply to the authorities for such refund in respect of the overtime as they might deem reasonable. The increase in the cost of renewal of instruments was exceptional, and not necessarily of a recurring nature.

Mr. H. W. Birks seconded.

Mr. S. P. Adams said he had read that a Marconi station had been established at St. Lucia, and he would like to know if it was in connection with the company or opposed to them, and if it would affect their income.

The Chairman said, so far as he understood, the work of the wireless station would not interfere with the work of the company in any way.

The motion was then carried, and subsequently a vote of thanks was accorded the board and the staff.

Western Telegraph Co., Ltd.

Sir J. Wolfe Barry, K.C.B., the chairman, presided, on November 10th, over the annual meeting, held at Electra House, E.C. He said that the message receipts afforded an additional revenue of nearly £74,000 for the period under review, which included eleven months of war, with its resultant stoppage, in the case of the company, of telegraphic traffic with Belgium, Germany, and Austria. The closing of these sources of revenue had, however, so far been compensated by increased earnings due to the obligatory use of plain language enforced by the several Governments under whom they worked. These restrictions were latterly modified, permission having been given in the early part of this year for the use of certain well-known codes with South American countries, which had been much appreciated by the telegraphing public. Congestion of lines beyond the company's system necessitated the suspension on August 5th last year of "deferred" and "week-end" telegrams. The former were re-introduced on October 1st, 1914, and advantage was quickly taken of the restoration of this facility. No damage to the company's cables had been experienced in consequence of the war. The sections in North Brazilian waters were interrupted by normal circumstances for four months, and owing to the exceptional conditions then and there prevailing their cable-repairing steamer was unable to attempt their restoration until March last. Communication during the interruption was, however, 'maintained with the Northern States of Brazil by the Brazilian Government landlines. The general expenses showed a decrease of nearly £9,000, principally due to three causes, the first being the occupation of their own offices and staff quarters at Buenos Aires and Montevideo, thus effecting a considerable saving under the read of rent. The second was their inability, owing to the war, to obtain the usual annual supply of forms and stationery until after the close of the financial year. The third cause was the fall in the value of the Brazilian milreis, which affected all their payments in that currency. There was also the very considerable decrease of over £40,000 in the cost of the maintenance of the cables, but income-tax was higher by close on £15,000. He felt sure that the shareholders would endorse the action of the directors in subscribing to the war relief funds. The balance carried forward was considerably larger than usual, but their message revenue for the current year since July 1st last, showed a decrease of over £25,000, and it was not yet known whether and to what extent the proposed taxation of profits would affect the company. He might mention that very great difficulty had been experienced in restraining the younger members amongst their technically trained staff from joining the fighting forces of the Empire, but they had, with few exceptions, accepted the ruling of the Army Council that they were best serving their country, being specially trained men, with technical knowledge and experience, in remaining at their posts and carrying on the work of State and commercial telegraphic communications. A letter was recently received from the War Office stating that the Council fully realised the importance of the work on which the employés of the company were engaged, and appreciated the efforts which were being made by them in the present emergency. The Council wished the staff to know that it was fully recognised that they, in carrying out their important duties promptly and efficiently, were doing their duty for their King and country equally with those who had joined the Army for service in the field.

Sir J. Denison-Pender, K.C.M.G., seconded the motion, which was carried without discussion.

Amazon Telegraph Co., Ltd.

Mr. Geo. Keith (chairman and managing director) presided over the annual meeting, on Tuesday, at the offices, 42, Old Board Street, E.C. He said that he regretted that the revenue of the business fell very short of what it was last year, and, notwithstanding the very substantial reduction made in the maintenance and working expenditure, they were unable to pay any dividend. The Amazon rubber trade, upon which their business mainly depended, continued very dull and depressed during the year. The low price of rubber further restricted its collection, and there was a decrease in the year's crop of about 12 per cent., which, coming after the falling off of the year before, seriously crippled trade generally on the Amazon, and their business suffered badly in consequence. The traffic receipts showed a decrease of £24,771, due to the falling off of the traffic transmitted over their cables and to the lower exchange. Interest brought in £296 less, and the total revenue, including the subsidy and transfer fees, came out at £57,933, or £24,818 less than the previous year. On the other hand, the expenditure showed a large decrease, which reflected great credit on Mr. Nosworthy, their general manager, and the staff, who exercised every possible economy in the working and maintenance of the cables. The station expenses had been reduced by £3,738, due to the lower exchange and other reductions in the various charges. The expenses attending maintenance of cable showed the large reduction of £11,233, due to less cable having been used during the year, and to the smaller vessel, *Ramos*, having done the cable repairs in the place of the larger vessel, *Viking*, which was laid up practically during the whole year. The other charges were less, and altogether the year's working expenses amounted to £34,939, or £17,221 less than they were last year. After meeting the working expenses and providing £22,888 for the year's debenture interest and sinking fund, there remained a balance of £107, making the amount to be carried forward £5,947, as compared with £5,840 brought in from last year's accounts. Altogether, considering the crisis through which Brazil was passing, and the increased difficulty in getting accounts collected, he thought the figures shown in the balance sheet were not unsatisfactory. As regarded the present year, business generally on the Amazon still continued anything but bright, and there was little prospect of improvement while the war lasted. The lower exchange value of the currency had lately been helping matters somewhat by increasing currency value of the rubber, whilst owing to lack of employment currency wages had so far not risen, but, rather, fallen. This gain in the currency price over the cost of production was acting in some measure as compensation for the excessive export duties which continued to handicap the Amazon rubber industry. This over-taxation should evidently be largely reduced, if not abolished, for, surely, it could not be in the interest of Brazil to paralyse its rubber interests by over-taxation. The economic conditions in the Amazon appeared to be gradually improving. A good deal of cereal planting was being done up-river, and the people should become more and more self-supporting and less dependent on imported supplies. The new crop, which would soon be coming down river, was expected to be larger than last year, and this should lead to increased activity and better business on the Amazon.

Mr. E. B. Ellice-Clark seconded the motion, and the report was carried without discussion.

Drake & Gorham, Ltd.

Mr. Bernard Drake presided at the annual meeting, held at Westminster, on November 11th. He said that £811 had been paid out of profits to the 62 members who were serving their country. In addition to this, fees had been paid in full to two directors, one of whom, Lieut. Carver, was at the Dardanelles. Out of profits, £1,194 was provided to cover depreciation on investments, and £555 for income-tax, as against £67 last year. Economies had been effected in several directions, without which a loss for the year would have been inevitable, especially in view of the disappointing results of the Manchester office, where the installation profits were less than a third of those for the previous year. The amount of work in hand at the close of the year was largely in excess of the previous year's record, and included some important installations. Amongst these might be mentioned a complete generating station for the United Alkali Co., which would contain three turbo-generating sets, each of 1,000 kw., and one of 250 kw., or a total of, say, 4,700 h.p. This plant would include Babcock and Wilcox boilers, Parsons geared turbines, condensers, superheaters, and all modern improvements, and would, it was hoped, lead to further work of the same class. It was to be used for electrolytic work in connection with urgent war requirements. They had also large contracts for the Cotton Powder and other powder companies, in connection with which they had made a special study of the requirements, for the Lord Wandsworth Institution, and the new buildings of the Horticultural Society at Wisley. Ten camps and military hospitals had been, or were being, fitted with light and power, as well as an aeroplane factory. The Queen's Hotel, Birmingham, was being lit for the L. & N.-W. Railway, and lighting contracts for Messrs. W. G. Armstrong, Whitworth and Co., Ltd., Lever Bros., Joseph Crosfield & Sons, and Topham, Jones & Railton, as well as a lengthy list of other installation contracts were carried out during the year. The wholesale department had sustained a severe loss in the death of its capable assistant manager, Mr. F. H. Gooch, who was killed at Vermelle after serving for eight months at the front with the Cameron Highlanders. The restriction of lighting and the absence of new building work had naturally affected the results, but, in spite of this, the net profit was slightly above that of the previous year. Attention was being paid to the lighting requirements of munition and other factories engaged in Government work. Owing to the shortage of carbons caused by the war, there had been a large demand for half-watt lamps with specially-designed fittings to replace arc lamps. They had manufactured complete switchboards for H.M. Office of Works, to be used at Windsor Castle, the Houses of Parliament, and elsewhere; also for corporations, power companies, and others. The shortage of capable labour had caused considerable inconvenience in the works. The use of commercial lorries and delivery vans propelled by electric accumulators had been extended during the year, and vehicles had been supplied to the Liverpool Corporation, the Corporation of Bury, Sir W. G. Armstrong, Whitworth & Co., Ltd., Messrs. Greenall, Whitley & Co., and the Blackpool Industrial Cooperative Society. Subject to their acceptance of deferred payment, they had the offer of several corporation orders. Considering the fact that one of their principal departments, viz., that connected with country-house lighting, had been so seriously affected by the war, he thought it was a cause for congratulation that they had been able to adjust themselves to the altered conditions and to show a small profit. This had been largely due to the ungrudging loyalty of the office staff, who had willingly undertaken the work of absentees by working long hours.

Mr. John Forbes seconded the adoption of the report, and the motion was adopted.

Berlin Electricity Works Co.

As the whole undertaking in the German capital of the Berlin Electricity Works Co. passed into the possession of the City Council on October 1st, the report of the directors for the year ended with June 30th, 1915, represents the final statement which will be made in as far as the Berlin works and system are concerned, the intervening three months coming within the new financial year under the fresh arrangements made for maintaining the activity of the company in other directions. The report states that the continued existence of the company was assured. The results of liquidation according to the existing reserve funds, to the accumulation of which close limits had been drawn through the participation in the profits by the city, would not have approximately corresponded to the quotations for the shares, although these had been influenced for years past more by the prospective expiration of the concession than by the receipts from the sale of electrical energy. Though it was by no means certain a year ago that the capital invested in the Berlin works would be released, the company was able, thanks to its intimate relations with the A.E.G. group, to secure extensive lignite coalfields at Golpa and Zschornewitz, which were held at its disposal without the payment of any intermediate profits, and which were originally intended to be the means of furnishing cheap current for Berlin and environs. It had, however, been ascertained in the event of the City of Berlin not deciding to accept the proposed distant supply, that the possession of extensive coal-fields would render possible the production of current at so low a rate that the supply to industrial undertakings, whose existence depended upon the cost of current, appeared to be assured. That had proved to be the case. The Bavarian Nitrogen Works Co., for instance, had undertaken to purchase 500,000,000 KW-hours for a period of 15 years, with the right of extension of the agreement, from the Electro Works Co., which the Berlin Electricity Co. had formed to work the coal-fields in question. In the case of the exercise of the right granted to the Bavarian Co. to withdraw from the agreement at the end of five years, arrangements had been made for the payment of adequate compensation by the latter. A contract had also been concluded with the Electro-Saltpeter Works Co., of Zschornewitz, for the annual delivery of 240,000,000 KW.-hours, and the supply would begin in the spring of 1916. The area of the coalfields had been enlarged by the purchase of the majority of the shares in the Leopold Mine, which adjoined the fields of the Electro Works Co.

The City of Berlin, subject to the completion of the accounts, paid to the company the sum of £6,150,000 on October 1st. Out of this amount had to be redeemed an open debt of £574,000, together with the payment of the dividend and the City's share in the profits for 1914-15. The purchase price also served for the acquisition of shares for £197,000 in the Leopold Mine and shares for £250,000 in the Elektro Works Co., to which the Berlin Co. was granting the funds for the erection of the great power station at Zschornewitz, and the company also defrayed out of the price shares for £370,000 in the Electricity Supply Co., which had been acquired for the purpose by the Zurich Bank for Electrical Enterprises. The details of these transactions and of the balance remaining would be set forth in the accounts for 1915-16. The unity of administration with the A.E.G. would be maintained with the consent of the boards of both companies, and with the alterations necessitated under the changed circumstances. In connection with the recent interchange of the Berlin Electricity Co.'s shares for shares in the A.E.G., it was mentioned that ordinary shares in the former for £1,738,000, had been exchanged, out of a total ordinary share capital of £2,205,000. The accounts show the following figures for the past two years:—

	1913-14.	1914-15.
Ordinary share capital	£2,205,000	£2,205,000
Preference shares, 4½ per cent. ...	1,000,000	1,000,000
Loans	2,792,000	2,792,000
Gross profits	962,000	798,000
Interest on loans	119,000	119,000
Renewal fund	32,000	27,000
Depreciation fund	256,000	249,000
Net profits and balance forward ...	567,000	426,000
Dividend on ord. shares	264,000	198,000
Dividend on ord. shares, per cent.	12	9
Carried forward	13,000	17,000

The report states, further, that the value of the connections advanced by 19,788 KW. to 300,472 KW. during the year, the increase representing 80,402 glow lamps, 2,007 motors, and 586 apparatus, and at the end of June, 1915, the connections comprised 2,187,203 glow lamps, 41,472 arc lamps, 44,950 motors, and 8,453 apparatus. The number of customers advanced to 51,769, and the deliveries were 252,762,233 KW.-hours, as compared with 267,589,125 KW.-hours in 1913-14, the decrease being attributed to the influence of the war.

Reductions of Capital.

County of Durham Electrical Power Distribution Co., Ltd.—A petition to confirm a reduction of capital of the County of Durham Electrical Power Distribution Co., Ltd., of Newcastle-on-Tyne, came before Mr. Justice Sargant in the Chancery Division, on Tuesday. Mr. Martelli, K.C., for the company, said it was proposed to reduce the capital from £500,000 in 100,000 £5 shares to £300,000 in £1 shares. The reduction was to be effected by cancelling capital lost or unrepresented by available assets to the extent of £2 per share, and by sub-dividing each £3 share into three £1 shares. The loss of assets amounted to £207,000, and it was proposed to write off £200,000. There had been a depreciation of the company's investments, which were of the nominal value of £282,000. The chief reason for the loss of assets was a change in the method of generating and distributing power since the company was incorporated in 1899. At that time it was the practice to use a number of small power stations, but now it was considered better to use one large central station. The company had recognised this, and had entered into an arrangement with the Newcastle-on-Tyne Co., the effect of which was to render a large proportion of their stations commercially useless. No dividend on the ordinary shares had been paid since 1907. His lordship confirmed the reduction.

"Z" Electric Lamp Manufacturing Co., Ltd.—Mr. Justice Astbury, in the Chancery Division, on Tuesday, on the petition of this company, sanctioned a reduction of capital of the company from £150,000 to £15,000. Counsel stated that the loss of assets was chiefly on the value of the company's patents.

Petrograd Electric Lighting Co. of 1886.—At a meeting of the Zurich Bank for Electrical Undertakings, on November 3rd, it was mentioned that the danger of the Petrograd Electric Lighting Co. of 1886 being compulsorily liquidated by the Government had passed away, the company having been placed solely under State supervision. It was, however, unfortunate that the Moscow City Council was attempting to bring about the liquidation of the Petrograd company or its supply works in Moscow, so as to gain premature possession of the local works. The former Ministerial Council had adopted a negative attitude towards these endeavours, but a change in the Ministry had just taken place, so that it remained to be seen whether the liquidation would now be undertaken.

International Light and Power Co., Ltd.—The report for the year to June 30th, 1915, states that the net profit, after payment of interest on debentures and London and Canadian administration charges, is £10,273, plus £3,886 brought forward, making £14,160. The preference dividend at the rate of 6 per cent. per annum for the year has been paid, absorbing £12,328, leaving a balance of £1,831 to be carried forward. The progress of the subsidiary companies in Venezuela and the Argentine has been retarded by the effects of the war. The political and social upheaval in Mexico has greatly depreciated the national currency, and the earnings of the Mérida undertaking have been seriously affected thereby.

Southern Brazil Electric Co., Ltd.—The report for the year ended June 30th states that the net earnings of the several Brazilian undertakings, so far as at present ascertained, show as a whole an increase in currency of about 8 per cent. on the year. On the other hand, the heavy depreciation of the Brazilian exchange tells severely upon the sterling revenue figures. After deduction of all charges in Brazil and London and of interest on debentures to July 1st, 1915, there remains a balance to the credit of profit and loss of £2,127, which the directors propose to carry forward.—*Times*.

Castner-Kellner Alkali Co., Ltd.—The directors have declared a final dividend at the rate of 24 per cent. per annum for the six months ended September 30th, 1915.

STOCKS AND SHARES.

Tuesday Evening.

The principal market in the Stock Exchange this week has been that for rubber shares. The rise in the price of the commodity, and the really excellent reports which are being made by many of the younger, as well as the senior, companies have attracted public fancy, with the result that the market during the past few days has worn an appearance strongly reminiscent of the boom time of 1909-1910. A thin film of dust, for instance, hung over the market. The press and crush were so great all day that perspiration streamed from the faces of those engaged in the business.

Money has not been made in the same way as it was in those days, for the simple reason that, speculation being prohibited, as well as open bidding and offering, there is an end to the dealing in such large lines of shares as enabled the big turns to be made in times gone by. When there are a lot of transactions in 50 shares at 2s., with commission at a halfpenny per share, the volume of work will be enormous, but the remuneration scarcely so marked.

In other departments, the uncertainty surrounding the attitude of Greece, to say nothing of that of Roumania, has provoked a little selling here and there. News from the Near East is too obscure to encourage Stock Exchange business, and investment buying has died away to some extent, although, taking the Stock Exchange round, there is a good deal more going on than might have been supposed when one remembers that the country is at war, and a good part of Europe engaged on the same sanguinary work.

Brazilian issues of various kinds are again on the mend. The recovery cannot be in connection with the rate of exchange between London and Rio, because this has remained about 12⅜d. for a week or more. But every day brings along new buyers for Brazilian securities; and in the inquiry for Government and municipal bonds, the tramway and other utility securities are not overlooked. Rio Tramway Firsts are firm at 93½, and the Seconds at 83. Anglo-Argentine Tramway issues, too, are in further request, and sharp rises have occurred more particularly in the first preference shares and in the 5 per cent. debenture stock. Other Argentine securities are more popular than they were, though some doubt exists as to the various harvests of the Republic, a good deal of news received in connection with the crops being conflicting, where it is not actually contradictory.

Mexican descriptions keep steady, but, in consequence of the lack of information with reference to affairs in the country, the recent buyers have stayed their hands, although very little stock has come into the market. The disposition is to wait for more definite news before either buyer or seller will make a move. New York is so absorbed in piling up profits, directly or indirectly through the war, that the rumour factories are not troubling to manufacture Mexican news at the present time. Doubtless, however, this will come in due course. Meanwhile, the only change in the group is a good rise in Mexico Tramways to 40, Mexican Light & Power common keeping steady at 10 points lower.

The theatrical movement of the week is a jump of 15 points in City Services common shares, and nearly as much in the preferred; this has lifted the prices to 94 and 83 respectively. No dividend has been paid on the preferred since July, 1914, but the company has just published a scheme whereby fresh capital will be assured and the company placed in a position to earn dividends on its common shares. The pyrotechnical rise was brought about, of course, purely by New York buying, and it gave people on this side an opportunity of selling their shares, of which some, at any rate, of the holders did not fail to take advantage.

Consolidated Gas & Electric Power of Baltimore common and preferred have reacted a trifle after their recent display of strength, and the American-Canadian munition shares of various kinds are mostly a little lower. It is stated, nevertheless, that both Canada and the United States are receiving huge orders for munitions from Great Britain and from Russia, both of whom, by the way, are also credited with being very large buyers of war material in Japan.

Electric lighting shares are so quiet that not a single alteration has taken place in the list of prices. It is a long time since this has happened, although it was a state of affairs common enough week by week a year ago. Manufacturing issues are almost equally quiet. Castner-Kellners are better at 3⅛, on the dividend announcement, making 20 per cent. for the year, as against 15 per cent. in 1913-14. Callender's debenture stock came to market without finding any ready support, and the price has, consequently, been marked down 7 points to 85.

This is an illustration of the manner in which a good many investment securities will have to be scaled down when holders want to sell, because obviously there is not much attraction in a commercial debenture stock yielding 5 per cent., however excellently secured, if the British Government is paying 5¼ per cent. for money at three, six, and twelve months dates of repayment. Treasury Bills, from which this rate of interest is obtainable, are a form of security the return on which, certain holders claim, is not subject to income-tax; and we suppose that there are not wanting some people quite ready to take advantage of such elasticity of conscience as Treasury Bills invite, and who would not return this income—for such it actually is—on the usual form.

Home Railway stocks are not a bad market, on the whole, although some of the recent steam has evaporated. The feature is the strength of Underground Electric income bonds, which are 3½ points higher at 74½. The rise is due to buying on behalf of those who look at the high yield and the fact that the interest is paid free of tax. The Company's first income debenture stock, which is cumulative, stands at 104. There is no particular change in either class of the shares.

New York Telephone bonds are good at 101¼, recovering the greater part of the interest payment recently deducted. Western Telegraphs have also picked up the dividend taken off the price last week. The Eastern group is firm, with small improvements in Eastern Extensions and Eastern Telegraph ordinary stock. Globe Telegraph & Trust shares of both classes retain their rise, and there is a little investment business going on in them. Marconis are also somewhat harder, but Americans keep quiescent at 17s. 9d. Substantial improvement has occurred in many of the shares in the copper mining list; indeed, the markets for nearly all base-metal shares are substantially stronger than they were a week ago.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Blackpool-Fleetw'd	Sept. 25	7,085	+ 2,182	38	33,886	— 458	8	..
Bristol	Oct. 29	86,771	+ 4,766	43	412,573	+ 88,565	30·5	..
Cork	„ 28	1,946	+ 101	43	21,839	+ 28	54·25	..
Dublin	„ 29	24,221	1,518	43	264,876	+ 10,457	9·89	..
Hastings	„ 28	3,551	6	.	..	+ 58	19·8	..
Lancashire United	„ 27	6,774	715	4	75,561	+ 4,682	42	..
Llandudno-Col. Bay	„ 29	1,043	— 279	48	16,583	+ 1,637	6·5	..
Tyneside	„ 27	2,298	— 201	17	10,950	— 503	11	..
Anglo-Argentine	„ 28	304,274	746	3	2,198,260	—138,435	..	..
Auckland	„ 22	20,841	1,054	16.2	8,126	— 2,001	25·42	1·08
Calcutta	„ 30	17,119	+ 2,498		..	+ 8,935	..	..
Kalgoorlie, W.A.	August	3,[illegible]6	..	35	22,119	..	..	..
Madras .. .	Sep 15	2,05	289	37	34,819	+ 458	..	..
Montevideo ..	October	27,157	+ 667	52	880,588	—80,882	..	
Dublin-Lucan Rly.	Oct. 29	796	+ 78	17	2,719	+ 98	7	..

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend, 1914.	Price Nov. 16, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	7½	—	£6 18 4
do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	3½	—	7 2 10
do. do. do. 4½ Pref. ..	4½	3¾	—	6 0 0
do. do. City Pref.	4½	3½	—	6 8 7
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4¼	—	5 17 8
do. 4½ Deb.	4½	87	—	5 3 6
City of London	9	12¼	—	7 7 3
do. do. 6 per cent. Pref. ..	6	10¾	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10	—	7 0 0
do. do. 6 per cent. Pref. ..	6	10½	—	5 17 8
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	83 xd	—	5 8 0
Kensington Ordinary	9	6	—	7 10 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref. ..	6	4¼	—	7 1 2
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	8½	2¼	—	7 15 7
do. 4½ per cent. Pref. ..	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	85	—	5 6 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6½	—	7 13 10
do. do. do. 7 per cent. Pref.	7	6	—	5 16 8
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6½	—	6 18 6
do. 4½ Pref.	4½	4½	—	5 9 0

Telegraphs and Telephones.

	Dividend, 1914.	Price Nov. 16, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	101½	— ½	5 18 0
do. Def.	1½	23	+ ¼	6 10 5
Chile Telephone	8	6½	—	6 3 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11⅞	+ ⅛	*6 15 0
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord...	7	124	+1	*6 9 0
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	82	—	4 18 0
Globe Tel. and T. Ord.	6	10¼	—	*6 13 9
do. Pref.	6	10¼	—	5 17 1
Gt. Northern Tel.	22	33½	—	6 11 4
Indo-European	13	46 xd	—	6 18 4
Marconi	10	1 23/32	+ 1/32	5 10 6
New York Tel. 4½..	4½	101½	+ 1½	4 8 9
Oriental Telephone Ord.	10	1 15/16	—	5 8 1
do. Pref.	6	⅞	—	6 17 2
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5⅝	—	*8 2 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12⅜ xd	—	*6 9 4
do. 4 Deb.	4	80	—	5 0 0

Home Rails.

	Dividend, 1914.	Price Nov. 16, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented ..	4	68	—	5 16 0
Metropolitan	1½	24¾	— ¾	4 18 0
do. District	Nil	14⅛	—	Nil
Underground Electric Ordinary ..	Nil	1⅜	—	Nil
do. do. "A"	Nil	5/-	—	Nil
do. do. Income ..	6	74½	+3½	*9 3 0

Foreign Trams, &c.

	Dividend, 1914.	Price Nov. 16, 1915.	Rise or fall this week.	Yield p.c.
Adelaide Sup. 6 per cent. Pref. ..	6	5	—	6 0 0
do 5 Deb.	5	97	—	5 3 0
Anglo-Arg. Trams, First Pref. ..	5½	4	+ ½	6 17 6
do. 2nd Pref.	5½	3⅜	+ ½	8 8 0
do. 4 Deb.	4	76	+ ½	5 5 3
do. 4½ Deb.	4½	75	—	6 5 0
do. 5 Deb.	5	80	+4	6 11 7
Brazil Tractions	8½	57½ xd	—	6 1 9
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	40	+6	Nil
do. 5 per cent. Bonds ..	—	50	—	Nil
do. 6 per cent. Bonds ..	—	44	—	Nil
Mexican Light Common	Nil	30	—	Nil
do. Pref.	Nil	40	—	Nil
do. 1st Bonds	—	60	—	—

Manufacturing Companies.

	Dividend, 1914.	Price Nov. 16, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	2 5/16	+ 1/16	6 1 9
British Aluminium Ord.	5	1 1/16	—	4 14 1
do. Pref.	6	18/8	—	6 9 9
British Insulated Ord.	15	10⅛	—	7 8 2
do. Pref.	6	5⅛	—	6 2 2
British Westinghouse Pref.	7½	84/-	—	8 10 8
do. 4 Deb...	4	72	—	5 11 1
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	10½	—	7 2 10
do. 5 Pref...	5	4½	—	5 11 8
do. 4½ Deb.	4½	85	— 7	5 6 0
Castner-Kellner	20	3⅛	+1/3	6 8 0
Edison & Swan, £3 pd.	Nil	10/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	57	—	7 0 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/9	—	7 1 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	12¾	—	*8 19 4
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	7¾	—	6 5 0
Telegraph Con.	20	33½	—	*8 8 0

* Allowance made for dividends being paid free of income-tax.

Fire at American Works.—Reuter reports that damage to the extent of £200,000 has been done by fire, the origin of which is uncertain, at the mills of John A. Roeblings, Sons and Co., at Trenton, New Jersey, who are manufacturing barbed wire for the Allies.

SHANGHAI ELECTRICITY WORKS.

(*Concluded from page* 627.)

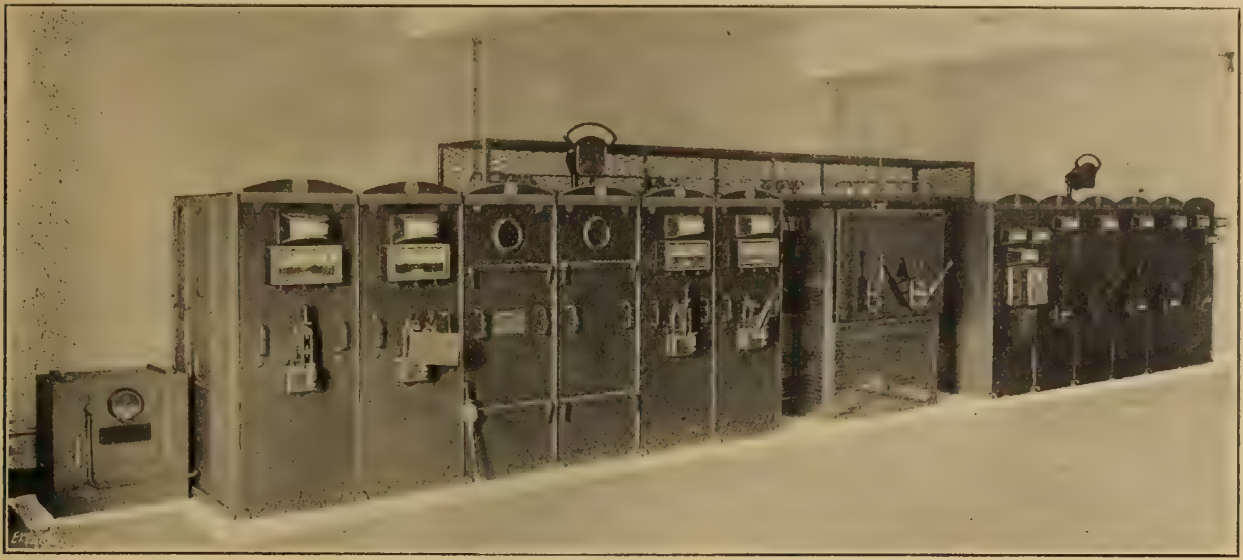
As we have already indicated (June 25th), although the Riverside station has hardly yet been completed, the rapid increase in the demand has compelled the supply authority to undertake large extensions, and Mr. Aldridge recently paid a visit to this country in connection with a scheme for the installation of additional plant of 20,000 KW. capacity, together with the necessary steel buildings to form an extension of the Riverside power house, and additional switchgear and cables. The extension will bring up the capacity of the station to 34,000 KW. At Fearon Road station two 600-KW. A.C. generating sets will be removed to make room for extra-high-pressure switchgear; this station will then have a capacity of 3,200 KW. (in addition to the traction plant), making the total capacity of the Shanghai municipal plant about 37,200 KW. The new extensions will be carried out on such lines that the old Fearon Road station, which is geographically the centre of Shanghai, will become a large distributing station, and eventually this will be fed by trunk feeders at 20,000 volts from Riverside.

Mr. Aldridge informs us that both lighting and heating are making steady progress, but the power demand shows a phenomenal increase; several large cotton mills are now connected to the mains, taking a bulk supply, one mill alone takes over 1,500 KW. day and night—most of the Shanghai mills work 24 hours a day. At the end of last year a new flour mill, equipped with the most modern American flour-milling machinery, was started up with power from the Council's mains, taking about 600 H.P. Other mills are being converted, and new ones erected—one which will be erected in the near future, adjoining the Riverside power house, is likely to require at least 2,000 KW. Whereas last year the units sold totalled 32,885,000, they are expected this year to reach 56,000,000, divided up as follows:—Private lighting, 16,980,000; power, 33,612,000; heating, 554,000; public lighting, 1,000,000; traction, 4,000,000.

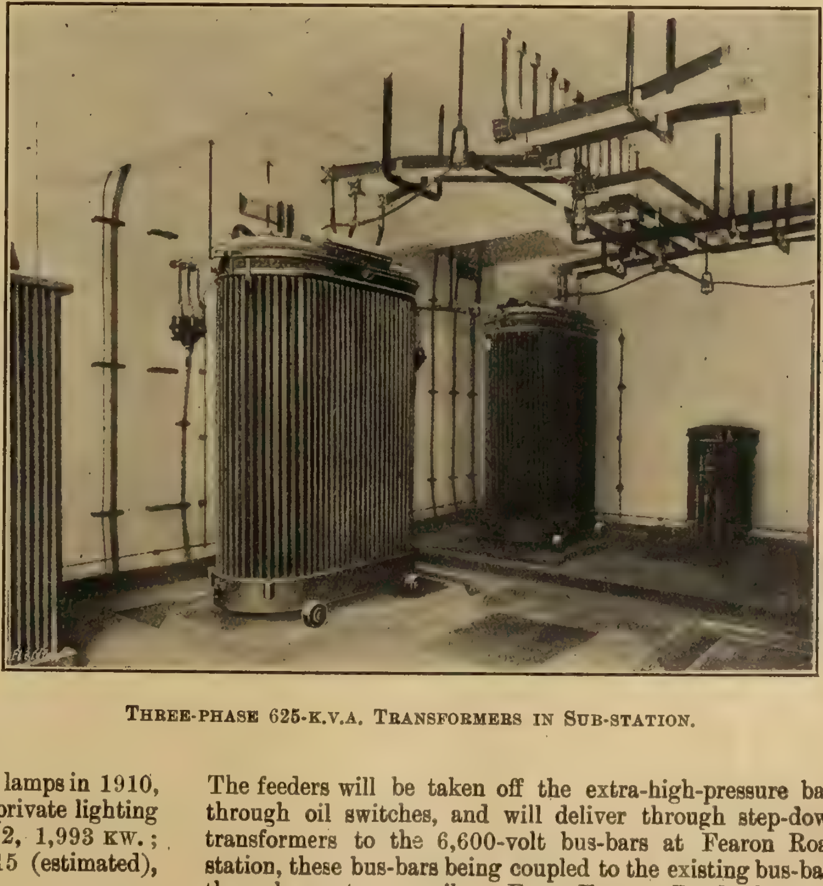
Since the introduction of metallic-filament lamps in 1910, the yearly rate of progress in the demand for private lighting has been as follows:—1911, 767 KW.; 1912, 1,993 KW.; 1913, 2,100 KW.; 1914, 3,500 KW.; 1915 (estimated), 4,600 KW.; 1916 (estimated), 5,000 KW.

The maximum load in 1916 is expected to be 21,000 KW., of which about 1,000 KW. is required for traction, leaving a load of 20,000 KW., to meet which there is a total installed plant capacity of only 18,400 KW., without reserve. Thus it will be seen that the necessity for extension is imperative. The present "extension," in point of fact, is half as large again as the first section of the Riverside station.

The new plant and the existing Riverside station will operate in effect as two independent stations, with separate boiler house plant and switchgear, although they will feed into a common distributing system. All the generators will work at 6,600 volts, transmitting direct to Fearon Road only, a distance of five miles; but whereas at present the trunk feeders are operated at this pressure, in the case of the new plant each generator will be coupled directly to step-up transformers raising the pressure to 22,000 volts, at which pressure the new bus-bars will be fed through oil switches. This section of bus-bars will be electrically coupled to the existing 6,600-volt bus-bars through transformers. The feeders will be taken off the extra-high-pressure bars through oil switches, and will deliver through step-down transformers to the 6,600-volt bus-bars at Fearon Road station, these bus-bars being coupled to the existing bus-bars through reactance coils. From Fearon Road duplicate

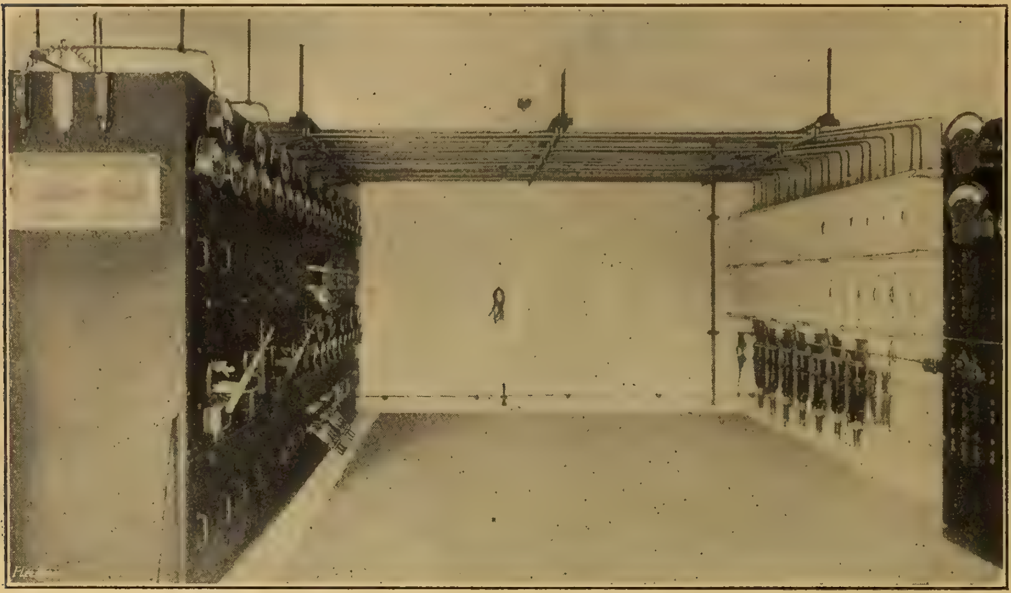


British Thomson-Houston 6,600-volt Switchgear in Standard 2,000-kw. Sub-station.



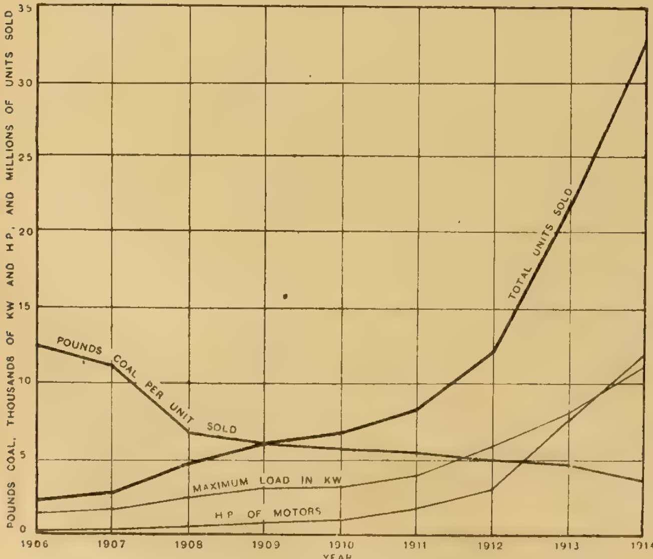
Three-phase 625-k.v.a. Transformers in Sub-station.

ring mains connect up the principal sub-stations in the city. In addition, an outer ring supplies the more distant sub-stations; this outer ring is also supplied by a pair of mains taken diagonally across to a point five miles from Fearon Road—that is, 10 miles from Riverside. It is proposed later on to increase the pressure on the diagonal mains to 20,000 volts by the use of step-up and step-down transformers. The total cost of the extensions is estimated at about £240,000.



B.T.H. Low-pressure Switchgear in Standard 2,000-kw. Sub-station.

We give herewith some illustrations of the equipment of the sub-stations, with high and low-pressure switchgear supplied by the British Thomson-Houston Co., Ltd. The arrangement is practically standardised, and is designed to secure the maximum of reliability at moderate expense. The ring mains are looped into the sub-stations, and so connected to the sectionised bus-bars that either feeder can be made dead without interfering with the supply. The Merz-Price system of protection is applied to the ring mains as well as to the generators. In the sub-stations the transformers are situated on the ground floor, and are surrounded by channels which would carry off the oil in case of accident, to an underground tank; they are mounted on wheels for facility in moving them. The high-pressure switchgear is installed on the top floor, whilst the low pressure gear is on the middle floor, to reduce the length of heavy cables leaving the station. The high-pressure switches are of the B.T.H. "truck" type, which can easily be withdrawn from their cubicles for cleaning or repair. It will be noticed that hardly any cables leave the sub-stations overhead—only the street lighting cables; the main distributors are usually laid underground from the sub-station for a sufficient distance to avoid the appearance of congestion overhead; they are then taken up the channels of I-section reinforced concrete terminal poles to connect with the overhead cables, armoured cables and Siemens pot-heads being employed.

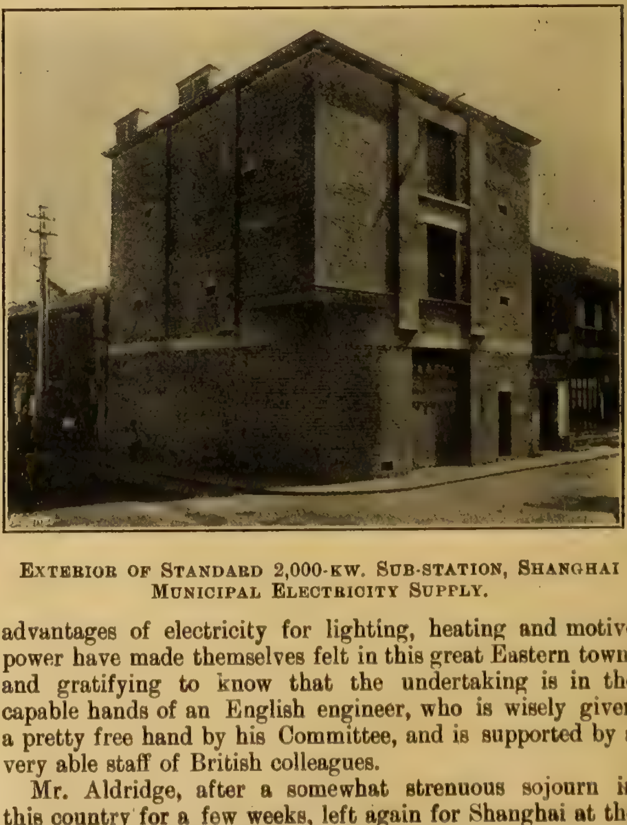


Curves showing the Progress of the Shanghai Electricity Undertaking.

The whole of the plans and specifications for the works have been prepared by Mr. Aldridge, as municipal electrical engineer; in the case of the extensions, Mr. Aldridge works in conjunction with Messrs. Preece, Cardew, Snell and Rider. In our issues of April 21st and 28th, 1911, we reproduced at considerable length their reports on the first instalment of plant and mains in connection with the Riverside station.

The present chairman of the City Council is Mr. E. C. Pearce, who had been chairman of the Electricity Committee for some years, until on receiving the higher post last April, he had to vacate the former, no doubt with regret, for he had taken a great personal interest in all the works appertaining to the department. The Committee now consists of Messrs. A. W. Burkill, F. A. Fairchild, C. M. Bain, P. Peebles, and A. S. P. White-Cooper. The chairman has been connected with the Electricity Committee almost continuously during the past 14 years, and possesses a thorough grip of the electricity supply business with its many ramifications, a very essential qualification for a chairman.

We are indebted to Mr. Aldridge for the photographs which we have reproduced, and for the particulars regarding electricity supply in Shanghai, which are embodied in this article. It is interesting to observe how rapidly the advantages of electricity for lighting, heating and motive power have made themselves felt in this great Eastern town, and gratifying to know that the undertaking is in the capable hands of an English engineer, who is wisely given a pretty free hand by his Committee, and is supported by a very able staff of British colleagues.



Exterior of Standard 2,000-kw. Sub-station, Shanghai Municipal Electricity Supply.

Mr. Aldridge, after a somewhat strenuous sojourn in this country for a few weeks, left again for Shanghai at the end of last month, with our best wishes for the continued prosperity of his big undertaking.

GERMAN BUSINESS METHODS AS I KNEW THEM.*

Except that a working journalist is supposed to possess a good many of the attributes of a dynamo, I am at a loss to comprehend why I have been honoured with an invitation to address the British Electrical and Allied Manufacturers' Association.

A journalist always skates on thin ice when he attempts to talk business with business men. There are only three or four of us who know anything about business, and the rest of us are all working for them.

During my ten years' of professional activity in Berlin as the resident correspondent of London and New York newspapers, my time and thought were largely preoccupied with observing and reporting the Fatherland's preparations for her assault on a peaceful and happy world. My lot was cast in Germany in the years when the tiger was crouching for the attack. He—let that at least be said to his credit—made ready for the fray without stealth. He sharpened his teeth for all the world to see and hear.

Foreign correspondents in Berlin, even though bound to specialise in high politics, could not live there as long as I did without acquiring at least a knowledge of German business methods in broad outline. As I look back upon them now, I envisage them as a strange combination of scientific efficiency and diabolical unreliability. When I heard the German Chancellor, on August 4th, 1914, confess to all the world from his high place in Parliament that Germany had violated Belgian neutrality because "necessity knows no law," I heard him give expression to the basic principle of German business methods. Germany's conduct in war is on all fours with her practices in trade. In both, she believes that the end justifies the means. Never in all my long residence in Germany could I reconcile the skill, enterprise, and industry of the average German business man with his incredible disregard for the elementary principles of honour, propriety, and generosity. It is a hideous everyday commercial axiom in Germany that a man does not live up to his word of honour in business because he is not expected to. I once told a Berliner that a German always keeps his word, because he cannot get anybody to take it. That was too subtle for the Hun, and he is probably wondering yet what I meant.

The German business man is certainly an incongruous mixture of sagacity, zeal, and cunning. You go to Germany to give an order, let us say, for an electrical installation. The company with which you are about to deal will have you fetched at the station in a luxurious motor-car and send to welcome you a director who can talk English as well as you can. You will be escorted to a *de luxe* hotel, where delightful apartments have been reserved for you, and you will probably be confronted before the dust of travel has been removed with an elaborate schedule of how it is proposed to occupy your time outside of the hours when you are not at the works. For the week of your sojourn you will be blown off to entertainment and honours a potentate might envy, and you will leave town thinking, quite rightly, that as a business diplomat the German who has wined and dined you, and been your Diogenes through the highways and byways of his stupid "night life," is without a peer. But you will not have gone half-a-day's journey toward home before your late opulent host will begin to plot to get the best of you under the contract whose ink is not yet dry. He will keep the contract if it is in his manifest interest to do so. He will break it if he has a ghost of a chance to do so without any greater peril than a law-suit. If he is fighting a foreigner in his German courts, a law-suit can hardly be properly described as a peril, for in the compiled judgments of German courts cases are few and far between in which contract law has been interpreted to the disadvantage of a native litigant.

In the lexicon of German commerce there is no such word as "faith." Probably that is so because in the German language there is no such word as "gentleman." The unreliability of a promise is common in the most trifling departments of business in Germany.

The German business man is not constituted to view with equanimity a deal which has not turned out as profitably as he had hoped. Then it is that he will not shrink from squirming out of his contractual obligations either deliberately and in cold blood or seeking the sanction of the law for doing so. He has been known, for example, to do something like this: He will give A, let us say, exclusive agency rights in England for a German speciality for a fixed period of years. Aggressive, ambitious, and eagerness personified, he finds at the end of six months that A's sales are not up to the German's expectations. Thereupon he will not have the slightest compunction in entering into a surreptitious bargain with B for competitive rights with A, assuring B convincingly that he is in no way infringing A's rights. If there is trouble, he lets A and B fight it out. Take this case: A foreign corporation owns a trade-mark for a food product of international reputation; let us call it, for the purposes of the story, Congealed Prunes. The firm is surprised one fine day to learn from a friendly source in Hamburg that the Congealed Prunes Co., Ltd., of Berlin, is doing a massive trade in that well-known and popular brand of merchandise. The foreign concern finds that passing strange, as it has never exported to Germany. It sets inquiries afoot. What does it find? That a couple of estimable gentlemen, named Schultz and Meyer, having ascertained that Congealed Prunes were a good thing, in more ways than one, decided to annex the trade-mark for Germany and Austria, and having duly registered it at the Imperial Patent Office, were now its inviolable possessors under German law. They might have acquired Pears's Soap, or Beecham's Pills, or Westinghouse Air-brakes in the same way and proceeded to manufacture under those names a German substitute for the real article.

There is an immense traffic in illicit business information in Germany. Priceless commercial secrets have a habit of reaching competitors with frequency. Again, I presume that misdemeanours of this sort are not unknown in this country; but I am convinced that underground trading in the private affairs of your rivals, who are often your friends, goes on in the German business world to an extent utterly unknown in Anglo-Saxon communities. Sometimes I have thought that it is the eagerness of German banks to exploit new industries that has encouraged the practice of an engineer or a department superintendent or a managing director going to a bank and inducing it to finance a competitive works purely on the assurance that the applicant for capital, through his confidential knowledge, is able to snatch the business of an older-established concern in whose employ he has been for many years, and often enough still is. It is considered perfectly ethical from a German banker's standpoint to supply funds for industries born under these criminal auspices. I have been told that many successful German works came into existence in exactly that way. Everybody does it, so custom seals it with approval. It is just as recognised a business proposition, I suppose, as it is for a German cavalier to advertise in a newspaper that "a man of good appearance, excellent family, university training, and congenial nature, is willing to marry into a well-established business—only child preferred." For years you in this country have extended limitless hospitality to young Germans, who have made you believe that they were willing to work long hours in your offices and works for the purpose of acquiring the English language and British business habits. I wonder if it has ever occurred to you that they might also have been possessing themselves of your vital business secrets and communicating them, in the magnificent spirit of "Deutschland uber Alles," to some unknown General Staff of Commerce and Trade in Berlin or Hamburg, there to be filed, card-indexed, and exploited in Germany's boundless purposes in the markets of the world. I do not allege that the German "volunteers" who have thronged the City and the shipping offices and counting houses of Liverpool, Manchester, Birmingham, Bradford, Glasgow, or Sheffield for the past twenty years have actually been commercial spies, but I do say that, judging by conditions in their own country, they were not above it. I am afraid that the cheap German clerk who has infested British offices was one of the costliest investments British business men have ever made.

I pass now, though I have only tried to sketch the one side of the medal in vaguest outline, to the other and brighter side. There *is* another side, and it *is* very bright. I refer to the splendid groundwork of organisation on which the German commercial structure rests. To you men of the British Electrical and Allied Manufacturers' Association any account of German industrial organisation must be an old story. I should think it were a tiresome story, too, in many respects, for the world, in its admiration of scientific business management in Germany has been a little prone to exaggerate its merits. I would consider it impertinent for me to attempt to tell you either of the existence or excellence of German organisation in your own branch. I am sure that the broad, general scheme under which the A.E.G. and the Siemens-Schuckert concerns wage trade war at home and abroad are perfectly well known to you, and that nothing I could say to you about them could conceivably sound anything but amateurish, and would probably be brilliantly inaccurate.

I am fairly certain that a trip through your great works at Trafford Park, Rugby, Stafford, Wolverhampton, Birmingham, or Bradford would reveal to the practised eye that shop management in the British electrical trade is in every respect on a par with any systems which have sprung from the brain of a Rathenau. I have heard it said that perhaps in only one department of your industry has German practice given better results than those achieved in this country. I allude to the passion of the German manufacturer for specialisation. To this is due his habit of employing an extraordinarily large number of engineers. An American engineer once told me that in a works employing 500 men it was not uncommon in Germany to find a staff of 50 engineers. These engineers, on their part, are content to devote their skill and energies indefinitely to a specific and more or less minor speciality and to concentrate on developing it, instead of aspiring to generalise in the engineering field, even though thereby the status and emolument of the engineer might be considerably improved. The result of this system, as far as the works is concerned, is that it marshals an engineering staff of varied and highly specialised talents, their joint teamwork insuring the maximum of general efficiency. In practice this system also, I suppose, results in a works obtaining valuable markets for specialities. It is all part and parcel, this specialising mania of the Germans, of their infinite capacity for taking pains: a trait which has as much to do with their conquests in the foreign trade realm as any other one factor. The readiness of the Germans to make anything for anybody anywhere is one of the secrets of his international commercial progress.

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* Abstract of some remarks by Frederic William Wile, late Berlin correspondent of the London *Daily Mail*, at an informal gathering convened by the British Electrical and Allied Manufacturers' Association.

The German has always looked up to Great Britain as the master business mind and the Mecca of all those who would study commerce at the fountain head. That is why the three greatest commercial geniuses Germany has produced in our time—Ballin, the shipping king; Thyssen, the Carnegie of the Fatherland, and the elder Rathenau, who died in June—all served their business apprenticeship in these islands. No modern young German business man, at least before the *Gott strafe England* era, considered that he had had a proper start in life without personal acquaintance with the commercial practices of this country. He may have had his degree from the Commercial High School or the Colonial Institute of Hamburg or Cologne, or graduated from the great Charlottenburg Technical College at Berlin, but until he had actually taken a course with the "Shopkeeper of the World," he looked upon his training as incomplete. It is probably known to most of this audience that the Allgemeine Electricitäts Gesellschaft, of Berlin, when it decided, about ten years ago, to go in for export trade on a broad scale, entrusted the organisation and management of that department to an English engineer. When he took charge, the A.E.G. were doing £100,000 a year in export. When he left their service at the outbreak of the war they were doing £2,000,000. When Lord Claude Hamilton, the chairman of the Great Eastern Railway, a few years ago set up the remarkable doctrine that England had no young men of sufficient managerial capacity to run a great transportation system, I recalled how Germany had found it necessary to come to England for a 31-year-old engineer to superintend the foreign trade of her greatest electrical undertaking.

Yet, even though Germany has traditionally looked upon Britain as the mother of commerce and trade, the Germans have undoubtedly outstripped this country in respect of organisation. Still an agricultural State long after England was a great industrial State, it was necessary for Germany to resort to intensive methods if she was to catch up with a country decades ahead of her in wealth, power, plant, and experience. Against the superior numerical strength and natural resources of Britain she decided to match organisation. It is the same card on which she staked her chances to win this war. She knew perfectly well that in all the potential sinews of war—men, money, munitions, food, ships, and everything else—she was palpably inferior to the combined resources of the Allies, and that her inferiority must become more marked the longer war lasted. What she figured on was that German super-organisation of inferior resources would overcome unorganised superior resources.

Without straying farther from the point, let me repeat that Germany resorted to hyper-organisation as the most effective means at her command to overtake the lead of older industrial civilisations. Dr. Walther Rathenau once explained to me that that is the reason why the Fatherland in the past 44 years has developed numerous business geniuses, but no great politicians. When Bismarck built the Empire with the cement of blood and iron, he fashioned a structure so complete for all immediate purposes that the brains of the country, eschewing politics as a useless career, went in for business as the field which offered the greatest promise of both fame and fortune, as well as the greatest opportunity for national service.

How zealously and successfully they went to work Germany's trade balance in the last year before war is eloquent testimony. To me it will for ever remain testimony that, however much the German war party, who caused the war, hankered for it, the German business world wanted peace. Germany's industrial development is a romance well worth a historian's narration, and, once written, will deserve a place among the text-books of all peoples desirous of raising themselves to economic affluence. It will tell of almost countless guilds, leagues, associations, and societies, and notably the powerful Cartels, or syndicates for regulation of sales, prices, and output, formed to deal with every branch and sub-branch of mercantile activity. Cartels are the German name for trusts, which they resemble in all essentials. I recently heard the statement made that there are no less than 30,000 associations of one sort or another dealing with the question of foreign trade alone; a likely enough assertion when we stop to consider that German economists acknowledge that 72 per cent. of the population is directly dependent upon industry, as compared with 28 per cent. which lives on agriculture.

But it is to the tremendous zeal and application of the German, especially in export trade, that his success is principally due. He is an insatiable student of the demands of the particular market on which he has designs. He puts its local customs, prejudices and traditions under his microscope before he begins catering for its business. He learns, in particular, all there is to know about its credit system, and prepares to accommodate himself to it. He will not be ashamed, if necessary, to wait three or five years for his money, where an Englishman, a Frenchman, or an American would not dream of extending credit for more than 90 or 100 days. I have been assured by a notable member of your own trade that no German merchant ever took an order away from an English, American, or French firm *on equal terms*. Either the German goods were lower in price, or they were a good deal better for the same price, or there was some distinct advantage of some other kind. The German makes it his business, somehow, to see that the advantage is there. It may only take the form of submitting catalogues or tenders to the firm in Holland in the Dutch language and in guldens, or to the prospective customer in Spain in Spanish and pesetas, or the German may be guilty of so revolutionary a thing as to cut his cloth for Patagonia as the Patagonians want it, and not as the Germans think they ought to have it.

Then, there is the systematic and sleepless support which the German Government affords to its business pioneers throughout the world. German Embassies and Legations, besides being centres for purely diplomatic intriguing, are headquarters of the German business organisation in their particular capitals and countries. A German business man never appeals to them in vain for counsel or assistance. The German consular service throughout the world is a business-getting service, pure and simple. But in addition to all these external aids to trade there is the wise system of developing commerce by sagacious legislation at home. I mean, of course, most particularly, the scientific protective tariff, with its "fighting" rates, and the effective scheme of reciprocal commercial treaties which are based upon it. There is the intimate partnership between the great shipping companies and the Government, which finds expression in subsidies and liberal facilities for port and docking necessities. There is the practice of preferential rates to German merchants and manufacturers engaged in the export trade, for transport of both their raw materials and finished products over the lines of the State railways, or on the State-owned canals. There is that abiding interest in the welfare of industry which the Emperor never fails to take—such little things as going to the works of the A.E.G., as he did on one occasion which I well remember, to listen to a two-hour highly technical dissertation on a new turbine. There is the system which he insisted upon developing, much to the disgust of his snobbish aristocratic *entourage*, of conferring distinguished honours, social and otherwise, upon men whose claim to distinction was only that of having brought some new glory to German industry.

We read much these days of the "Capture of German trade," but I wonder if it is being approached with that far-sighted and comprehensive thought and energy which alone will pave the way to the desired goal.

I had an opportunity the other day of talking to an Englishman who knows more about German trade practices, especially in the realm of export, than any man now in this country. I asked him what he would do if Mr. Asquith decided to create a new Government department called "Office for War on German Trade" and placed him in autocratic charge. His reply was evasive, yet illuminating as a searchlight. He said: "England wouldn't know what to do with Germany's trade if it were offered to her on a silver platter to-morrow." England had not the necessary plant to begin with. That was obvious. Nor the available capital required for such vast extension of plant as coping with Germany's trade would demand. But what was a thousand times more deplorable was the deep-rootedness in the most eminent British industrial quarters of ethics and methods—at even the zenith of the Lloyd George "speeding-up" era—as violently out of tune with the needs of the hour as Nelson's wooden *Victory* would be among Admiral Jellicoe's ironclads.

In my German papers I read that German exporters are on tip-toe waiting for peace suddenly to break out, in order that the markets of the world may be the scene of dumping of vast quantities of Teuton wares on a scale hitherto unwitnessed. From a meeting of the leading German industrial associations at Dresden the other day a telegram was sent to the Kaiser assuring him that the manufacturers of the country, with their organisation, plant, energy, ingenuity, and eagerness unimpaired by the war, were only waiting for the moment to arrive when the German commercial army could once again clear for action throughout the globe. This is one of the most significant warnings from business Germany to reach the outer universe, and it ought to be taken seriously to heart in England. In the United States defensive measures are already in prospect. Congress is to be asked at its forthcoming session to pass legislation making it unlawful for foreign manufacturers to sell their products in America at less than the cost of production there, in order to protect American merchants from an inflow of cheap products from abroad at the end of the war.

I am aware that British industry in general, and your own great branch in particular, have concentrated during the past year on war and Government work. I know that this has seriously interfered with the prosecution of export trade, but unless you begin now, no matter how urgent your present pre-occupations, to look far ahead and think of things after the war, I am very much mistaken if you will not find that the Germans have out-generalled you. They, too, are pre-occupied with war work, and Jellicoe effectually frustrates, even if they were not, any possibility of their doing export business. But you may be quite sure that with their marvellous faculty for leaving no contingency uncontemplated, they are at this very hour busily planning and plotting for a new raid on the world's markets of even a more determined character than any effort they have ever put forth in the past. With the vast accumulation of bonded indebtedness which your war finance is piling up, the need for intensive exploitation of export trade will be far more urgent than at any previous time in British history. Face the future now instead of later. Set Germany the pace, instead of following supinely in the lead she will be all too ready to assume. She relies on your "week-end habit of mind." She figures on exactly what is taking place: your absorption in the present, and characteristic British thoughtlessness for the time to come. Your fleet has paralysed German commerce during the war. Let British sagacity, thoroughness, far-sightedness, and organisation keep it paralysed after the war. "Waiting to see" will be as fatal to British industry as it has proved for certain politicians.

Above all, make your Government understand that you cannot meet German competition on equal terms, to say nothing of capturing German trade, until there is that offensive and defensive alliance between Government and industry which has contributed so largely to the development of the enemy's commerce both at home and abroad. Make your Government realise that one of their vital functions is to facilitate, not hamper, business. Make them see that the British business man is henceforth welcome at British Embassies, Legations, and Consulates in foreign parts, and no longer regarded an ignoble intruder on diplomats who spend far too much time merely in dining out on their country's behalf. Make your Government see what tariffs have done for German trade. Make them establish a ministry for foreign commerce with a minister at its head who is an eminent and practical business man, and not a meritorious politician.

Make your banks above all realise the *rôle* they have to play in promoting British export trade. Tell them how the story of German industrial development is very largely the story of lavish support of commercial undertakings by banking capital. Insist upon a condition in future where a manufacturer looking for funds for the foundations of a legitimate enterprise will be the most welcome of all visitors to the marbled premises of your joint stock octopuses. When the bankers of England have learned how the German merchant and manufacturer seeking trade abroad are accompanied step by step by the German banker, English financiers will have acquainted themselves with still another secret of German economic progress. And their studies will not be complete until they have looked into the system which German banks have brought to the point of a fine art, of extending the German credit scheme into whatever foreign district, no matter how remote, that Germans have invaded for trade purposes.

Make your great shipping and railway companies realise that, along with the banks, they are the natural allies of British business men in pursuit of foreign markets. Make them see that the extraordinary emergency in which the export trade will find itself at the close of the war requires extraordinary co-operation of all interested agencies, and that a spirit of broad-gauge and liberal concessions is required if the emergency is to be adequately met.

Make your rising generation of young business people appreciate the value of foreign languages. Not a few of the German triumphs in export markets, particularly in Britain's own Dominions and in the East, have been directly attributable to their command of English. Their progress is South America has been due in no little degree to the fact that they send there, with samples and order books, agents who know Spanish. Until you British equip yourselves to deal with the Russians in Russian, with the Scandinavians in their tongues, with all the purchasing peoples of the earth, in fact, in terms familiar to them, you will enter the forthcoming race for world-trade domination handicapped in favour of the pains-taking, thorough-going German.

There are two or three other things in your power after the war which no amount of German organisation or recuperative talent can overcome, and you will be recreant, in my humble judgment, to your elementary self-interest if you fail to come to grips with them promptly and comprehensively. I would build round the British Empire first of all a tariff wall so high that no German manufacturer who ever lived could leap it. As eternal punishment for the crimes of which the *Lusitania* will for ever be the symbol, I would place the brand of Cain upon the forehead of German shipping by decreeing that a German vessel of commerce should never again pollute the waters of a British port. I would cause it to be looked upon as a disgrace for any British merchant to offer German goods across his counter. I would withhold the right of naturalisation from German subjects, for unless that were done the privilege of British citizenship might some day be extended to one of the executioners of Edith Cavell or a man who helped to murder our wives and children from the bomb platform of a Zeppelin. I know that time heals even the scars of a great war, but the wounds which German warfare has ruthlessly cut across not only the British Empire, but civilisation itself, being of no common sort, call for retribution of no ordinary calibre. England will do everything that Germany hopes for most dearly of all if you return to the state of "business as usual" with her when the guns are no longer barking. You business men have a stupendous and inspiring task before you in seeing that German dreams of rehabilitating German trade, in British markets at least, remain blasted for all time. As one who is your unqualified well-wisher, I devoutly trust you will rise to the opportunity and master it.

After a brief discussion, Mr. D. N. Dunlop, the Secretary, said that he did not agree with all that Mr. Wile had said. German methods had brought about this war, and he thought that they would bring about the downfall of Germany. What was needed was a strong Federal Association of all the organisations in this country. A Minister of Commerce was not of much use unless he was backed by a capable organisation. A Board of Trade Committee was sifting out the facts in regard to the trade position, and the B.E.A.M.A. was taking an active part. It had appointed overseas committees, and was appointing correspondents all over the world. It was by taking off the coat that we should win. The work was not going to be done all at once. He believed in co-operation, and by co-operating they would succeed. The Council had given, and was giving, consideration to many matters, and it was backed up by the men of the different departments. There was no need for pessimism. What was wanted was strong co-operation of all interests in the industry, and if a little patience were exercised it would be found that when the war was over they would by co-operation with the Institution and with Government Departments have available a structure, which was being slowly put together, which would greatly benefit British trade.

Mr. Davenport, in closing the proceedings, said that the Association was trying to avoid a policy of "wait and see." It was hard to find time to get the people who should be interested in the subject to give their attention to it. There were indications that the Government Departments were waking up to the seriousness of the future position. German competition would be extremely severe after the war, and there was a need for a closer Imperial Brotherhood between the Colonies and the Allied countries.

POWER STATION SWITCHGEAR.

Mr. P. V. Hunter, Chairman of the Newcastle-on-Tyne Local Section of the Institution of Electrical Engineers, in his inaugural address on November 8th, spoke at length on power-station switchgear. He said that the diversity of opinion as to the correct design and arrangement of power-station switchboards was most striking. It was common to find two power stations of similar date, in close agreement as to general design and lay-out, but differing radically in the arrangement of the switchgear. He gave illustrations in diagram of the bus-bar connections of five important power stations in this country and in America. The fundamental difference between the various arrangements was the degree in which they provided for internal breakdown of the switchboard; the more complicated arrangements made the more complete provision. They might correctly define the function of switchgear as being to maintain supply by isolating faulty sections. It was also logical to insist that before perfection was secured, switchgear should not only isolate faulty sections, but also provide against interruption of supply in the event of a breakdown of any part of the switchgear itself. On the whole, such differences in design as were met might be reasonably expected, since they were dealing with something quite outside calculation, namely, the probability of an accident to, or the failure of, any part of the switchboard.

After illustrating various types of bus-bar arrangements, Mr. Hunter said that it would seem quite reasonable that, if the effect of a bus-bar fault had to be limited, the proper way to do it was to divide up the bus-bars into a large number of separate parts, each part being so small that it included one section of the system only, the working of the remainder being independent of it. To some extent the degree of complication would depend on the character of the load. On certain loads little opportunity occurred for taking generators and feeders out of service, and in these circumstances bus-bar switches would have to be more frequent.

It was a fairly safe rule not to include more than two generators on one division of bus-bar, and if the generators were exceptionally large it was better to reduce the number to one. Speaking of the more common troubles met with in switchgear, he said these were, according to his own experience, and arranged in order of frequency of occurrence:—(1) Mistakes made by operating staff; (2) unforeseen effects; (3) failure of apparatus due to weakness or deterioration.

The most frequent mistake on the part of operators was to open the isolator of a feeder carrying load, instead of the one next to it. Notwithstanding the serious risk of such accidents, they did occur, really due to the fact that a switchboard consisted of a large number of parts of identical appearance, the only distinction being the labelling. Various suggestions for the adoption of distinctive colouring, etc., had been made, but the most satisfactory arrangement was a complete system of screens and interlocking. The arrangement could be made to provide that no access could be obtained to conductors while they were alive on account of the screens being automatically locked under these conditions. The oil switch was interlocked with its isolators, so that the latter could not be opened or closed while the oil switch was closed. There still remained the difficulty that the feeder terminals might be alive through some mistake in not opening the switch at the other end of the feeder. This was met by replacing the disconnecting switches, normally used between the switch and the feeder, by a set of earthing switches.

Interlocking, if adopted at all, must be complete, as partial interlocking led to more accidents than its complete absence. The bus-bars had to be dealt with separately. A simple method was to treat each length of bus-bars as a unit, and place it and the isolating switches disconnecting it from the oil switches, in a gallery. Access to the bus-bars was obtained by means of a door at each end of the gallery only. A locking bar from end to end of the gallery was provided. This bar could not be rotated into the position that allowed the two doors to be opened until every oil switch connected to the particular length of bus-bar (including the bus-bar switches) was open and isolated.

These precautions, if carefully designed and constructed, were not expensive compared with the alternative of more complicated switchgear, and should give immunity from mistakes leading to breakdown on the switchboard itself.

Under the heading of unexpected effects, the principal item was abnormal mechanical forces occurring on short circuits. Most trouble had been experienced with isolating switches opening unexpectedly. These forces were generally recognised, and could be provided against. Another possible source of trouble was the fusing of the primary winding of current transformers having wound primaries.

Referring to oil switches, he said it was not so generally known that the vapours and gases given off when opening heavy loads were highly conducting; he had known cases where oil switches had successfully opened heavy short circuits, and the gases afterwards escaping from the switch had produced another short circuit outside the switch.

The failure of switchboards through deterioration was a rare occurrence. Experience had led to the use of materials of permanent character, and, in particular, rubber insulation for high-tension circuits had been abandoned.

In conclusion, he said he felt sure that it was a better procedure to adopt arrangements preventing those particular faults to which switchgear was most liable, rather than to regard the faults as inevitable, and provide complicated arrangements to limit the extent of them. Experience led him to the view that it would be a mistake to attempt to standardise switchboard arrangements, or switches. His personal opinion was that there was a strong probability that future development would include, not only safety interlocks, but the complete abandonment of bare conductors for high-tension power station switchboards, and that the security of supply thus obtained would justify the use of a minimum of switchgear.

THE ELECTRICAL INDUSTRY AND THE WAR.

On Thursday last week Mr. H. Hodgson Wright delivered his inaugural address as Chairman of the Yorkshire Local Section of the Institution of Electrical Engineers, from which we make the following extracts:—

The one outstanding fact that this world-war has taught us is that success cannot be won without the aid of the engineer and mechanic, and an organised production of munitions of war on a scale far vaster than ever imagined before. In no previous war has the engineer, both mechanical and electrical, played such an important part.

The highest and most specialised skill of our engineers, metallurgists, and chemists is directly pitted against the skill of the enemy in the production of new designs, new metals, and explosives. Every new weapon must be an improvement on the last, thus the war is proving a great spur to invention in every branch of engineering.

Science has been organised: its units have been registered and the best brains of the professors and students of science throughout the Empire are being made use of.

Twelve months having passed since the admirable inaugural address of our immediate past chairman, I propose to devote a few remarks retrospective to some of the points raised on that occasion. They have an even greater significance to-day, in the light of the present situation.

That address very properly indicated the duties devolving upon those of our profession remaining in civil life. I only propose to refer to three of these duties, which are interdependent and inseparable.

The first is: "To do all possible to support the sentiment 'business as usual' with regard to the electrical industry in particular and all other British industries in general."

Whilst this sentiment was then admirable in itself to indicate that our factories must be kept going, it must not have the effect of weakening our determination to put the last ounce of energy into the production of munitions.

At the present time, therefore, the sentiment "Nothing as usual" would be more appropriate. Twelve months ago, only our largest engineering works were organised for the production of munitions. Now nearly all, irrespective of size, are "controlled" by the Government.

Secondly: "To assist in every way possible the efforts which are being made by British manufacturers to capture and retain foreign and colonial trade which until recently has been in the hands of alien enemies."

During the war we have an industrial breathing time so far as German and Austrian competition is concerned. What measures are we taking as an electrical manufacturing industry, either individually or collectively, to conduct the coming industrial war?

Once hostilities are ended, the ability and organisation of Germany will be directed to underselling us in every market of the world. Prohibitive tariffs will, to a large extent, prevent her trading with Belgium, France, Italy, and Russia for many years. Whether we shall allow her to compete freely with us and our Allies, within the Empire, is, I hope, at least doubtful. A much restricted world market is, for her, in any case, certain.

Nor shall we ourselves be free from severe competition by our Allies and by neutrals, particularly America. In Germany economic causes will force a reduction of wages, and a flood of cheap German goods will result. No great wage reductions are probable in this country.

To meet these conditions we must cheapen production by better organisation, improved machinery, designs, and co-operative sale methods. Increased efficiency of production and the utilisation of existing and new scientific methods are absolutely necessary if we are to hold our ground against the coming competition.

We need a higher and more general standard of specialised technical education for our engineers. It is here that Germany has gone ahead, and she has reaped the benefits of that education in the organisation of her factories.

Many manufacturers still continue the old-fashioned sale methods of waiting for customers instead of waiting on them. There must be a complete change of these methods.

A much closer study of foreign markets is needed; for that purpose a thorough technical and commercial education is as necessary for our salesmen as for our engineers. Much foreign business has gone to our competitors owing to our neglect and lack of commercial organisation in foreign markets. Our expert salesmen should have passed through every shop and should have held positions in the estimating and designing departments, and should be capable of advising customers on highly technical questions.

If financial reasons prevent the employment of a staff of highly salaried commercial experts abroad, then costs may be reduced by co-operative sale methods.

By carrying the same principle a step further, electrical manufacturers would extend their foreign markets by combining to charter an electrical exhibition ship fitted up with those goods which are most in demand. The cost per firm need not be much more than that of a land exhibition. The ship might be chartered every four or five years, and the stay at each port would be determined by the importance of the market.

I am confident that a co-operative scheme of this kind is possible, and would result in the capture and retention of much valuable trade formerly held by enemy competitors.

Far too little attention has been given by our sales engineers to the study of foreign languages, and I strongly recommend our junior members, whose duties may take them to foreign countries in later years, to learn at least one language besides their own. Yet it appears to me that, however perfect we may be individually as salesmen, and however closely we may study foreign markets, there will still be wanting for complete success that organised State assistance which Germany has so lavishly extended to her foreign industry.

Our foreign trade can never be fully developed without diplomatic, legislative, and financial assistance. The Board of Trade, as at present constituted, and the diplomatic and consular services, as carried on by the Foreign Office, are not adequately equipped for the encouragement and protection of our foreign trade. The Board of Trade was originally intended to deal primarily with transport, *i.e.*, shipping, railways, and carrying agencies.

The great spending departments of the Government are controlled by the Admiralty and War Office. Is it not quite as important that the earning, or trading, side should be also controlled by a separate Government Department?

A permanent and non-party Board of Industry is required, presided over by one of our most experienced business men and advised by a permanent staff of experts.

It is almost incredible that practically no funds are set aside by the State for the purpose of advancing foreign trade. In the year 1913-14 the amount of our foreign trade was over 1,400 millions, yet the cost of running the whole of the Board of Trade, including the home departments, was only £213,000.

Apart from the consular services, the Foreign Office staff interested in trade in foreign countries usually consists of commercial attachés, having little or no special knowledge or commercial training, and who use their office as a step to advancement. But the limited number of these officials renders their work of small value; China, with a population of 400 millions, and a yearly import trade of 80 million pounds, has one commercial attaché.

It would be the business of the Board of Industry to appoint qualified trade commissioners in our colonies, dependencies, and all foreign countries, whose duty it would be to collect and report to headquarters all useful information as to trade openings and the activities of our foreign competitors, to negotiate for improved and, if possible, preferential trade relations, notably in connection with international loans, and to counteract and prevent the dissemination of false and injurious political and commercial information by enemy competitors.

Thirdly, "To consider carefully the methods of educating and training young electrical engineers with a view to re-organising and improving such methods, in order that in future the designing as well as the manufacture of all electrical apparatus required for the naval and military services, shall be carried out by British-born subjects. Special attention should also be given to business training, so that the business methods of British firms may be entirely up-to-date and their sales organisation controlled by Britishers."

The importance of the proper scientific training of our electrical engineers and, indeed, the complete overhauling of our present education system, is a subject which is vital to the electrical industry.

It is a remarkable fact that England, the birthplace of modern industry, is the last of the great nations to build up its educational system. We are still behind other great nations in making public provision for the higher branches of education.

Even at the present day we have no national system other than that of elementary education, which is very far from meeting the needs of the nation.

The inseparable relationship between education and national success in commerce and industry is a fact which hardly needs proof, but which will become more accentuated as years go on, due to the higher standard of training required by our artisans and engineers.

One of the first duties of our legislators after the war should be to provide the country with an organised system of compulsory primary and secondary education, forming a co-ordinated step to our technical high schools and universities.

The leaving age for primary schools should be raised, and the continuation schools made compulsory. The last period at the primary school should be devoted to a pre-apprenticeship training, during which the youth's aptitude, or otherwise, for engineering would be proved.

Our present haphazard apprenticeship system results in lads being put into trades for which they have no natural ability, and the financial position of the parents only too frequently demands that the boy be put to the trade which pays the highest wages, irrespective of his aptitude for it.

It should be the special duty of the teachers during the pre-apprenticeship period to note the boys likely to be suited to skilled handicrafts.

The teachers should be encouraged to acquire a first-hand knowledge of the scope and requirements of the local engineering trades by study and visiting the works. A much closer collaboration between the education authorities and the engineering employers is necessary, and would lead to more suitable youths being selected for trade apprenticeship.

It is gradually becoming recognised that the only effective way to train the rising generation of skilled workmen after leaving the elementary schools is to have half-time in the workshop and half-time in the technical school between the ages of 14 and 18.

A number of our principal technical schools give a two or three years' day course of instruction for student apprentices during the winter months. These are steps in the right direction, and I should like to see the scope of the classes widened to form part, or an extension, of our elementary education system, with the grant of a leaving certificate. This certificate would be a guarantee that the boy had attained a definite standard of education, and would thus gradually become a qualification required by the engineering employers for trade apprentices.

Usually engineering works do not provide special facilities for practical training, and the apprentice has to pick up such experience as he can in a more or less haphazard fashion. In a few British and certain German and American works, special schools and training shops are provided. One, at least, of our foremost electrical manufacturing concerns has an admirable apprentice school.

The instruction is divided into two classes: "General" and "Trade." The "General" class is a continuation of the apprentice's regular education, and affords proof that our elementary education system is not turning out boys sufficiently educated to make their way into skilled trades. The remedy for this is in the trade schools.

The second or "Trade" class is devoted purely to trade teaching, and consists of youths selected from the "General" class.

The teaching of both classes is undertaken by the firm's engineering staff, assisted by leading foremen and shop engineers, and is carried out in working hours and at the firm's expense.

The first object of the school is to turn out good workmen; its second to fit them for promotion to positions as charge hands, foremen, and inspectors. The quality of the workman is thus raised, and with it the standard of the foremen.

Whilst it is both possible and profitable for a large firm to provide its own trade school, for small works it would be impossible for financial and economic reasons, except by a co-operative school system to which each firm would send its own teachers and pupils. Such a system would not be easy to carry out in practice, owing to difficulties of distance, etc.

It is to be hoped that ultimately the need of such schools will be met by half-time trade classes provided by the education authorities in all large industrial centres.

It must be noted that the improved educational facilities discussed will gradually result in increased numbers rising from the ranks of labour to fill the commissions of the engineering industry.

The foregoing remarks apply to those the majority of whom are likely to remain workmen all their lives. The education of our technical engineers is built up on the secondary or public schools, forming an intermediate step to the higher technical school.

In this country we make the mistake of allowing technical instruction to be given too early, instead of postponing it till after the completion of a thorough secondary education.

If it is desirable that our primary instruction be a matter for public control and supervision, it is doubly the case with our secondary and higher instruction. So long as State control stops here and no contact and co-relation exists between our popular instruction and the instruction above it, so long will our education system be unsatisfactory.

The primary school naturally presses up to the secondary sphere, and the secondary to the university or higher technical school. They should be inseparable and co-related, thus forming a highly efficient instrument for the avoidance of friction and competition. But not only must the steps in the education ladder be inseparable in the sense indicated, but there must be a closer association between our universities and technical high schools and the engineering industry. Much of their work is of a purely academic character, and has little practical application.

I am convinced that great advantages would result to the electrical and engineering trades if they would submit those problems to the universities for solution, which they have neither the staff nor the time to solve. Such a connection could not fail to be of great mutual value, and would result in manufacturers taking a keener interest in technical education and the teaching staff being in closer touch with industrial problems.

Immediately the war is over Germany will endeavour, at all costs, to recapture her lost foreign trade, and we may be certain she will flood the world with low-priced German goods. The strongest weapon we can forge to meet that competition is without doubt to look carefully to the better training of our artisans and engineers. The Institution is one of the channels through which we can make our influence felt on questions within its legitimate scope, and there can be no doubt that technical training is one of them.

WAR ITEMS.

Trade After the War.—In several of the daily papers just now considerable space is being devoted to the urgent need that exists for securing an early statement from the Government regarding our national after the war policy concerning trade. The Council of the Association of Chambers of Commerce of the United Kingdom is stated to have framed the following resolution respecting the prospect of wholesale German dumping:—

> TRADE AFTER THE WAR.
>
> Inasmuch as large numbers of our soldiers will return to industrial employment after the war it is necessary to look ahead in order that nothing may be allowed to occur likely to lessen their opportunity of obtaining employment and a livelihood. It is thought that Germany may pour into this country large quantities of manufactured goods, at low prices, in competition with the products of our working people, depriving our people of a market and thereby reducing employment. This Council beg to warn his Majesty's Government of such a possibility, and consider that the Government should be prepared well in advance with a considered and matured plan, to prevent unemployment caused by the action of German manufacturers, and to secure continuity of business for those who have undertaken enterprises with the hope of obtaining a portion of trade formerly done in competition with British subjects by those countries with whom we are at present at war. This Council strongly impresses upon his Majesty's Government the necessity of deciding its policy in connection with this question before the time shall have arrived when the feared mischief may have begun, shortly after the conclusion of peace and the re-opening of the markets of the world.

One of the papers states that the London Chamber of Commerce is holding a special meeting this week to consider the whole question of trade relations after the war between Great Britain and her Dominions and the Allies on the one side, and our enemies on the other. It is said that a prize of £1,000 will probably be offered for the best scheme of trade defence submitted to competent judges by January 1st next. The Council of the London Chamber is understood to be making further representations to the Government in favour of the more general adoption of the metric system of weights and measures, and to urge members of the Chamber to introduce the system into their own businesses without delay.

A Berne telegram to the "Morning Post" states that it is reported from Vienna that Germany has induced the Austrian Chamber of Commerce, at a plenary meeting, to agree virtually to all her demands regarding a future economic and commercial union between the Austrian and German Empires. Austro-German commercial policy will be based on a unified plan, and both countries will negotiate and conclude in common all commercial treaties with other States. It is stipulated that Germany and Austria must agree, before beginning peace negotiations, upon the economic demands which they intend to put forward, and to include Hungary in the Austro-German economic treaty.

Perhaps it will not be out of place if at this point we quote the views of the "Spectator" respecting the future position of German industry:—"After the war every German manufacturer will find that his buildings and plant and his house, and every permanent form of wealth he possesses, are heavily mortgaged, and that the interest upon this mortgage is a first charge upon his business. It is quite true that the interest will be payable to other Germans, but that fact will not reduce his expenses of production. From this point of view the burden upon his future industry is exactly as great as if the interest were payable to Americans. Nor is there any way of his escaping this increased cost of production except by repudiating his debt. Thus, so far from the German industry being unassailable after the war, it will be heavily embarrassed by the debts which the German Government have contracted to pay for the war. Our own position will be relatively better, not indeed because we have borrowed abroad, but because we have raised at any rate some portion of our war expenditure out of current taxation."

We may conclude our references to this matter by alluding to a question asked in the House of Commons on November 10th, and the Prime Minister's reply thereto. Mr. Fell asked whether the Prime Minister would take the opportunity to be afforded by the expected presence in this country of the leaders of several of the Dominions, to hold a conference with them to consider the steps to be taken throughout the Empire to meet the flooding of the whole Empire with cheap goods from enemy countries, which was expected at the conclusion of the war. Mr. Asquith, in reply, said that "this and any other question of interest to the Empire" would be discussed when the opportunity was given by the presence in this country of the Dominion Government representatives. As already announced in our pages, The Parliamentary Committee of the Allies is to meet in Paris in January to consider important trade questions that will call for common action at the end of the war.

Proposed Cable Manufacturing in Australia.—According to an Australian paper just to hand, a conference took place at Melbourne on September 29th with the Federal Attorney-General and representatives of the copper producers of the Commonwealth, with a view of arriving at an agreement by which ore should be treated in Australia instead of being exported. Representatives of all the principal copper-producing firms were present. Mr. Hughes stated at the conclusion of the conference that the proposal was that ore should be treated in Australia to produce metallic copper, and, further, that copper goods, particularly wire, cables, tubes, etc., required for Australian consumption, should be manufactured in the Commonwealth. The conference was unable to reach finality, and a further meeting is to be held at a later date.

Electricity Works and Depleted Staffs.—Mr. A. D. Chalmers, Mr. D. W. Ritson, and ten other employés at the Gillingham (Kent) Electricity Works, have asked permission to join the reserve forces for the period of the war. As the matter is a serious one, and as the Council may be deprived of practically the whole of the staff, the matter has been referred to the Electricity Committee for consideration.

Blackburn Corporation has decided that it must retain the services of men in the gas and electricity works. These number 100, and there are 29 other employés of military age considered indispensable.

Italy.—Voluntary patriotic effort on behalf of the war is as much evident among Italians as with us, and our contemporary, "L' Elettrotecnica," gives a list of 45 of the most considerable electric supply associations and electric manufacturers who are pecuniarily assisting the families of their staffs at the front, keeping their situations open, subscribing to the funds of the Red Cross Hospital and to local relief committees, subscribing to the National Loan for themselves or assisting their employés to subscribe, and otherwise evincing their solidarity with the national aims in the present crisis.

Hot-Plates in Submarines.—Last winter, through an appeal made in the "Morning Post," a flotilla of our submarines was provided with electric cooking hot-plates. A letter from a Lieutenant-Commander shows how these hot-plates are "tremendously appreciated." Their use, he says, will be more frequent than ever in the winter that is now at hand.

Restricted Lighting.—The "Times" states that owing to the number of fatal accidents in Manchester due to the darkened streets, the local Watch Committee has petitioned the Home Office authorities to remove, or at least modify, the lighting restrictions.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

15,369. "Telephonic receivers." E. A. Graham. November 1st. (Complete.)

15,390. "Electrical instruments." Evershed & Vignoles, Ltd., J. C. Needham, and S. F. W. Finnis. November 1st.

15,406. "Electrical indicating devices for electrical pianos and the like." H. Richardson & H. E. Gill. November 2nd.

15,421. "Electro-magnetic power transmission and conversion system." J. Dollard & H. W. Brown. November 2nd.

15,427. "Electric coupling appliances." J. B. McIndoe. November 2nd.

15,447. "Electric switches." W. L. Wise & British Thomson-Houston Co., Ltd. November 2nd.

15,448. "Circuit connections of electron discharge apparatus." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). November 2nd.

15,459. "Electric lampholders." General Accessories Co., Ltd. (L. Rosenthall & C. Seymour, Transvaal). November 2nd. (Complete.)

15,460. "Electric adaptors." General Accessories Co., Ltd. (L. Rosenthall & C. Seymour, Transvaal). November 2nd. (Complete.)

15,471. "Apparatus for adjustably holding X-ray tubes." E. H. Hanson and H. W. Cox & Co., Ltd. November 2nd. (Complete.)

15,514. "Pumps." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). November 3rd.

15,518. "Telephonic receivers." E. A. Graham. November 3rd. (Complete.)

15,525. "Means for compensating for leakage in wave transmission systems." G. Constantinesco & W. Haddon. November 3rd. (Complete.)

15,539. "Alarm fuses for telephone, telegraph, and like systems." Automatic Telephone Manufacturing Co., Ltd., J. Savin, & S. R. Smith. November 4th. (Complete.)

15,555. "Electric resistances." British Thomson-Houston Co., Ltd. (General Electric Co., United States). November 4th.

15,563. "Construction of electric switch." G. Markt. November 4th.

15,579. "Telegraph apparatus." W. J. Mellersh-Jackson (Western Union Telegraph Co., U.S.A.). November 4th. (Complete.)

15,595. "Construction of dynamos and electro-motors." H. B. Mansell and G. Walker. November 5th.

15,633. "Protective devices for electric circuits." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). November 5th.

15,652. "Switchboards especially applicable to military portable telephone sets." H. J. B. Hampson. November 5th.

15,681. "Operating rotary converters and other alternating-current machinery." A. H. Railing & C. C. Garrard. November 6th. (Addition to 10,841/13.)

15,685. "Electric heating device." Landis & Gyr Akt. Ges. November 6th. (Convention date, November 9th, 1914, Switzerland.) (Complete.)

15,695. "Method of making vitreous bodies." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). November 6th.

PUBLISHED SPECIFICATIONS.

1914.

21,096. Alternating Electric Current Circuits in which Condensers are employed. British Insulated & Helsby Cables, Ltd., and H. Higham. October 17th.

21,145. Electrically-actuated Tools. W. J. Mellersh-Jackson (Commonwealth Electric Tool Co., U.S.A.). October 17th.

21,184. Electrical Pressing Irons. A. E. Reimers & F. F. Kiefer. October 19th.

21,266. Telephone Systems. E. G. Godfree. October 20th.

21,388. Wireless Signalling Systems. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 22nd.

21,593. Electric Switches. C. H. Miller. October 27th. (October 28th, 1913, U.S.A.)

21,998. Electrical Switches. H. Leitner. November 4th.

23,238. Electric Batteries. F. J. Beaumont. November 28th.

23,314. Electric Heat Radiators. A. B. Neiman. November 30th.

23,653. Simplified Method for Localisation of Bullets and other Foreign Bodies by means of X-rays. G. G. Blake. December 7th.

1915.

180. Electric Starting Devices for Motor-driven Vehicles. Maschinenfabrik Oerlikon. January 5th. (January 29th, 1914.)

459. Brush-holders for Dynamo-electric Machines. A. B. Back. January 12th.

1,694. Ionisation Devices for Amplifying Electric Currents. Western Electric Co., Ltd. (Western Electric Co., U.S.A.). February 3rd.

4.076. Storage Battery Separators and process for making same. T. A. Willard. March 15th.

5,104. Electric Motor Controllers. Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co., U.S.A.). April 1st.

6,302. Electrically-actuated Tools. W. J. Mellersh-Jackson (Commonwealth Electric Tool Co., U.S.A.). October 27th. (Divided application on 21,143/14, October 17th.)

6,364. Electrically-actuated Tools. W. J. Mellersh-Jackson (Commonwealth Electric Tool Co., U.S.A.). October 28th. (Divided application on 21,143/14, October 17th.)

6,738. Electrically-actuated Tools. W. J. Mellersh-Jackson (Commonwealth Electric Tool Co., U.S.A.). May 5th. (Divided application on 21,145/14, October 17th.)

8,047. Electric Switches for Lighting Installations. Robert Bosch (firm of). May 31st. (June 9th, 1914.)

8,903. Electrical Relays. V. Tedeschi & A. Rossi. June 16th.

Telephony on Air-Ships.—In *La Lumière Electrique* a brief description is given of a new telephone outfit which has been devised by the company "Le Matériel Téléphonique" for the use of the pilot and passenger in an aeroplane. The noise of the wind and the propeller renders conversation in the ordinary way impossible. The equipment consists of a head-set with two watch-type receivers, which are closely applied to the ears, and a special type of transmitter which is worn on the breast under the clothing, between the neck and the third rib. The apparatus are connected by flexibles and plugs to a circuit provided in the fuselage, and a battery of three dry cells is supplied, capable of maintaining communication for 100 hours. It is stated that conversation can be carried on no matter how great the noise of the air and the propellers.

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Vol. LXXVII.] CONTENTS: November 26, 1915. [No. 1,983.

Page

Excessive Freight Rates 673
A Commercial Electrical Association 674
Copper 675
Swiss or German? 675
Australia's Invitation to Trade 675
An American Motor Searchlight Plant (*illus.*) 676
Extensions at Kettering Electricity Works (*illus.*) 676
Our Trading Opportunities throughout the World (*continued*) 678
Correspondence—
  Trade with Russia and the Metric System 679
  Decimal Coinage and the Metric System 680
  The Institution and Alien Enemy Members 680
  Who will Assist? 681
  Electrically Heated Soldiers... 681
  A Contractor's Complaint 681
  The Tungsten Lamp Association 681
Electricity Supply 682
War Items 684
New Electrical Devices, Fittings and Plant (*illus.*) 685
Business Notes 686
Electrical Accidents in 1914 690
Notes 690
City Notes 693
Stocks and Shares 695
Share List of Electrical Companies 696
Market Quotations 696
Exports and Imports of Electrical Goods during Oct., 1915 697
Decimal Coinage and the Metric System (*concluded*) 698
The Production and Properties of Electrolytic Copper, by B. Welbourn (*illus.*) (*concluded*) 700
Russian Electricity Works Statistics 701
Legal... 703
New Patents Applied for, 1915 704
Abstracts of Published Specifications 704
Contractors' Column ... ... Advertisement page xx

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NOTICE.

IN view of the recent Increase in the Postal Charges, our Subscription Rates for Great Britain and Canada will until further notice be increased to £1 1s. 8d. and £1 3s. 10d. respectively.

EXCESSIVE FREIGHT RATES.

COMMERCIAL men throughout the country have been reviewing with no small concern the continued increase in freight rates charged by British shipping companies during the past six months, when the conditions ruling throughout the commercial world have been entirely without precedent in history.

In justice to the shipowners, due allowance must be made for the difficulties caused by the serious reduction of ships available for mercantile purposes as a result of the heavy demands from the Government for vessels for transports. Due allowance must also be made for the all-round increase in the working expenses, particularly in the wages and coal bills. After making the most liberal allowances for these contingencies, however, there appears to be no reasonable justification for the abnormal increases in freight rates.

The rates for cotton goods have increased, in some cases, as much as 300 per cent. since the commencement of the war, while the charge for carriage of steel has risen from 10s. 6d. per ton, at which figure it stood just prior to the outbreak of hostilities, to no less than 50s. per ton, the present rate! The excessive rates demanded for carriage of foodstuffs have proved one of the most important factors in the bolstering up of prices to the present high level, and as a result of the inability of the railway companies to successfully cope with both the commercial and Government demands, the coastwise steamship companies have carried vast quantities of foodstuffs from one part of the Kingdom to another at practically whatever excessive rates they thought fit to demand.

If further proofs be needed that the rates charged during the past twelve months have been most exorbitant, the balance sheets published recently by British steamship companies will supply them at a glance. Profits as high as 80 per cent. on capital have been recorded on several occasions already, and at 60 per cent., or round about that figure, quite a number of hitherto comparatively modest dividend-earning steamship companies figure conspicuously, after having made the most liberal allowances possible for depreciation and renewals and repairs. Hardly a solitary exception can be found of a British steamship company which has not experienced phenomenal prosperity during the past twelve months, a success, it should be noted, that has been attained against the most adverse conditions arising from labour shortage, wages increase, costly fuel, and extra working expenses all round, and, moreover, on a total tonnage carried, in most cases far below that of a normal working year.

Whereas the German mercantile marine has been reduced to a state of utter ineffectiveness, in consequence of the inability of the German fleet to prevent the blockade of its coasts, the British steamship companies have enjoyed, in a very large measure, the protection of the British fleet, and through this powerful agency have been enabled to reap a golden harvest. The burden of maintaining this great and powerful protector of our commercial welfare at the present high level has been quietly borne by the British public, and it must be considered a decidedly poor return for all the sacrifices made if this great weapon is to be used in the hour of need by the British steamship owners as a means to exploit the public, whose sacrifices and patriotism have enabled the shipping companies to prosper so exceedingly when they might reasonably have suffered a prolonged period of depression bordering on calamity

The effect of such artificial impositions upon the trade of this country, both now and hereafter, is bound to prove of most serious import. From a strictly commercial point of view it is questionable if the shipowners can be seriously blamed for taking the opportunity to line their pockets at the public expense; and, doubtless, the argument they would at once adopt to justify their actions would be found to be based upon the law of supply and demand.

At a time such as the present, however, when restrictions and impediments abound on every hand to prejudice the smooth working of an accepted institution, the law of supply and demand cannot effectively operate without imposing unjust burdens upon one section of the community to the corresponding advantage of another. In the present case, the sections imposed upon comprise collectively the entire commercial interests of the country, and the results are too serious to admit of delay in their removal.

The Government doubtless owes much to the shipowners for the valuable services they have rendered at a critical period in the history of this country; the debt, however, which the shipowners owe to the British fleet for its protection is one on a far higher plane altogether and hardly comparable from any standpoint. In any case, the public and the commercial interests of the country cannot under any circumstances whatever be allowed to be imperilled by the obligations of either to the other, and the necessity for prompt action by the Government in the direction of fixing maximum freight rates is agreed upon by manufacturers and others throughout the country to be of the greatest urgency. There appears to be no reason why, in common with other sections of commercial enterprise which have been wholly or in part regulated and controlled by the Government, shipowners should not also be placed above the temptation to "make good" at the period when immunity from artificial restrictions and manipulations is most vital and most necessary to the commercial stability of the country.

A Commercial Electrical Association.

There has been a feeling for some time past among men who are interested in the electrical trade in various non-technical capacities that there is room for what might be called a commercial electrical association. We allude to men who take no interest in the Institution of Electrical Engineers, as it does not meet their particular requirements. They have been to a few meetings and "got tired" because they are non-technical men. Yet they want something more than an electrical sales managers' meeting society. It has remained for Mr. Howard Foulds to take the initiative in such a direction by making the suggestion public in an address to the Birmingham Electric Club, but he plans a far more ambitious scheme which might perhaps embrace the less pretentious one.

He propounded it in the course of a paper on "Organising the Electrical Industry," in which he pointed out that all of the existing associations and societies within the electrical industry are dealing individually with work which, as to the major portion of it, is common to all of them. He would like to see them amalgamated, Sub-Committees being appointed to deal with matters that were special to each of them. His argument is that these associations are wasting time and money by endeavouring to do something which separately they are not strong enough to carry out effectively, and he thinks that it would be infinitely better if there were some large association for the protection and development of the commercial side of the electrical industry, instead of "nearly a score" of smaller societies dealing with the matter. Those smaller societies will derive comfort from the knowledge that he sees good in all of them; they may not all readily agree with him that none of them is doing anything which has a sufficiently important result upon development of the applications of electricity to industrial and commercial uses. We believe we are correct in saying that the activities of the Electrical Development Committee are restrained owing to war conditions. We quote from his remarks:—

> We have nothing whatever to compare with the Commercial Gas Association, which organises a complete publicity crusade throughout the country and through the gas companies and gas departments of municipalities supports a very fine scheme of publicity.
>
> What I am really anxious about is that we should establish in our industry a body which shall be *prima facie* a commercial association. A technical institution we already possess, which does an enormous amount of valuable work, but we must have something far different if we are to meet the competition of the gas industry, and if we are to develop the employment of electrical methods. The nucleus of such an association already exists in the Manufacturers' Association, but we should require something more than this. We require, in addition, a strong association of supply undertakings, and one which will include the company as well as the municipal undertaking, because, commercially, there is no difference between the objects they have in view; and, further, we require a sound financial section, which will, if necessary, provide the funds for extending industrial undertakings.

As our banks do not support the trade of the country, Mr. Foulds regards it as the business of substantial industries to create their own financial institutions, and establish a body which shall be in a position to weigh up any propositions submitted to it, and provide the necessary financial backing. The financial position at the moment does not encourage us to hope for early support of British electrical industry along the lines adopted by industrial banks unless the industry itself plays a leading part. The proposition is, on this ground, a timely one for discussion. Among other objects of the proposed association Mr. Foulds mentions the training of young men to act as commercial and trade ambassadors in foreign countries, and do anything and everything which could bring the electrical manufactures of this country into full employment, not only within its borders, but also abroad. At this point Mr. Foulds has, in our estimation, touched one of the weak places in our electro-industrial armour. He at any rate does not think that we have reached the limit of our productivity. In his view none of the existing associations has a definite fighting commercial policy, while those which make some pretext of having it possess no means of prosecuting it. He recognises that some of the existing associations are of a nature that would prevent them from being absorbed by a commercial association, but he believes that many could be so absorbed, thus strengthening their influence, reducing their expenses, and saving a great deal of time. He holds that by securing the support of everyone in the industry, lay as well as technical, the association would be built upon a sure and solid foundation; that it would have such a huge membership that ample funds ought to be available for any progressive policy that was decided upon; and that the very existence of a powerful association of the kind would be a deterrent to any attempt in any quarter to interfere with the legitimate operations of the industry. For the purpose of discussion he advocates an organisation with three main sections, each having specialised sub-committees:—(1) Manufacturing and contracting; (2) Supply of electricity, including company and municipal; (3) Financial.

Mr. Foulds would like to see the new organisation take benevolent funds under its paternal wing and develop them, and he desires it to become so powerful an Association that even the industrial apathy of Parliament could not prevail against it. We have witnessed the rise and fall of many schemes for the better organisation of our electrical industries, but as we indicated last week, the matter is still full of interest and importance and is a legitimate one for discussion. The proposal is one to remember. If it were not war-time it might stand a better chance of receiving the attention that it deserves.

Copper. The copper market has shown increasing and sustained strength for some weeks, and, in spite of prices standing now at a higher level than since 1907, it would be altogether premature to assume that the upward movement has spent itself. The impelling cause, of course, is the ceaseless advance notified in America, where producers seem to have the position entirely in their own hands, and are able to raise their prices whenever orders of any magnitude are placed before them. The supply of immediately available copper in the United States is stated on all hands to have been reduced to trifling proportions, and, in view of this, there has been something like a scramble on the part of needy consumers who, having delayed purchasing, find themselves at last forced to enter the market for prompt supplies. The only conclusion which can be arrived at regarding the broad outlines of the situation is that the war demands are, in one way and another, licking up such a huge quantity of material, that the current output, large though it is, is insufficient to supply requirements. On the top of this there is a practical paralysis of the copper industry in the State of Arizona, where a strike has developed into a lock-out, and where the men are now showing a very nasty spirit, with the result that considerable damage has been done to certain of the properties. There is no relief in sight so far as the European market is concerned, although, if only some reasonable arrangement could be made in connection with the shipping of copper from America, there might be some relaxation of the difficulties. At the present time it is very hard for people here to buy copper, and still harder for them to ship it when it is purchased. Prices of refined copper are soaring, and, in spite of it all, the demand continues on a pretty good scale, although, naturally, the main consumption is that in connection with the supply of war materials. The shipments of refined copper from America to Europe continue small, but, to counterbalance this, the exports of brass and materials into which brass enters, show a large increase compared with last year.

Swiss or German? It is remarkable to observe how the course of the war is tending to de-Germanise the directorate of that great investment and underwriting corporation bearing the title of the Bank for Electrical Undertakings (Bank für Elektrische Unternehmungen), of Zurich, whose annual report for 1914-15 was quoted at length in our issue of October 29th. When addressing the shareholders about a year ago, as was mentioned in this journal on December 25th, 1914, Dr. Julius Frey, the chairman, explained that the reason the Germans had a majority on the board—19 Germans against seven Swiss—was to be found in the historical development of the institution, and it would not be appropriate to remove deserving directors because of the displacement of shareholdings. It was incorrect to assert, the chairman added, that the bank was a German undertaking, as the decisive factor was the possession by Swiss of the majority of the shares. Apparently, however, to satisfy a section of the shareholders two additional Swiss directors were then elected to the board, still leaving the German element with a majority of 10 members. During the intervening period three directors have passed away, one of whom in the person of Emil Rathenau, as Dr. Julius Frey informed the shareholders at the meeting held on November 3rd, took the initiative in the formation of the bank, and had actively co-operated in bringing it to the position which it occupied to-day. We thus find confirmation of the statement made in this journal several weeks ago, that the bank owed its origin to the Berlin A.E.G. Another German, bearing the characteristic name of Commercial Councillor Deutsch, has been elected in substitution as the representative of Germany industry, whilst Herr Engster, chairman of the Oerlikon Machinery Works, and Herr Jenny, of Durst, have been chosen as representatives of the Swiss electrical industry. But probably the most important fact is that Dr. Julius Frey, who, a year ago, was in favour of the retention of the German majority, and who in conjunction with his Swiss and German colleagues consented to the addition of two further Swiss members to the board, has now agreed, together with his fellow-members, to a still further increase in the Swiss element by the election, which has just taken place, of five new Swiss directors of prominent standing. As one German member has now resigned and not been replaced, the final result is a board composed of 18 Germans and 14 Swiss. This further change has been effected in order to take into account in the composition of the directorate the actual conditions in relation to the distribution of the shares among the proprietors. Thus, although it was not thought advisable a year ago to remove deserving directors, the lapse of a year has so far brought about a change that the German element has now been diluted by the strengthening of the Swiss members of the board. At this rate of progress and bearing in mind that the majority of the shares are held by Swiss subjects, it is conceivable that the future may possibly hold out the prospect of the equalisation of the respective nationalities on the board, although the German financial interests would doubtless take precautions with the object of preventing any alterations being made which would place them in a minority.

Australia's Invitation to Trade. The Report of H.M. Trade Commissioner for Australia (Mr. G. T. Milne), which we summarise elsewhere in this issue, brings home to us that Australia is as ready to buy from us as to fight for us, but it warns us that we on our side must be ready to offer as favourable trading conditions as our competitors are doing. The principle of giving substantial preference to British goods, in the absence of supplies of local manufacture, has been adopted by State and other public departments generally throughout the Commonwealth, and in every tariff revision there is a growing tendency to augment this preference. At no time in the history of Australia has there been so widely-expressed a desire to trade with the Mother Country as since the outbreak of war. It is clear, however, that British manufacturers, in order to profit by this invitation, will have to give more consideration to the matter of representation in the Commonwealth. A number of firms have given their views upon the relative conditions under which agencies for British and foreign manufacturers are held there, and they appear to justify the complaint which has sometimes been made that the conditions under which foreign firms appoint agents are more liberal, and freer from restraint, than those attaching to representatives of a British manufacturer. Mr. Milne's opinion, after sifting these views, is that British firms will be well advised to bear in mind that, in introducing a new line to a market where competition is keen, liberal treatment of a responsible representative may be that factor which will make for success, and that it may be bad policy to reject the terms of an agent because they appear to be high. Some of our firms at home do not realise that effective representation in Australia, where the distances between consuming centres are often very great, cannot be secured without considerable outlay. Several Australian firms have criticised the treatment their partners have met with, when making a business trip, from firms in the United Kingdom, in comparison with that meted out by firms in the United States or on the Continent. We well know that some of these pieces of counsel are very familiar; the pity of it is that they have to be repeated to-day.

AN AMERICAN MOTOR SEARCHLIGHT PLANT.

The use of motor searchlight plants in the European War has apparently caused the naval and military authorities in the United States to devote greater attention to such auxiliaries, as in the recent manœuvres at Plattsburg, near New York, considerable interest was shown in a machine recently completed by the Autocar Co., of Ardmore, Pennsylvania, and of which we are able to give some illustrations. The vehicle, which is designed not only to provide the necessary current for the searchlights—two in number—but also to transport the latter from point to point, is one of the company's 2-ton motor lorry chassis fitted with a body specially designed for its purpose, the sides being constructed of heavy steel plates in order to provide protection for the electricity-generating plant. Unlike many motor searchlight vehicles, in the Autocar machine the current-generating plant, as will be seen from fig. 2, is entirely independent of the engine which propels the wagon. It is carried on the floor of the vehicle, and comprises a horizontal two-cylinder petrol engine, having a bore and stroke of $4\frac{3}{4}$ in. × $4\frac{1}{2}$ in., direct coupled to a Westinghouse direct-current generator, designed to run at a speed of 1,200 R.P.M., at which it gives 56 amperes at 125 volts (7 KW.). The engine is fitted with a centrifugal governor, which regulates the speed within very close limits, and is furnished with its own petrol tank and independent radiator in connection with the water circulation system.

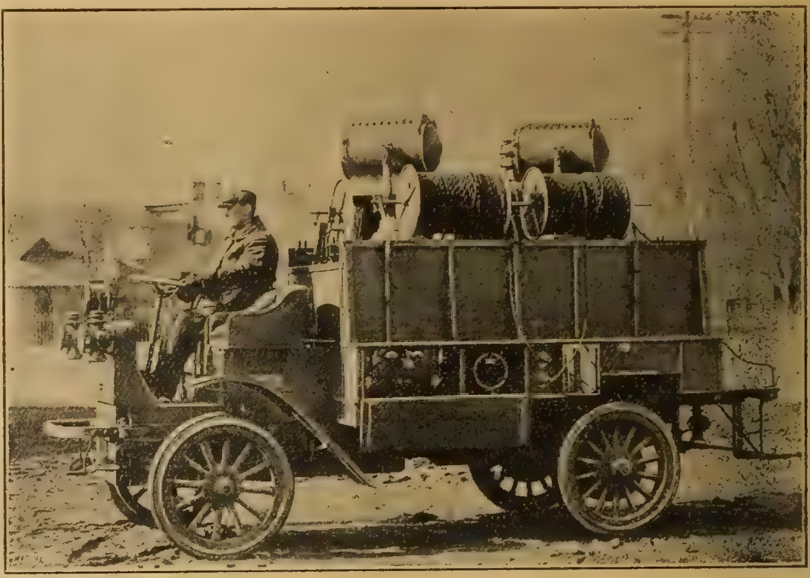


Fig. 1.—An American Motor Searchlight Plant.

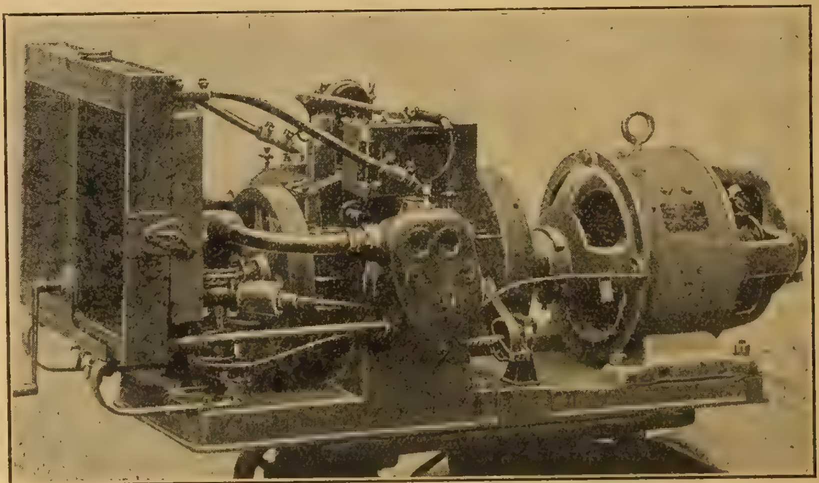


Fig. 2.—Petrol-electric Set for Motor Searchlight.

The searchlights are 14 in. diameter, and are each of 5,000 C.P. capacity, they being capable of projecting an effective beam of light up to a distance of a mile on a clear night. The searchlights are mounted on hand trolleys, so that they can, when necessary, be used some distance away from the vehicle on which the generating plant is carried. The trolleys, which are constructed entirely of steel and aluminium, run on a pair of spring-equipped cycle-type wheels, fitted with 28 × 3-in. pneumatic tires. They are light in weight and rigid in construction, and so designed that they have a large road clearance, enabling them to be used on very rough ground. Each searchlight is provided with 1,350 ft. of cable divided into two reels of 675 ft. each, so that each lamp can be operated independently of the other at a distance of a quarter of a mile from the generating plant, or half a mile from each other.

Fig. 3.—Motor Searchlight in Operation.

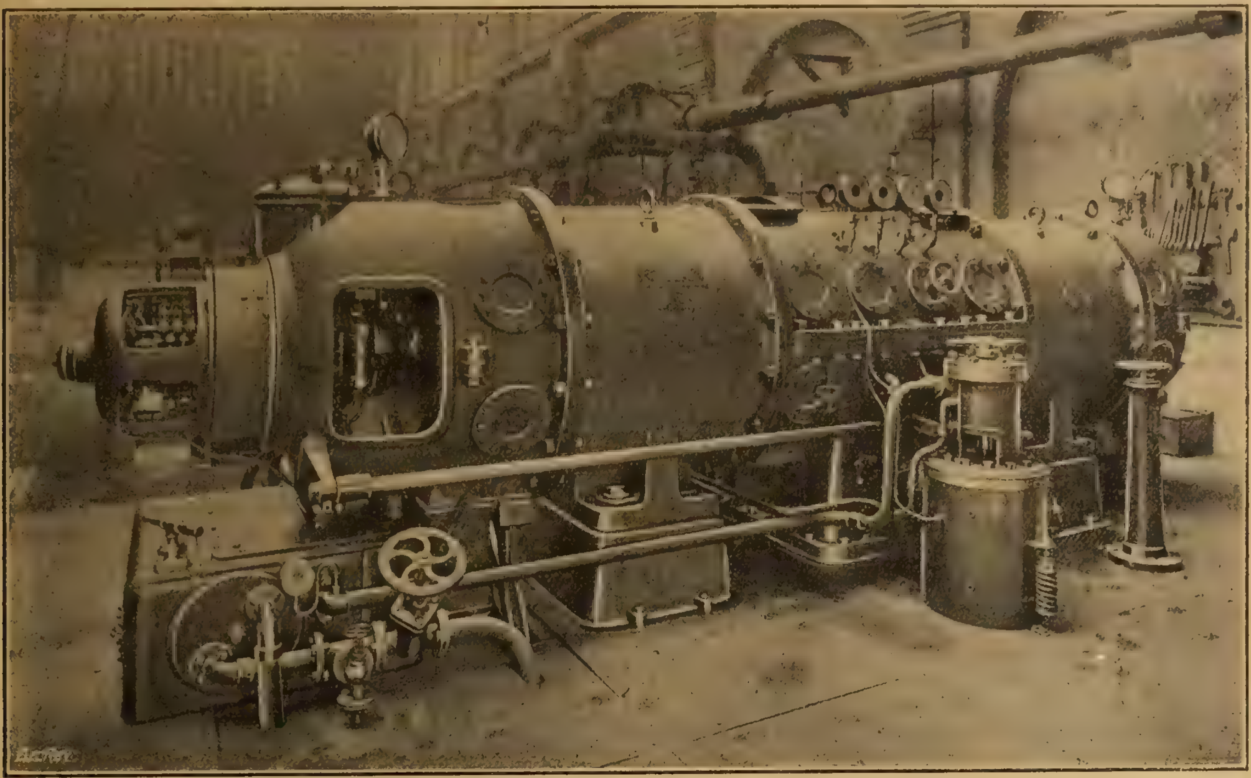
By means of specially-designed attachment plugs and reel arrangement, the lamps can be operated at any distance, within the limits of the cable, from the generating plant without it being necessary to unreel all the wire to get at the inner ends, the latter being arranged to pass through the heads of the reels, so that the attachment can be readily made. The necessary switches and cable connection plugs are contained in a cupboard formed in the near side of the body of the vehicle.

The machine has already been tested at the U.S. Marine Barracks, League Island Navy Yard, Philadelphia, by the U.S. Engineering Department at the Washington Barracks, and by the authorities of the Maryland State Militia, and is reported to have given very satisfactory results.

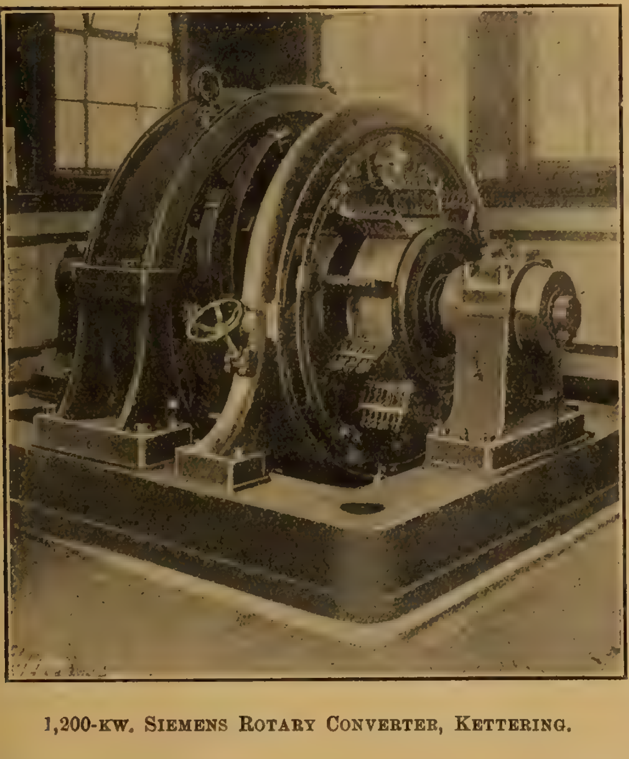
EXTENSIONS AT KETTERING ELECTRICITY WORKS.

In a recent issue we referred to the inauguration of a very considerable extension of plant at the electricity works of the Kettering Urban District Council. These works were started in 1904, and for the year ended March, 1915, generated some 2,228,000 units with a peak load of 1,100 KW. Kettering is a manufacturing town of over 30,000 inhabitants, whose staple trade is chiefly bootmaking, though there are several large engineering works and clothing factories, and it is noteworthy that more than 35 of these factories rely upon the electricity department for their power, though this by no means exhausts the opportunities of the department in this direction.

The Council has full wiring powers, obtained under an Improvement Act, and has spent nearly £15,000 on assisted wiring schemes in the town. In the case of all motors installed under these schemes, the work is carried out direct by the electricity department, but house wiring is in nearly all cases carried out by contractors who are paid on a schedule basis. The latest plant extension was decided on in 1913, with a view to meeting the prospective requirements of the near future, and in the same year a contract was placed for the work. At that time the Council's generating plant consisted of a 460-KW. mixed-pressure Brush turbine set and a pair each of 315-KW., 150-KW. and 75-KW. sets, giving a total capacity of 1,540 KW.



Brush-Ljungstrom Turbo-Alternator installed at the Kettering Electricity Works.



1,200-KW. Siemens Rotary Converter, Kettering.

The winter peak-load of 1912-13 reached 950 KW., and as the estimated peak-load for 1914-15 was 1,100 KW. (which was almost exactly attained), it was evident that a failure of the turbine set would leave the department in a difficult position. The supply up to that time had been on the direct-current system, and the electricity works are situated practically in the centre of the town with factories all round, none being further away than 1½ miles. The average factory load is about 100 H.P., and there has been no difficulty in obtaining the stated voltage at the different feeding points, so that it was decided to retain this system of supply.

In considering the type of plant to be installed, Mr. Walker, the Council's electrical engineer, was to a great extent influenced by shortage of space at his disposal, which rendered direct-current turbo-generators in tandem or a geared direct-current turbine set impracticable, and thus the choice was almost limited to the type of plant installed—viz., a turbo-alternator and converting plant.

In the selection of this plant, the Council, after considerable inquiry, decided to install a Brush-Ljungstrom turbo-alternator with condenser, &c., and a rotary converter to operate directly in conjunction with it.

The Ljungstrom turbine, as many of our readers know, is a departure from usual turbine practice, being of the radial flow double rotation type, with two turbine disks rotating in opposite directions, each disk being directly mounted on the rotor of its generator.

The Kettering turbine set is designed for a continuous output from its two generators of 1,265 KW., with steam at 150 lb. pressure at the stop valve. The alternators are three-phase machines, and the range of voltage at the direct-current terminals of the rotary converter is 460-540.

The steam consumption of the combined plant in lb. per KW.-hour at the direct-current terminals—the efficiency of the rotary converter being taken into account—is at a temperature of 500° F., full load, 14·8, half load 16·8, and at 680° F., full load 13, half load, 14·8.

The efficiency of the rotary converter, which was made by Messrs. Siemens Bros. Dynamo Works, is at full load 95·5 per cent., at three-quarter load 95 per cent., and at half load 93 per cent. This machine, which is designed for a continuous output of 1,200 KW., and has an overload capacity of 25 per cent. for three hours, is directly connected to the turbo-alternators through an oil break switch, and is started up direct from them, taking three-phase 50-cycle current and running at 600 R.P.M.

The condensing plant for the turbine consists of a tubular surface condenser of 3,250 sq. ft. cooling surface, and will condense 20,700 lb. of steam an hour; it also was constructed by the Brush Co.

The air, water extraction and circulating pumps are of the Rees-Roturbo rotary type, direct-coupled to a 66-H.P. motor.

It may be mentioned that while the turbine set was duly installed to the specified time, the rotary converter was, unfortunately for the Council, commandeered by the authorities after it was packed up for delivery to Kettering, so that the winter load was actually met without the use of the new plant. A duplicate converter has been supplied by Messrs. Siemens, and the combined plant has been taking the entire load since the beginning of October, during which time the peak load has also reached the full load of the plant.

The main contractors were the Brush Electrical Engineering Co., Ltd., who have been responsible for the complete extension; the work has been carried out to the specification and under the supervision of Mr. W. A. Walker, the Council's electrical engineer, to whom we are indebted for the above particulars.

OUR TRADING OPPORTUNITIES THROUGHOUT THE WORLD.

(*Continued from page* 647.)

The Trade of Australia.

"No Room for Germans." We have endeavoured to keep our readers accurately posted regarding the strong anti-German feeling that has existed in the Australian Commonwealth since the outbreak of war, and its very definite effect upon trade policy. Those who have studied the situation have noted the growth of such sentiment as new revelations of the treachery of the German character have been brought to light, and as the horrors of Prussian frightfulness have turned the blood cold. The attitude of our Australian brothers and sisters is reflected in the strong decisions of the Government to root out German influences from the metal and other trades, in the sweeping declarations that have branded firms "Enemy" in spite of their having works in England, and in the determined prosecution of those guilty of trading with "enemy firms." It is not for us to say how far there has been excess of zeal in developing this policy. The Colonies are quite capable of conducting their own affairs. They know the extent of the evil, and at close quarters are familiar with local circumstances and many things that we cannot expect to know. But such views as reach us here leave room for no misunderstanding. Whatever freedom they may have granted the German trader in the past—and they have to confess that they have welcomed him pretty cordially—they don't want to touch him or his goods with a long pole now, and they won't—*if they can get what the market wants from anybody else at a reasonable price.* They may put a thumping big tariff on goods from Germany and Austria in the future—it will have to be pretty big to be prohibitive for certain lines unless we change our ways and manage to manufacture more cheaply; they may buy from *or through* present neutral countries; but if their existing mood continues, the German importer will not be able to trade there without a mask, if there is a ghost of a chance of what the market needs being obtained from somebody else. Their desire is to produce their own manufactures if they can manage to do so economically. In a small way it has been tried for half a dozen electrical lines, but as things are, and are likely to be, the demand is too limited to assure a continuous production at acceptable prices. The new policy in regard to metal supplies may have a bearing on this aspect of the matter of Australian industry, but there is no reason for allowing this possibility to affect us in our efforts to supply the needs of the market. Having thus generally introduced the matter, we may get down to the details of the present position as they are set forth for our guidance in the report prepared by H.M. Trade Commissioner in Australia, Mr. G. T. Milne, for the year 1914. The report has just been issued by the Board of Trade, and we have selected such parts of it as we think should be of interest to electrical manufacturers, traders, and contractors:—

The General Position. A review of the financial position of the country revealed conditions of exceptional strength, and, apart from the disturbing factor of drought, it is doubtful if any other country in the world was so well prepared to withstand the economic effects of war as Australia. The possession by a people, numbering about five millions, of gold reserves amounting to between £40,000,000 and £50,000,000 sterling is probably unique. The outbreak of war affected prices in lines of business where stocks were low. Local manufacturers have suffered inconvenience to some extent in obtaining supplies of raw or semi-manufactured material, particularly where they had been depending on Continental sources of supply, but importers generally are accommodating themselves to the new conditions, and goods formerly obtained from Continental countries now engaged in the war are being supplied by the United States, Japan, or the United Kingdom.

The following table shows the value of the imports in 1913 and 1914 of engineering and allied goods:—

	1913. £	1914. £
Bar, rod, etc.; blooms, slabs, etc.; girders, joists, etc.	2,201,000	1,631,000
Galvanised plate and sheet	1,943,000	1,969,000
Pig and scrap	318,000	301,000
Machines and machinery (all kinds except agricultural)	4,789,000	5,076,000
Metals, manufactures of, dutiable	2,201,000	2,524,000
Railway material, rails, and fishplates	1,282,000	1,479,000
Tools of trade	651,000	609,000

German and other Competition. Data for 1914 as to countries of origin are not yet available. In the five years ending November, 1913, the imports of manufactured merchandise in which the United Kingdom meets with competition from foreign countries have grown from about 40½ millions to about 60½ millions sterling per annum, representing over 80 per cent. of the total imports.

The shares of the three countries chiefly interested in the import trade were as follows:—

	1909. £	1913. £
United Kingdom	25,710,000	38,285,000
Germany	4,464,000	6,886,000
United States	4,135,000	7,125,000

These figures show how foreign competition has grown even in a market pre-eminently British in sentiment.

American Manufactures. It is notable that, while imports of American manufactures have been steadily increasing from year to year, the sales of Australian produce in the markets of the United States have been relatively small. The latter is due partly to lack of direct shipping facilities, and also to the American import duty on wool and meat (now removed). On the other hand, the tonnage of vessels flying the German flag entered and cleared at Commonwealth ports, rose from 633,000 tons in 1905 to 1,211,000 in 1913. Favourable conditions of exchange having once been created, by the development of the German market for Australian wool and metals, the activity of German manufacturers seeking a market for their products has been intensified from year to year.

The German Government's part in this trade campaign has included: The appointment of official representatives to foster trade; low railway rates for export; co-operation between manufacturers and banking institutions, and also among the manufacturers themselves; export bounties.

German Efforts to Please. In distributing their products, German manufacturers have not relied on such chance orders as might reach them through shipping houses in Hamburg, London, or other centres, but, by means of effective local representation in the Australian market, have been enabled to keep closely in touch with its requirements to an extent that would be quite impossible had they relied on shipping-houses only. When breaking new ground, they have displayed readiness to comply even with the whims of their customers; but of recent years they have not been quite so ready to abandon standardised forms as previously. The c.i.f. quotation has been featured more extensively by Continental firms than by British. The effect of the freight rates of British railways and British-owned steamship lines has been such as to involve loss of orders to our manufacturers. This condition will continue to operate adversely to British industry and commerce until the individual interests of the manufacturer and those of the railway company and shipowner are brought into close co-operation. The success of German manufacturers has been contributed to by close attention to such details as packing, finish, and appearance, and by showing greater readiness than their competitors to sell goods on consignment on attractive terms. In heavy lines, *e.g.*, electrical machinery and railway material, lower prices, combined with a guarantee of quick delivery, have enabled them to secure a strong hold in the Commonwealth market.

Japanese and Neutral Activity.

The opportunity for capturing the Australian trade formerly done with Germany has been seized by the United States and other competitors. In industries where quick delivery of a given order may be essential, such as in the engineering and machinery trades, there is a likelihood that orders which under normal conditions might be placed in the United Kingdom will be placed with foreign manufacturers. The representatives of American, Swedish, and Japanese manufacturers have displayed increased activity since the outbreak of war. Even before then the United States might be regarded as Great Britain's most formidable all-round competitor in the Australian market. Now their share in the imports of machinery represents one-third of the total imports under this heading. Swedish manufacturers are exercising care in the selection of special representatives for the sale of their products, and are participating in the growing market for oil engines and other power plant. Their imports also include telephones, electrical fittings, and lamps. Japanese manufacturers are apparently determined to enter the Australian market for electrical machinery and appliances. Formerly their activities in the electrical trade were limited to porcelain insulators and a few glassware fittings; now they say they are ready to quote for motors, generators, transformers, water turbines, wires, and cables, as well as telephones and telegraphic apparatus, certain kinds of measuring instruments, and dry cells. They are issuing well-illustrated catalogues, some of which are printed in England with quotations in British currency.

Public Contracts.

Purchases of material and machinery by public bodies in Australia, whether Federal, State, or municipal, are usually made by tender, although in some cases purchase is by indent. When such is procurable locally, the term within which tenders are returnable is short, but when what is required has to be imported a longer term is generally stated. It is a matter of complaint among engineering firms, however, that in some instances the term stated is too short to enable the local agents for firms at home to communicate with their principals, except by cable. In the case of a lengthy specification this is impracticable. Most of the public departments are, however, willing to extend the term for returning tenders on proper representations being made. By far the greater number of public bodies in Australia adhere to the practice of having one of their own officers as sole judge in case of disputes. Contractors urge that such a provision is unfair, as it violates the principle that no one can be judge in his own cause, that it tends to restrict competition, and is thus contrary to the interest of the tax-paying community. The view of the Victorian Railway Commissioners is that long experience has demonstrated that independent arbitration has led to abuse by giving occasion to unjust and excessive claims. It appears doubtful whether the Commissioners will see their way to making the desired modification.

Representation.

For the manufacturer to rely exclusively on such orders as may reach him through shipping firms or merchants is to do himself and British industry less than justice, as while business can doubtless be secured by this somewhat passive method, its volume will compare unfavourably with the more direct, active method of local representation. Many manufacturers are deterred from making appointments of agents through the difficulty of securing the services of really reliable firms undertaking work of this kind. Where a large firm contemplates the appointment of an agent it will probably find that the best, and, in the end, most economical, course to follow is to send out one of its partners or responsible officers with full power to do what is necessary after investigating the market. It may in some instances be found advisable to send out a representative from the home firm to act as resident general representative, whose duties will mainly consist in the supervision of the agents whom he may appoint in the various States. In the case of small firms, who manufacture lines more or less closely allied, but which do not clash, it should be possible for them to co-operate in such a way as to secure jointly the benefits of local representation. Satisfactory arrangements for representation are often made with partners or responsible officers of Australian firms visiting the United Kingdom for the purpose of securing agencies, and discussing business policy with their principals in the agencies already established.

Firms communicating with the Trade Commissioner in regard to the appointment of an agent will save time, and facilitate the work of finding a suitable representative if they will indicate clearly the nature of the proposed agency, its scope, and duration, whether any business has been done with the Australian market through shipping houses in London, whether the manufacturer has been previously represented in Australia, and if so, by whom. Indications regarding the basis on which commission will be paid, and as to travelling and advertising expenses, catalogues and other trade literature will be helpful.

Treatment of Agents: The Old Complaint.

In order to ascertain what justification, if any, there is for the statement that British manufacturers are not so liberal as their foreign competitors in the matter of commission, travelling, and advertising expenses, etc., and in order to form a comparison of British and foreign methods regarding agency representation generally, the Trade Commissioner recently issued a circular letter accompanied by a schedule of specific inquiries. The replies received from several of the more important firms are summarised shortly below. The observation is still made that British manufacturers do not study local requirements so closely as their foreign competitors.

Commissions.—Most firms representing engineering and machinery manufacturers say that the commissions paid by Continental and American firms to their agents are, as a rule, higher than those paid by British firms. Foreign firms appear to offer larger discounts from their price lists where goods are sold to the agent outright, or on consignment, than do British. On the question of commission on indirect orders, the predominating practice with British and American firms is that the agent is covered. A machinery house, however, says that American and Continental firms do not readily agree to this; and another large engineering firm considers the treatment received from German and American firms in this respect is better than from British firms. More than one firm complain that their British principals hold that as they can themselves do business with the Agents-General of the Australian States in London, they are not obliged to pay commission to the Australian agent.

Travelling Expenses.—Both Continental and American firms are reported to be more liberal than British. The latter in many cases appear to make no provision whatever for travelling expenses to the agent, while the former in some instances allow £100 to £200 per annum. With regard to the allowance by the agent to his travellers, £1 per day, plus steamer and railway fares, appears to be usual.

Catalogues and Consignment Agencies.

The criticism of British firms under the heading of catalogues is well summarised by a large firm dealing in electrical appliances in the remark that, as a rule, Continental and American catalogues give more information about the goods than the British, and are more frequently renewed and brought up to date. Continental firms favour this form of agency more than either British or American. Continental firms are always ready to send consignment stocks, and go out of their way to look for business on the *quasi* basis, that is, to secure themselves by sending stocks out to be paid for when sold, and not later than, say, 12 to 18 months from date of shipment; again, they often send out goods amounting to a certain sum to be paid for against documents, and they duplicate the order or goods to an equal amount to be sent out on consignment.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Trade with Russia, and the Metric System.

Referring to your article "Decimal Coinage and the Metric System," the views of Englishmen abroad, who buy practically solely from home, may help a little in assisting you in bringing about a reform which is very necessary if we are to keep our position in the foreign markets, and not lose again the tremendous advantage which is at present ours—a desire on the part of foreign countries, allied to our cause, to make purchases in England.

As we are at present in Russia, our remarks will more especially apply to this country, where there is a market for all classes of machines and engineering specialities, besides other articles, of proportions little dreamed of at home.

Dealing with your questions in order:—

1. Yes! We employ the English system with England, metric system with Germany, France, Switzerland, and Scandinavia, and mostly with clients here, although the Russian measures are used in corresponding with places where there is a possibility of the metric system not being in force.

2 (*a*). Yes.
2 (*b*). Yes.
3. Yes.
4 (*a*). Most emphatically.
4 (*b*). Most emphatically.

The Change.—Anyone who has ever used the metric system for money or measures will affirm that the saving in labour is infinite, and the possibility of error greatly reduced. It is a fact that inability to handle our weights and measures and money loses hundreds of thousands of pounds of orders yearly to the old country, and during this period of the war, when so many firms here have been purchasing from England, we have been asked so often what is a "yard" that we have duplicated a list of English weights and measures and translated them into the metric and Russian systems and given them to clients.

It may perhaps help some readers to realise the difficulties of the foreigner if we give you a simple example of how a subtraction is made :—

Price, £5 12s. 7d.; discount (say), £1 16s. 11d.

This is the way a foreigner does it on paper :—

£4 31 19
£1 16 11
£3 15 8

Imagine the possibilities of error, and his efforts to arrive at the top line correctly!

Disorganisation Due to the Change.—The writer served part of his time in an English works, and went direct from there to a German establishment, and in less than a week was as much at home with millimetres as with sixteenths of inches. At that time the South of Germany had not quite forgotten the numerous sizes of inches that had existed, but no trouble was ever experienced in workmen adopting the metric system, and Englishmen will surely not say that they would be less adaptable.

Quoting in Foreign Money.—It is often stated that were manufacturers to quote in foreign money, they would practically become speculators on the rate of exchange. We have found that in normal times the rate of exchange varies so slightly that the variations balance themselves in the course of a year, and in the event of a large order, most banks are always prepared to give a forward quotation, relieving the manufacturers of worry on that head. If the Germans were able to quote in foreign currency, why not England?

Delivery.—English manufacturers quote usually franco works or f.o.b. English port, more often the former. In our experience we find it pays handsomely to quote delivered at the purchaser's mill, and we not only almost invariably obtain the order against a competitor quoting franco their works, but obtain a price much higher than the competing firm.

It may be argued that it is impossible for the manufacturer to calculate duties, cartage, freight, etc., but it is infinitely more difficult for the client, and he is less inclined to take the trouble when someone else (usually a German salesman) is prepared and willing to do it for him.

It is a simple matter to obtain quotations for freight to any port in the world from any place in England. Any shipping agent will quote.

Duties can be reckoned from the tariffs published in English; any clearing agent here will quote for clearing and delivering to any town, and anyone who would be prepared to go to the trouble would experience a pleasant surprise.

Of course, a live salesman on the spot will usually beat a quotation by letter, and therefore the most businesslike method of obtaining foreign orders is to appoint good agents, but they must be *good*.

A mistake often made by English firms is that they appoint an agent on the strength of his letter-head, without troubling to put him through an inquiry agency or making some inquiries as to his abilities to influence business.

Collection of Accounts.—English practice demands cash against documents at an English bank. This is extremely difficult for a foreign purchaser, and except that there is a slight delay in obtaining the actual cash, there is no disadvantage in collecting through a bank in the town where the clients reside, there being a sufficiency of first-class banks having branches everywhere.

Stamp Duties.—One of the details which cause a good deal of trouble here is the stamping of accounts. All accounts when sent out must bear the following duty stamps :—

When goods are purchased by retailers, 10 kopeks for every 100 roubles, say £10.

When purchased for own use, 50 kopeks for every £10.

These stamps, called Gerbovoie Stamps, may be purchased at any Consulate. If these stamps are not on the accounts we are liable to a heavy fine, and are precluded from annulling stamps ourselves if we put them on; and in any case, this would be a heavy tax on a reseller, as he has to pay the higher duty on his own accounts.

All firms in Germany before the war adhered to the regulations; but, with the exception of one or two, it is a custom unknown to English firms.

John A. Merrett,
Merrett & Jones.

Petrograd, *October* 17/30*th*, 1915.

Decimal Coinage and the Metric System.

Your very able article on the metric system of measurement is most interesting; but I fancy that, so far as manufacturers are concerned, you are preaching to the already converted. The difficulty does not lie with them, but with their customers, the general public.

In our own case, we have to keep two sets of figures in vogue. Lists and quotations have to be given in metric notation to customers in foreign countries, whilst another set of figures has to be employed in this country and the British Dominions overseas.

Naturally, we should be only too pleased to avoid this double work, apart from the waste of time to which you call attention in your article, resulting from our present incongruous assortment of weights and measures. But those into whose hands the goods ultimately come are used to *thinking* in terms of inches and pounds, rather than in millimetres and kilos, useless to them. No expression of opinion, therefore, on the part of manufacturers can ever result in the general adoption of the metric system in this country.

The only hope for such a salutary change appears to rest upon Government action, short of which nothing will prevent the average buyer from insisting upon the continuance of a system to which he has grown accustomed.

If, after a certain day, it were made obligatory upon all traders to sell only by metric measures, their customers would be forced to adapt their mental vision to these; and though a certain difficulty would naturally occur at first, it would be a small matter in comparison with the saving of time which would very quickly be effected. The difficulty would, moreover, be greatly discounted by the fact that, during the period of probation before the law came into effect, the public would have been forced to take cognisance of the new measures, and have accustomed their minds to grasping what they looked like in practice. Once this result has been achieved, and they are able to *think* in the new terms, there would be no further difficulty.

Chas. H. Elliot,
Managing Director,
The Associated Battery Co., Ltd.

London, S.E., *November* 16*th*, 1915.

An incidental advantage of the adoption of the metric system, which you are so ably advocating, and of a decimal coinage, which is its proper corollary, is the facility given for the use of adding machines, which type and sum any reasonable number of items without mental exertion, or need for checking, in a small fraction of the time taken by the most expert caster.

In one concern known to me some 10,000 consumers' accounts, up to £2,000 wages and salary payments, and a large number of other receipts and payments have to be dealt with every month, the work including the dissection and allocation between various departments, and all the various revenue and capital accounts for the preparation of complete monthly balance sheets. Thanks to the use of metric measures and a decimal coinage all the casting of this mass of figures is performed by three adding machines, at a saving of time and clerical labour that is hardly calculable.

Similarly, the use of slide rules and logarithms is greatly facilitated. It is true that by decimalising our British measures and money such aids can be utilised, and, personally, I find it worth while to do this in the preparation of estimates, the summing and dissection of wages and costs sheets, etc., whenever a large number of items have to be dealt with; but the conversion takes time, has its own risks of error, and the processes are not readily checked or acceptable to auditors and others who stick to British ways. Of course, there are many accountants in our leading firms of auditors who are familiar with decimal methods, but they all want money values in £ s. d. when it comes to auditing.

It is difficult for anyone who has not worked with both systems to realise how much unnecessary mental drudgery and clerical labour is entailed by our measures and coinage. May your powerful advocacy help to bring about this much-needed reform.

Henry M. Sayers.

London, S.W., *November* 16*th*, 1915.

The Institution and Alien Enemy Members.

It is to be regretted that the President and Council of the Institution of Electrical Engineers have not seen their way clear to make known the attitude they intend to adopt with respect to subscribers to the Institution who are of alien enemy origin.

One can only imagine that the Council either is unmoved by the continued outrages and barbarities committed by our enemies, who week by week add further gruesome details to the same, or that the subtle influence which is known to have been at work to nullify the movement towards the exclusion from the Institution of members of alien enemy origin has been successful. It is hoped, however, out of respect to the hundreds of subscribers who are offering their lives for their country, that if the Council refuses to take the necessary steps (even if it needs a general meeting or plebiscite to amend the rules and regulations and by-laws of the Institution) to enable aliens to be removed from the roll of members, these brave men, upon their return, will refuse to continue to belong to an institution which has so failed in its duty to them.

Station Engineer.

The exclusion of men of alien enemy birth from the Institution of Electrical Engineers is a matter on which numbers of electrical engineers hold very strong views, and resolutions have already been passed by representative bodies and forwarded to the Institution, but, judging from past experience, the Council may be expected to sit tight and let the agitation die down. Their position is a very strong one; in the ordinary course of events vacancies on the Council are filled by their own nominees, because, although great dissatisfaction is constantly being expressed at their policy, or want of policy, not only by individuals but by representative organs of the electrical industry, the opposition cannot be easily organised to make its weight felt. The only time that the Council of the I.E.E. took any notice of the wishes of the rank and file was when they wanted to increase the subscriptions. Then, and not till then, did the provincial members, who formed the largest proportion of the membership, get their long-standing grievances redressed. The application of that lesson is obvious: If all those members who resent the lofty disdain with which the Council regard any suggestions made to them will hold up their subscriptions (and the subscriptions can be held back for *two years* without loss of membership), then something is bound to happen.

This is quite a feasible method of protest, for, quite apart from those who want the German excluded, there must be hundreds who feel that it would do the Council good to be made aware that they are not irresponsible demigods, but the elected executive committee of the electrical industry in the British Empire, and that it is their duty to study and work for the interests of the profession which they represent.

There promises to be a severe commercial war between Britain and Germany, when Germany may be expected to use any weapon, however unworthy, and the revelations of German activity in the United States should open the eyes of the Council to the danger of allowing men of German birth in any way to influence the policy of the I.E.E.

It was stated on good authority recently that the proposal that members should write direct to the Secretary of the I.E.E., stating their views on this subject, was not feasible, for the German influence was so strong that large numbers in British manufacturing firms would be victimised if they expressed their views to their own Institution. If this is true, it is a scandal that should be righted at once. Perhaps those who can speak with first-hand knowledge would let us know through the columns of the REVIEW if this is really the case, so that when January 1st arrives, and the subscriptions are due, there may be a large number who are ready to do their bit to compel the Council to put their house in order, and either act promptly, or, if their hands are tied, to take a secret vote of the members and carry out the wishes of the majority.

Another Station Engineer.

If anyone is confusing the issue, it is "Another Station Engineer," as my letter was a plea for standing by our obligations (in the form of "Scraps of paper") and for fair-play. In no possible way can my letter of October 26th be read as indicating "that naturalisation papers carry the right of membership of the I.E.E., and that expulsion from the I.E.E. carries with it the denial of British citizenship," and I must decline the honour which "Another Station Engineer" would confer upon me of deciding what does constitute the right of membership of the I.E.E., even for naturalised British subjects. My points are quite clear:—

(*a*) That we should honour "Scraps of paper" in the form of naturalisation papers.

(*b*) If the members of the Institution, after all, decide upon some action, that each case should be treated on its merits.

As an illustration, I may say that only to-day an elderly Lancashire man, who was caught in Germany when the war started and who was released last week as being of no military value, called in to see me with a message of goodwill from a German-born naturalised British subject, who was also caught in Germany at the commencement of the war and has been interned there, together with other German-born naturalised British subjects, ever since.

A.M.I.E.E.

November 15th, 1915.

Who Will Assist?

I am trying very hard to get a temporary position for a Belgian engineering merchant who had a large business in Antwerp, but fled with his family to this country prior to the German occupation.

He has had a good deal of experience in the sale of engineering and electrical specialities, and, in addition to having a first-rate knowledge of Continental commercial matters, he speaks English, Flemish, Dutch, and French.

I feel certain that with his experience and knowledge he should be able to find a position in one of the engineering establishments of this country.

I shall be glad to give complete details in regard to this gentleman, who occupies an unimpeachable position.

H. Scholey.

56, Victoria Street, S.W.

Electrically Heated Soldiers.

I saw an item of news in the *Daily Express*, this being copied from a German paper, and as a good many people are fond of apologising for the Germans, and saying what wonderful people they are, I thought that after reading this you would no doubt think the same thing, as I think that for costs of production of energy the "Point Fives" are quite eclipsed. It is no doubt interesting from one point of view, that if the Germans are applying this treatment to all their soldiers there will be no need for further fighting, provided they use a suitable heating element for the purpose of absorbing the power mentioned.

The paragraph is with reference to a type of clothing to be supplied to the German army, with wires interwoven with the cloth, and current supplied to these wires for the purpose of keeping the individual soldier warm. The paragraph reads as follows:—

"The heat may be regulated from 30 volts to 250 *kilowatts*, the cost of the apparatus being 8d. for each man, and the cost of working 1½d. per hour."

R. Falshaw.

Harrogate, *November 18th*, 1915.

A Contractor's Complaint.

I was interested to read the letter in your issue of the 12th from "J.S.L." He touches on a point which never appears to have had the attention it deserves.

I refer to the custom of giving full trade discounts off lamps to people who have no right at all to receive them. Your correspondent does not quite grasp the point, as it is quite in order for an ironmonger to receive trade terms. The basic principle underlying discount is that it should only be given to retailers who depend on their discount for their gross profit. Apart from retailing, trade discount has no meaning.

Whenever questions of discount arise, that is the point, and it is useless to confuse it by contending that only persons who have received a training in electrical engineering should be given discount, for we see exactly the same argument arising in the case of a great number of wholesale firms who give discounts to people who are not in the trade, and say that they do so because these people employ their own electrician, *e.g.*, picture palaces, large factories, etc. Of course, this is utter nonsense, as the lamps are not for resale, and it is this kind of nonsense that electrical contractors have been swallowing for some time.

The question is, what is being done? and I think it would be extremely useful to have a letter from a responsible member of the Electrical Association published in these columns, so that the ordinary mortal can have some idea of the attitude of the Association.

In regard to the second paragraph in your correspondent's letter, I must confess that I cannot hold him blameless if he allows his business to be snapped up by cycle agents: but why not mention the name of the wholesale house referred to? If we knew who it was, we could act accordingly.

A. W. Kimber.

London, W., *November 17th*, 1915.

[Our correspondent suggests that the point in question has never had the attention it deserves; he is evidently unmindful of the repeated and prolonged discussions on this subject in our "Correspondence" columns in past years.—EDS. ELEC. REV.]

The Tungsten Lamp Association.

A number of your correspondents have recently called attention to the fact that members of the Tungsten Lamp Association were furnishing incandescent lamps to the Electrical Co., Ltd., and the A.E.G. Electric Co., Ltd. The facts are as follows:—

By an agreement dated June 20th, 1913 (over a year prior to the outbreak of war) between the members above mentioned and the Allgemeine Elektricitäts Gesellschaft, of Berlin, the Electrical Co., Ltd., and the A.E.G. Electric Co., Ltd., it was recited that an Order of the Chancery Division of the High Court of Justice had been obtained, dated May 21st, 1912, whereby, amongst other things, the validity of Patent No. 23,899* of 1904 was certified, and that the Allgemeine Elektricitäts Gesellschaft were manufacturing in Germany incandescent electric lamps and importing the same into the United Kingdom, which lamps, in view of said Order, were infringements of said patent, and in order to induce patent-owners to refrain from taking proceedings against the German company and its English offshoots it was agreed between the parties:—

(1) That the Allgemeine Elektricitäts Gesellschaft, the Electrical Co., Ltd., and the A.E.G. Electric Co., Ltd., would not import into or sell such lamps in the United Kingdom.

(2) That the Allgemeine Elektricitäts Gesellschaft would pay damages for such lamps as had already been shipped into the United Kingdom (which damages were duly paid). And

(3) That the Electrical Co., Ltd., and the A.E.G. Electric Co., Ltd., would purchase from certain manufacturers in England such lamps as they might sell in the United Kingdom, which lamps the manufacturers agreed to supply.

So long as the laws of Great Britain remain as at present, these members of the Tungsten Lamp Association are bound under said contract to supply to the above-named companies lamps for sale in Great Britain. Unless, and until, the law is changed, these members of the Tungsten Lamp Association are powerless to do otherwise than carry out a contract which the laws of Great Britain hold to be valid. This position is clear to any correspondent who is cognisant of, or refers to, the "Trading with the Enemy" Proclamation of September 9th, 1914, Clause 3, or the case of the Continental Tyre and Rubber Co. *v.* Tillings, and *v.* Daimler Co., decided by the Court of Appeal about February last.

W. C. Fisher,
Secretary, Tungsten Lamp Association.
London, E.C., *November 23rd*, 1915.

ELECTRICITY SUPPLY.

(*Abstract of inaugural address delivered by* Mr. C. P. Sparks, *President, to* The Institution of Electrical Engineers, *November 18th*, 1915.)

(I) Effect of Legislation.

No industry received earlier recognition by Parliament than that of electricity supply. Unfortunately, the advantages of encouraging private enterprise were disregarded. In the case of gas supply, after competition had been tried over a long period, monopolies were granted to private enterprise to supply gas over large areas, the price being controlled by a sliding scale connecting the price of gas and dividends. This method of operation has resulted in the greater part of the Metropolis being supplied by two gas companies representing the amalgamation of 19 smaller undertakings (the Gas Light & Coke Co. supplying an area in and around London of 125 square miles, from six main stations all supplied in bulk from the main down-river station at Beckton, 12 miles from the centre of the Metropolis). Under this method of control, gas is supplied at a low price, at the same time allowing the gas companies to earn such dividends that there has been little difficulty in financing the undertakings.

In spite of this precedent, Parliament in passing the Electric Lighting Act of 1882 decided that the unit of area in the case of our industry should be a parochial one. In consequence of this enactment, by the end of 1888 public supply was being given by only three companies under licences in Great Britain, and no supply was being given under any Provisional Order.

The effects of legislation in thus stifling the new industry in Great Britain were far-reaching. Our American and Continental competitors seized the opportunity to forge ahead in developing this new industry, which they had placed on a successful commercial footing. In the meantime, manufacturers in Great Britain, unable to proceed with the equipment of undertakings operating under statutory powers, had either to turn their attention to the equipment of separate works with lighting and power, or to operate without statutory powers by using overhead wires, permission for these being secured by private wayleaves of uncertain tenure. By this method of development the electric supply industry was started on unsound lines in this country, and the effects of this false start are still felt.

The Act of 1888 modified the Act of 1882 in four important particulars, but in spite of many efforts another 21 years had to elapse before further general legislation was secured.

It was not until 1908, when the companies obtained the right of association under the London Electric Supply Act, that the London County Council were constituted as the Purchasing Authority for the whole of the company undertakings in 1931, in substitution for the separate local authorities.

While immense trouble was taken in settling the method of supplying London in detail and in dealing with all local questions, the more important question of supplying London as a whole was disregarded.

(II) Electricity Supply in the Metropolis.

Unfortunately, owing to the legislation previously referred to, this area has been subdivided between so many electrical undertakings that the question of general supply cannot be considered from an engineering point of view. The present position arises through a series of initial mistakes, and future improvement is more a matter of adjusting numerous municipal and other vested interests than an engineering question.

Owing to the difficulty of co-ordinating the many separate interests created by the Acts of 1882 and 1888, and the fixed idea of our legislators that all interests were subservient to the interests of local authorities, no serious attempt to rectify this chapter of errors was made until 1904-5, when Mr. Charles Merz brought forward his epoch-making scheme to provide for the future electricity supply of this important area. The main outlines of this scheme were:—

The erection of three main power stations to supply the Metropolis—

(*a*) In bulk to the authorised undertakers then existing;
(*b*) Railways, tramways, and large consumers;
(*c*) Power in detail, and lighting up to 20 per cent. of the total supply to individual consumers.

A maximum price of 1¼d. per unit; dividends on a sliding scale depending on the average price (the average price taken as ¾d. per unit, with a standard dividend of 8 per cent.); if the average price exceeded 1d. per unit no dividend.

While Mr. Merz succeeded in getting the Bill of the Administrative County of London Co. passed by Committees of both the Lords and Commons, finally securing during the inquiry the adhesion of all the companies and several of the important local authorities in the area, the great length of the inquiry left only three days for the final stages (usually formal) in the Commons. The activity of a few private members sealed the fate of this Bill and, notwithstanding the general benefits that would have resulted, the clock was again set back, certainly for ten years, the further expansion of the individual undertakings rendering the successful development of any complete scheme more difficult and more expensive each succeeding year.

Six years after the passing of the 1888 Act, ten supply companies were operating in the Metropolis, and it was not until these undertakings had been established by private enterprise that the local authorities, who had had it in their power since 1882 to secure perpetual rights to supply their own areas, commenced their operations; in fact, 12 years after the passing of the 1882 Act only one local authority was giving a supply in the Metropolis.

Progress during the first six years after 1888 was at the rate of 2.3 million additional units sold per annum; during the next ten years 12 million additional units per annum; and during the last ten years 20 million additional units per annum, although the use of the more efficient metal-filament lamp increased the light obtainable per unit more than threefold.

The density of the sales for general supply in the Metropolis, apart from those for traction, is now about three million units per square mile, 45 million units being used annually per square mile in the area of densest demand.

General supply is now being given in the Metropolis (an area of 117 square miles) by 38 separate undertakings, and traction supply by 10, there being 48 power stations, and 8 different frequencies of supply.

In view of the successful results obtained in this country outside the Metropolis by concentration and the recognised practice of the rest of the world in allowing one authority to operate over a large area from a minimum number of power stations, there is little to be said on the London question from an engineering point of view; but in spite of the extreme difficulty in carrying through any scheme dealing with the whole area, it is clear from the results obtained elsewhere that London will be divided eventually for electricity-supply purposes into a reasonable number of areas, even if a scheme embracing the whole Metropolis is not carried through.

The two main difficulties to be met when approaching this matter from an engineering point of view are as follows:—

1. Owing to the large sums invested by a number of separate undertakings in small power stations and special distributing systems, any comprehensive scheme must suffer a disadvantage in the first instance due to the added cost of—

(*a*) New high-pressure network, and
(*b*) Cost and loss in conversion plant.

From past experience distributing systems have been the only part of a supply undertaking which has not shown serious obsolescence, and there is now every reason to consider the return of the necessary expenditure in any new high-pressure network over a period sufficiently long to allow the undertaking to develop, rather than to look on the immediate result.

2. Reliability of supply is of the first importance and of far greater importance than the provision of a supply at a minimum cost. It is, therefore, argued that it would be unsafe to supply the Metropolis from a few stations, special objection being taken to any scheme which commences by adding one new power station of considerable magnitude.

It will be agreed that adequate safety can be secured with far less than the present number of power stations (38 in number), and as most of the individual undertakings are being supplied by a single power station unconnected with any other undertaking, the general safety of supply would be improved if the separate undertakings were inter-connected and supplied from a suitable number of modern power stations, each capable of dealing with demands of not less than 100,000 kw. A commencement could be made with one station to supplement the supply from existing stations, and as the less efficient of these passed gradually out of use the main power station would be supplemented by a second or further stations as required.

Apart from public advantages of a co-ordinated supply working in the direction of a unified system with standard pressures of supply and of the cheapening of plant owing to the greater demand for standard apparatus, and also of the lowering of the price per unit, there are two main factors that render a scheme of consolidation of the first importance, namely, economy in fuel, and the removal of power stations from the more densely populated areas.

(III) Main Engineering Features.

Many inventions of value have resulted in improving the reliability of supply and in greater economy of production. The development of three-phase transmission, with resulting economy in first cost of generators and mains, the ease of transformation, and the invention of the induction motor, provided a system which enabled one undertaking to serve every class of demand in a large area.

The original alternating-current systems in this country were started for lighting supply, and consumers were supplied through overhead wires by separate transformers. To keep down cost and to raise the efficiency, frequencies of 80 to 100 cycles per second were selected. The choice of these high frequencies made the development of single-phase alternating-current motors almost impossible.

Although 50 cycles has now been adopted as the standard frequency of supply for all purposes outside special transmissions or single-phase railway work, the effect of developing A.C. systems on a wrong basis has not yet been eradicated.

The general parallel working of alternators was a matter of difficulty up to 1889, and at that date all the alternating supply companies in this country operated with alternators supplying separate groups of feeders. No material progress was made in the operation of alternators in parallel as standard power-station practice until after Mr. W. M. Mordey laid down the principles and demonstrated the theory by the practical parallel working of the alternators of his design. This pioneer work of Mr. Mordey at once had a far-reaching effect on power-station design and methods of working. It improved the reliability of the supply and lowered the operating cost by enabling the running plant to be worked at its most economical rating; it also showed the possibility of converting single-phase alternating currents into continuous currents by the use of synchronous motor-generators.

The development of the steam turbine, due to Sir Charles Parsons, together with the adoption of superheated steam and suitable condensing facilities, has entirely changed the character of supply undertakings. It has enlarged their scope by increasing the possible size of operating units, has greatly reduced the first cost of generating and boiler-house plant and buildings, and has lowered operating cost. The maximum size of turbo-generators is not yet in view; machines rated at 30,000 and 35,000 KW. are at work, while machines of still larger capacity are being designed. The upper limit in the size of generators is at present fixed by the extent of the system to be supplied and the limitations of the method of control, rather than by any limitations in the design of the turbine or electric generator.

The main improvement in steam-raising is the universal use of large boilers of the water-tube type, combined with superheaters and mechanical stokers using small coal of medium calorific value, as compared with small boiler units of various types, hand-fired with coal of high calorific value.

Large power stations now use boilers in which the superheater and economiser form an integral part of the boiler, each boiler on normal output evaporating up to 50,000 lb. of steam per hour at 200 to 250 lb. per square inch pressure, the steam being superheated 200 to 250 deg. F., as compared with boilers evaporating 8,000 to 10,000 lb. of steam at 80 to 150 lb. pressure.

The average efficiency in conversion of the heat energy of the coal has been raised from 65 to 85 per cent. on test and from 50 to 75 per cent. under operating conditions, with a material saving both in the cost of fuel and in labour. Also, due to mechanical stoking, boilers now give their full output efficiently and continuously for long periods, compared with the fluctuating output in the case of hand-fired boilers due to the necessity of cleaning fires. This factor is of prime importance in reducing the amount of boiler power required. Again, the use of small coal enables the entire coal supply to be handled mechanically, and the development of the suction ash-conveyor has reduced to a minimum the amount of labour required in the boiler house.

As a result of the improved thermal efficiency of the boiler house and resulting low temperature of the gases, mechanical draught has become a necessity, the old difficulties of induced-draught plant, due to action of the hot gases on the fan and casing, not occurring with the lower temperature at which the gases are now discharged from the boiler.

The decrease in the number of operating units and the simplified steam range have directly reduced the stand-by losses in the boiler house and steam piping.

The increase in size and the improved design of water-tube boilers and accessories have resulted in the space occupied by the boiler-house plant being reduced to one-fifth of that required for an equal evaporation of steam 30 years ago.

The invention and development by Mr. Ferranti of the paper-insulated lead-covered cable has not only reduced the cost of transmission and distribution, but has largely increased the reliability of operation. Almost all transmission cables are now paper-insulated, lead-covered, armoured, and laid direct in the ground; while for distributing purposes in the more central areas, paper-insulated lead-covered cables drawn into conduits are largely used. When it is considered that some 40 per cent. of the capital outlay in the electric supply business is due to distribution, of which the cost of cable represents the greater proportion, the importance of this development is apparent.

The development of the 50-cycle rotary converter has resulted in reducing the space occupied by transforming plant to one-half of that required by motor generators; the first cost has been reduced to between one-half and two-thirds, and the efficiency of conversion has been raised to 94 per cent. at full load.

The metering of electricity was a great difficulty in the case of early undertakings. The first meter developed for continuous-current supply was of the electrolytic type. No meters were available for alternating-current systems, and electricity was sold by annual contract.

Initially, the development of the continuous-current meter appeared to be a simpler problem than the metering of alternating currents. Now all alternating-current meters are of the motor type worked on the rotary-field principle. The absence of commutation and of collection of current has proved an enormous advantage in maintaining their accuracy, and more difficulty is now experienced in maintaining the accuracy of the D.C. meter over a given period than with the A.C. type.

No method of metering energy has been brought to greater perfection than that for the metering of electrical energy, and the ease and accuracy of measurement have played a great part in enabling losses to be analysed and improvements made by increasing the efficiency of apparatus and the operation of the system.

As an instance of close calibration and accuracy over a considerable period, I give the reading of three motor meters, the power factor of the supply varying from 0.8 to unity and the demand from 2.5 to 60 per cent. of the rated capacity of the meters.

	Meter (1)	Meter (2)	Meter (3)
Number of units registered	1,955,700	1,945,800	1,952,300
Mean reading—units		1,951,266	
Error from mean—units ...	+ 4,434	− 5,466	+ 1,034
Error from mean—per cent.	+ 0.23	− 0.28	+ 0.05

The introduction of the metal filament resulted in increasing the C.P.-hours derived from one unit of electricity threefold, to 800 C.P.-hours per unit, lamps of small C.P. being manufactured for pressures up to 250 volts. The recent development of incandescent lamps with nitrogen-filled bulbs has again more than doubled the number of C.P.-hours obtainable per unit, the figure now being 2,000. These improvements in the efficiency of incandescent lamps have resulted in increasing the standard of illumination and have largely increased the use of indirect lighting.

Although the number of units sold by some supply undertakings showed a marked decrease when metal-filament lamps were first introduced, the lowering of the cost of illumination at once resulted in increased business, which, owing to the growth in the number of consumers, has placed the supply undertakings on a more secure foundation.

Another important result of the introduction of the metal-filament lamp is that, owing to the high temperature at which the filament is worked, it is much less sensitive to fluctuations in pressure.

This characteristic of the metal-filament lamp, added to the absence of the blackening of the bulb, has much improved the quality of the lighting and has materially reduced the difficulties met with during the hours when the distributing network is heavily loaded.

The high efficiency of conversion from electric to mechanical power in the motor as originally developed left little room for improvement. The main efforts of designers have been devoted to reducing the weight and thus lowering the first cost, which has fallen 50 per cent. in motors of moderate size during the last 15 years. The other direction of advance has been in improved reliability, reducing the cost of maintenance.

Little further improvement can be expected in efficiency, which, for motors of moderate power, speed, and voltage, reaches 85 per cent.

(IV) Direction of Further Progress.

In the light of our present knowledge there are four main reasons why we should expect a large further expansion in the general supply, apart from the extension of electric traction and the use of electrical energy for electrochemical purposes. These reasons are as follows:—

(1) Necessity for fuel economy.
(2) The extension of lighting.
(3) The increased range of transmission.
(4) Domestic use of electricity.

(1) The economical use of fuel has been hindered in this country by its low price. Only a fraction of the total coal consumed is at present used for centralised supply of power and heat; the principal future economy in fuel is to be found in increasing the use of such centralised supply to allow the most efficient use to be made of the world's coal supplies. To attain this economy, large capital outlay is required on plant for converting the heat energy of the coal into electricity; but the present apparently lower cost when using fuel inefficiently at a large number of isolated points, retards progress in the direction of centralisation, as immediate results are often only considered.

The fuel-saving by using a centralised supply is due to the reduction of stand-by losses and to the higher efficiency of large generators and boiler plant when worked under skilled supervision. The fuel-saving under average conditions from a central scheme as compared with isolated plants is not less than 75 per cent. With the gradual increase in the cost of fuel, it is unquestionable that all main supplies for power and heat will be obtained in the future from centralised sources.

One of the next steps to lower the cost of production of electricity will be the gas-firing of boilers, the gas being obtained from producers worked at a low temperature. This will provide by-products from the distillation of the coal as a raw material for other industries. The sizes and positions of most of the present power stations prevent this system being used, as by-product processes can only be successfully worked on a large scale and with plant operating at a high load factor; but the increase of electrical energy taken from centralised sources of supply and the gradual change from comparatively small stations to main power stations, will allow of this method of generation.

(2) Apart from hygienic reasons, it is certain that electricity will prevail more and more as an illuminant owing to the greater number of C.P.-hours that can be obtained from a ton of coal by using electricity as compared with gas. With electricity generated in modern power-houses using 25 B.TH.U. per watt-hour, and with 85 per cent. efficiency of distribution, the number of C.P.-hours obtained per ton of coal is, with metal-filament lamps of 15 to 20 C.P., no less than 750,000, as compared with 260,000 in the case of gas, gas mantles of 20 C.P. and 13,000 cubic feet of gas per ton of coal carbonised being assumed. The amount of coal required with electricity for small units of light is thus only one-third of that necessary for an equal illumination with gas.

It may be suggested that further improvements in the gas mantle will equalise matters; but it must be remembered that electricity is more than holding its own in new developments. The half-watt lamps now on sale have again reduced the energy per C.P.-hour by more than 50 per cent. for lamps of 120 C.P. (smaller units of light being available when lower pressures than 100 volts can be obtained by transformation).

(3) Further research should result in improved dielectrics which would allow higher working pressures for underground cables, thus lowering the cost of transmission, increasing the size of each centralised undertaking, and again raising the operating load factor by the greater diversity in the demand.

Pending this development, the economical radius of transmission can be increased by using overhead lines outside the thickly populated districts, and it is not too much to expect legislative action in the national, as against private, interests. Statutory powers should allow the erection of transmission lines along the most economical routes, reasonable rents for wayleaves being fixed by an independent tribunal.

(4) There is no section of the general supply that opens up greater possibilities than electric cooking and heating, since at a low estimate the units required for these purposes would be ten times those required for lighting. This development would utilise to much greater advantage the distributing mains in residential areas, which are at present only fully loaded during a few hours per annum.

While the efficiency of conversion in the present electrical apparatus is high, and the system is an ideal one hygienically since there are no products of combustion, development has been slow for the following reasons:—

(1) With the present method of conversion of the heat energy in the coal to electricity it is only possible to deliver to consumers some 15 per cent. of the heat energy in the coal.

(2) The present cost of the apparatus and its maintenance. A large expansion of business would enable manufacturers to meet this point, and immediate improvement will take place as soon as the supply undertakings are prepared to let on hire and maintain apparatus on liberal terms in the same manner as the electric motor business was developed.

(3) The rates charged for this class of supply are in many cases not sufficiently low to encourage development. A low rate is essential and is justified by the high diversity factor and the large number of hours of use, resulting in a greatly improved load factor from the residential demand.

WAR ITEMS.

New Sources of Copper for Germany.—The mineralogist Oebbeke, of Munich, has called attention to the presence and possible working of copper ores in the Bavarian Rhine Palatinate, and the " E.T.Z. " states that this matter will receive energetic attention. There are also rich copper fields in the parts of Serbia newly conquered by Bulgaria, in the Morawa district. Ironically enough these mines have been worked for some years by French and Belgian capital; the copper output is said to be 20 to 30 tons daily. With the opening of the road to Constantinople, the Germans hope to be able to import considerable quantities of copper from Asia Minor, and it is claimed that the Arghana-Maden mine at Diarbekir will supply practically all the enemy's requirements. This mine is the richest in Turkey, and one of the most productive in the world; and there are valuable deposits in many other vilayets of Asia Minor. Many of these deposits have not been worked to maximum advantage in the past, and if their total production be insufficient to meet the normal demands of Germany, it is at least so great that copper famine does not seem likely to contribute appreciably to the enemy's defeat.

Reuter's agent at Copenhagen says that the copper famine in Germany is reported to be reaching an acute stage. A number of churches have received polite but firm requests to hand over whatever copper may be in their possession. The great Cathedral at Bremen, by way of showing a good example, has placed all its available copper at the disposal of the military, even its huge copper roofs, which are now being dismantled.

A newspaper report states that Germany is getting seventy tons of copper daily from the Serbian mines.

Russian Trade.—In a very valuable report on the measures needed for increasing French trade in Russia, which appears in the " Bulletin de la Société d'Encouragement pour l'Industrie Nationale " (pp. 107-146, July-August, 1915), it is pointed out that, in the electrical trades, a great lever on behalf of German trade is supplied by the standardisation rules for electrical machinery, etc., set up by the Deutsche Electricitäts Verband, which are in use generally throughout Russia. To remedy this disability, it is suggested that the rules of the Union des Syndicats d'Electricité Française should be substituted, and that energetic representations should be made to the Russian Association to this end. The diplomatic support of the French Government is also called for. The matter equally interests British manufacturers, and it would be well, at an early stage of the proceedings, for the British electrical industry to join forces with the French, in order that an arrangement may be come to serviceable alike to our own needs and to those of our Allies.

The " Times " correspondent at Petrograd states that the Council of Ministers has approved a proposal of the Minister of Finance to suspend the remaining commercial and industrial enterprises of enemy subjects in Russia, at present numbering 1,102, employing 32,208 hands, with an annual turnover of £10,633,488.

The Russian Ministry of Commerce has drafted a Bill with the object of exterminating German influences in the electrical industries of Russia. The Bill provides that concessions for electrical undertakings shall be granted in future by the Ministry of Commerce instead of by the Communes as hitherto.—" Ironmonger."

Starred Men.—Lengthy lists have been issued of scheduled occupations which the Authorities consider vitally important in connection with the munitions and industrial operations during the war. In list " A," which sets forth " occupations required for production or transport of munitions supplied by Ministry of Munitions," we find the following:—Electric welder and cutter; wiremen (building or shipbuilding), electrician (ship), armature winder; electrical instrument makers; scientific instrument makers. In list " B " (coal-mining), all classes of underground workers are included, and colliery electricians (above ground). In list " C," among the railway employés, telegraph wiremen are mentioned; and electricians employed in the " Screener (coke-screener), shale burner and shale mining " class are listed. List " D," which relates to reserved occupations of cardinal importance for the maintenance of certain branches of trade or industry, includes:—" Electricians engaged in maintenance and repair of tools and machinery (all trades)—electric light and power supply (public utility services, gas, electric light and power corporations, tramways, waterworks and canals). For the detailed lists we would refer our readers to the daily press for Monday and Tuesday last.

German War Allowances.—The Main Kraftwerke A.G., Hochst a.M., is paying members of its staff who have been called to the Colours 50 per cent. of their normal wages, plus 5 per cent. for each child, up to a maximum total of 70 per cent. of full pay. The families of workmen, wiremen, etc., are receiving 7 marks a week, plus 1¼ marks for each child, up to a maximum total of 12 marks (1 mark used to equal 11¾d.). The company continues its contributions to the sickness insurance fund. War bonuses are paid to men still employed, on the following basis:—7½ per cent., plus 2½ per cent. for each child, up to 15 per cent. total, for married men normally receiving up to 250 marks a month; 5 per cent., plus 2½ per cent. for each dependent, up to 12½ per cent. total, for single men receiving up to 150 marks a month.

The A.E.G., Berlin, has granted its married employés earning 300 marks, or less, per month a bonus of 50 marks on account of the rise in prices. Single employés in the same wage class receive 25 marks bonus.—" E.T.Z."

Arming Disabled Soldiers for the Industrial War.—The Verein Deutscher Ingenieure (German Society of Engineers), of Berlin, is organising a competition for the best design for an artificial arm that will enable a man who has lost an arm to do engineering work. Prizes to the extent of £750 (the first one being £500) are being offered in connection with the competition, which will close on February 1st next.

Australia and German Trade.—A Reuter dispatch from Melbourne states that the Federal Government has suspended all enemy trade-marks.

Mr. Hughes, in replying to a deputation which urged increased tariff protection against the dumping of cheap German goods after the war, said:—" If we have the power we shall take steps to prevent German goods from coming here after the war."

War Profits.—The Minister of Munitions has appointed Sir Henry Babington Smith, K.C.B. (chairman), Mr. Harold Brown, and Mr. William Cash to be the Board of Referees relating to the limitation of the profits of controlled establishments.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

G.E.C. Industrial Fittings.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have recently issued a supplementary pamphlet, No. F 1964, dealing with industrial fittings, including various vitreous enamelled half-watt lamp fittings, Benjamin and Holophane reflectors, &c., and sundry heating apparatus suited to industrial use.

We illustrate in fig. 1 a G.E.C. "munition" shop pendant, consisting of an 18-in. enamelled steel top reflector with an opal bowl underneath, the fitting being suited to the 200 to 500-watt sizes of Osram Atmos type (half-watt) lamp. Fig. 2 represents a G.E.C. Benjamin semi-indirect half-watt lamp fitting, constructed in sizes suitable for from 100 to 1,000-watt lamps with 16-in. and 20-in. top reflectors; while fig. 4 is a shell inspection hand lamp, designed especially for the examination of shell interiors. This is supplied in two sizes, 18 in. and 24 in. in length; the handle can be fitted with a switch at slight extra cost.

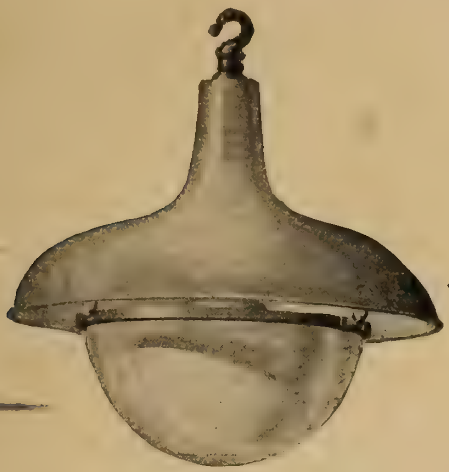


Fig. 1.—"Munition" Shop Pendant.

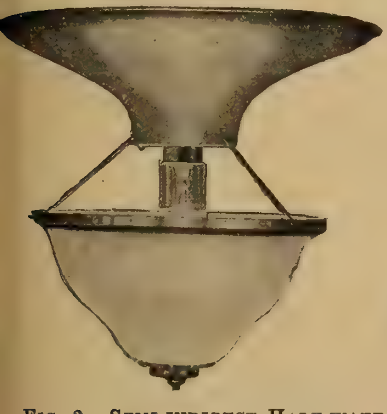


Fig. 2.—Semi-indirect Half-watt Fitting.

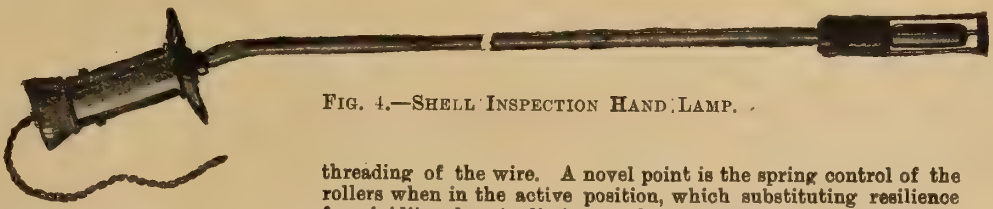


Fig. 4.—Shell Inspection Hand Lamp.

A series of Holophane industrial reflectors of the "extensive," "intensive" and "focusing" types for half-watt lamps of from 60 to 1,000 watts are listed.

Monometer Tinning Furnace.

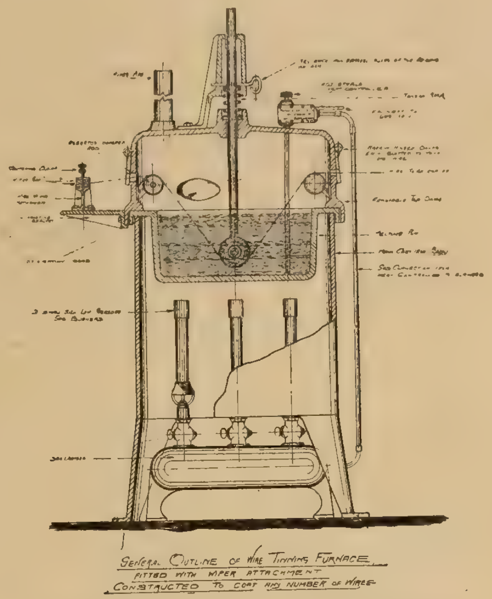
The usual method of coating wire with metal is to draw the wire through an open pot containing the molten metal, the very considerable loss through surface oxidation being accepted as inevitable.

In a system introduced by the Monometer Manufacturing Co., Ltd., of Whitehouse Street, Aston, Birmingham, the special features comprise a complete enclosure of the melting pot, means for the prevention of oxidation of the molten metal, a self-acting heat controller for maintaining the metal at the correct fluidity, a system of heating by low-pressure gas which produces intense heat without fans, blowers, or compressors, and ensures perfectly uniform distribution of the flame and heat, special guiding devices for the wire which enable it to be rapidly threaded on to the guide rollers, and the elimination of fumes. The last feature was the motif for a recommendation by H.M. Chief Inspector of Factories.

The body of the furnace is strongly constructed and supports the melting pot, which is covered by an enclosing dome-shaped casting, forming virtually a sealed chamber for the melting operation. This chamber is supplied with inert gases from the Bunsen burners under the melting pot, so as to produce an oxygen-free atmosphere, and the experience of many users of this system proves conclusively that the saving in residue effected amounts in many instances to not less than 4s. per ton of metal melted.

Another factor in reducing the dross formed, is the automatic temperature controlling device, which operates on the thermostatic principle, and is so constructed and arranged that immediately the metal has attained the required fluidity, the supply of the burners is cut down and the temperature of the molten metal kept constant. In wire coating this is a most important point.

The patent gas burner system comprises any desired number of Bunsen burners fitted to an equalising chamber, which distributes uniformly the volume and pressure of gas supply to the individual burners, the latter themselves having a peculiar internal construction which produces an intense heat with a remarkably low consumption of gas. The gas supply pipe is simply connected up to the ordinary town gas main.


General Outline of Wire Tinning Furnace
fitted with wiper attachment
Constructed to coat any number of wires
Fig. 3.—Monometer Tinning Furnace.

Within the melting chamber and above the melting pot are arranged a series of guide rollers over which the wire is run, the lowermost rollers being mounted on slidable rods individually adjustable in order that the rollers may be moved to facilitate threading of the wire. A novel point is the spring control of the rollers when in the active position, which substituting resilience for rigidity almost eliminates the possibility of wire breakages. As the wire leaves the molten metal it encounters a fixed wiper so positioned as to direct the drips back into the melting pot, the final wiping device being outside the melting pot and having the wiping blocks readily adjustable in respect of the pressure exerted on the wire.

Any required number of wires can be coated simultaneously, the wire simply being wound on a drum and thus passed through the melting pot. The furnace is throughout most strongly constructed with an ample reserve of metal, to meet any possible contingency that may arise, and the workmanship is claimed to be such as is rarely found in furnace work.

Dead-Ending a Crane Trolley Wire.

The accompanying illustration shows a convenient and serviceable way of dead-ending a travelling-crane trolley wire. For a No. 00 copper wire a 0·75-in. punched wrought-iron bolt washer may be used, and for other sizes reference to a wire table will show the size of washer required to fit over twice the diameter of the wire. The fibre tube shown is used as a safety stop. It should be long enough so that the crane trolley will be lifted off the wire at a sufficient distance from the end of the crane travel to prevent an accident in case of emergency.—*Electrical World.*

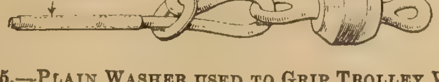


Fig. 5.—Plain Washer used to Grip Trolley Wire.

BUSINESS NOTES.

Lamp Shades.—We illustrate herewith one of the "Mazda" lamp shades which are used in connection with the restricted lighting arrangements in the trains running on the Great Western and Metropolitan Joint Railway, between Hammersmith and New Cross. The shades used are of rectangular construction, one side being opaque and the other three framing transparencies of the design produced herewith. We understand that the end in view is attained very successfully, a well diffused illumination being secured of as high intensity as permitted by the new regulations. These shades are available for use in contractors' and dealers' show-windows, &c. They pack flat for stock or postal purposes, and can be assembled in a moment and are carried by the shade ring of any standard lamp. All applications should be addressed to the British Thomson-Houston Co., Ltd., Publicity Department, 77, Upper Thames Street, E.C.

Board of Trade Inquiries.—Russia.—The Acting British Consul-General at Moscow (Mr. R. H. B. Lockhart) reports that a British engineer in that city, who claims to be well acquainted with trade and markets in Russia and to be able to conduct correspondence in Russian, is desirous of representing United Kingdom manufacturers of electric lifts, steam and water valves, fittings of all sorts, and dynamos. The name, &c., of the inquirer can be ascertained on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

The Commercial Intelligence Branch of the B. of T. has received inquiries from British firms at home for makers of the following:—

Celluloid accumulator boxes.
Electric bell pushes in wood.
Glass accumulator cells.

Catalogues and Lists.—The Cambridge Scientific Instrument Co., Ltd., Cambridge.—Illustrated list No. 195 containing a full description of their electrical distance thermometers (resistance type) for temperatures up to 1,000° F.

The Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, London, W.—12-page pamphlet (No. 246) containing illustrated descriptive particulars and prices of military telephones, including buzzer call field telephones; combined buzzer and magneto call telephones; portable field telephone exchanges; also field telephone cable and portable drums for same. Wiring diagrams are given.

Messrs. Drake & Gorham, Ltd., 1, Felix Street, Westminster Bridge Road, London, S.E.—Pamphlet No. 238 (10 pages) contains illustrations and prices of El Grilstovo, Ovenette, El Cooko, and other Hot-point electric cooking appliances, also domestic irons, El Bako ovens, electric ranges and fires, &c.

Book Notices.—We have received from the Great Central Railway a copy of the second edition of its brochure, "The Magnet of Commerce," in which is brought together a vast amount of information, excellently illustrated by half-tone pictures, line diagrams, and maps, concerning the developments which are constantly taking place in the coalfields and industrial centres of Lancashire, Yorkshire, Nottinghamshire, Derbyshire, &c. It contains the latest statistical particulars available respecting coal output, coal exports, coke production, coke-ovens in use, Immingham dock traffic and charges, and so forth. Its contents justify it in claiming for it a place in any collection of industrial and commercial literature.

"Diesel Engines for Land and Marine Work." By A. P. Chalkley. London: Constable & Co. Price 8s. 6d. net.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXXII. Part I. Newcastle: The Institution.

"Les Cables Sous-Marins Allemands." By C. Lesage. Paris: Plon-Nourrit et Cie. Price 3 fr. 50.

"Relativity and the Electron Theory." By E. Cunningham. London: Longmans, Green & Co. Price 4s. net.

"The Telephone and Telephone Exchanges." By J. E. Kingsbury. London: Longmans, Green & Co. Price 12s. 6d. net.

Liquidation. — Teleradio Electric Co., Ltd.— This company is winding up voluntarily, with Mr. E. H. R. Trenow, Balfour House, Finsbury Pavement, E.C., as liquidator. A meeting of creditors is called for November 27th. Creditors must send particulars of debts, &c., to the liquidator by December 11th.

For Sale.—Particulars appear in our advertisement pages to-day of a sale of stock-in-trade and plant of a builder, decorator and electrician, which is to take place at Kensington on December 9th.

The Borough Council of Leigh, Lancs., has for disposal one 250-kw. direct-coupled steam dynamo; Messrs. John Fleming & Co., Ltd., of Albert Sawmills, Aberdeen, have for sale one engine and dynamo, four dynamos, one switchboard and 12 arc lamps. Particulars are given in our advertisement pages to-day.

Silvertown Carbons.—The India-rubber, Gutta-Percha and Telegraph Works Co, Ltd., of Silvertown, E., are carrying large stocks of carbon pencils for pocket light batteries. They are making a speciality of this line. In discussing carbon manufacture in these pages some months ago, we showed that the Silvertown Co. were among the pioneers in carbon manufacture in this country; indeed, we believe that they have been manufacturing carbons for nearly 50 years. Carbon can be supplied by them in almost any shape or size, and the articles made include plates for batteries, electric furnaces, &c.; rods for batteries; rings, tubes, blocks, disks, buttons, &c.; contacts for electrical apparatus, and carbons for lightning protectors, telephones and other instruments.

LIGHTING AND POWER NOTES.

Argentina.—The provincial Government of La Plata has decided to erect an electric station for the supply of electric light to the public offices, for which a sum of 90,000 pesos is now disbursed yearly. The scheme includes the supply of light to private consumers situated along the route through which the underground supply mains will run. It is proposed to install oil engines at the new waterworks in Soavedra Park, and to modify the existing equipment there, whereby such economies will be effected that the cost of electric current will work out at 3 centavos the kw.-hour, thus facilitating the eventual supply to private consumers at 50 per cent. reduction on the existing tariff; and allowing of the amortisation of the new plant within four years. The preparation of plans and final estimates is being undertaken.

A co-operative electric supply association has been formed in the City of Concordia. The plant, comprises two 200-h.p. Diesel engines and generators and a third of 150 h.p. At Lujan, it has been decided to amalgamate the two competing undertakings, the Sociedad Anonima Alambrado Elettrica taking over its rival's plant and shareholders.

According to the *Review of the River Plate*, the Hydro-Electric Co., of Tucuman, has been condemned to pay $38,000 m/n to the Compania Santa Ana Hileret Limitada, as the value of land occupied by the power house in the Quebrada de Lules. The same paper states that the basis of an arrangement has been arrived at between the Compania Alemana Transatlantica and the City of Buenos Ayres, in respect of the action brought by the former against the city to recover $858,103 m/n due for electric current supplied for lighting purposes.

Aylesbury.—Street Lighting.—The U.D.C. has decided that the charge for current for street lighting shall be the capital charges of the undertaking so far as they can be apportioned to street lighting, plus the actual cost of production at the works, this arrangement to stand until March 31st next, when the matter will be re-considered; the sum arrived at as the capital charge is £346.

Barnsley.—R.D.C. Lighting Scheme.—The question of the proposed lighting of the R.D.C.'s district by electricity has been deferred by the Electrical Distribution of Yorkshire, Ltd., owing to the Board of Trade's refusal to deal with any new Bills on account of the war.

Bo'ness.—Plant Extension.—The Secretary for Scotland has intimated that he has no objection to the proposed extension scheme, which would be carried out by the National Electrical Construction Co. at a suggested cost of from £6,000 to £7,000, under the usual conditions. The company is to be asked to submit plans and specifications to the Council's consulting engineer before a final decision is arrived at.—*Glasgow Herald.*

Brierfield.—Loan Application.—The D.C. has authorised the clerk to communicate with the Treasury, if necessary, for sanction to the borrowing of money on electricity capital account for new connections and services.

Bury.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £980 for mains required to be laid to the car depôt and Messrs. Webb's works.

Buckhurst Hill.—E.L. Scheme Deferred.—The County of London Electric Supply Co. has informed the U.D.C. that in view of the decision of the B. of T. not to grant prov. orders during the period of the war, it has decided not to proceed with the scheme for the district.—*Essex County Chronicle.*

Buxton.—Loan Sanction.—The U.D.C. has received sanction to proposed loans of £445 (repayable in 15 years), and £159 (repayable in five years), for overspent balances of capital expenditure at the electricity works.

Cheadle and Gatley.—E.L. Scheme.—After having received from Stockport and Manchester T.C.'s terms for the provision of a supply of electricity for the district, the U.D.C. has adjourned the matter pending the report of the surveyor upon an E.L. scheme for the township.

Coniston.—E.L. Scheme.—With regard to the E.L. scheme for this parish, the Ulverston R.D.C. has referred the matter to the P.C. for consultation, and has decided that the work shall not be proceeded with until the sites for the poles for the overhead wires have been definitely approved of by the Council.

Continental.—Germany.—The first of four unusually large transformers intended for the new central electricity station at Golpa, has recently been completed. It has a capacity of 22,000 kw., and weighs 73 tons, the dimensions being: height, 19¾ ft., by 18½ ft. by 5½ ft.

Dublin.—The Corporation has sent back to the Electricity Committee a report in relation to tenders for the installation of an Underfeed stoker at the Pigeon House electricity station. Mr. Ryan remarked that an expert was to report on the whole electricity undertaking, and that they should be in a position to know whether expenditure of this kind was necessary. Consideration of a report on electrical energy supplied to theatres was postponed. A deputation from the city picture houses stated that they would be compelled to install their own plant if an increased rate were insisted upon.

Edinburgh.—New Power Station.—Last week the Council considered estimates amounting to £24,515 for shafts and tunnels for obtaining sea water for the condensing plant of the Portobello power station; the contractors' time for the completion of the contract was 65 weeks, and they had notified the Council that unless the tender was accepted at once they could not abide by the prices quoted, as the prices of materials were rising daily. Sir Alexander Kennedy also considered that the contract should be put in hand at once if the Council wished the station to be opened in 1917, as otherwise the buildings and plant would be ready before the sea-work tender was completed. The Council accepted the tender by 25 votes to 5.

Greenock.—The total units generated by the Corporation electricity works in the month of October amounted to 2,288,261, as compared with 1,336,728 in the corresponding month of last year.—*Glasgow Herald.*

Hull.—Price Increase.—The Electricity Committee has decided to increase the charges for electric light on the flat rate by a halfpenny per unit, and for other purposes by 15 per cent. upon existing charges, excepting where supplies are furnished under agreements for unexpired periods. The increases will come into force on January 1st, 1916.

Ilford. — Destructor Plant.—The L.G.B. having declined to receive a deputation with reference to the refusal of a loan of £870 for the erection of an electrical engine room at the dust destructor, referred to in a recent issue of the Electrical Review, the U D.C. has requested the Electricity Committee to bring up up the question of the equipment of the building at the earliest possible moment, the idea being to defray the cost out of the electricity reserve fund. The destructor is almost completed, and it is considered that practically one year's revenue from it would pay for the sum asked for.

India.—The electric drives at the mills under the agency of Messrs. Bradbury & Co., of Bombay, are proving remunerative, especially at the New Great Eastern Mills. The other mills under Messrs. Bradbury's agency, viz., the New City and the Colaba Land also show marked improvement in quality and quantity of production.

A portion of the electric machinery required to convert the driving of the Sun Mills in Bombay, by power from the Tata Hydro-electric Power Supply Co., Ltd., has arrived, and it is expected that the electrical installation will be completed and working early next year.—*Indian Textile Journal.*

Kilrea (Co. Derry).—The County Council, on a report of the surveyor, has granted permission to Mr. Peden, Kilrea, to erect poles for the purpose of supplying electric light in that town.

Leigh.—Electric Pumping.—A scheme for providing electric power for the pumping of sewage, which has been submitted to the R.D.C. by the Pilkington Colliery Co., is under consideration.

Littleborough.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £1,093 and £907 in connection with the electricity undertaking.

Llanfair Caereinion.—Annual Report.—The first annual report presented to the guarantors under the E.L. scheme shows that during the eight months current has been in use, a profit of £122 has been made. The cost of the undertaking was £1,072, and the profit reduces the liabilities of the guarantors to £950.

London. — Kensington Rating Appeal. — At the London Quarter Sessions, the Brompton and Kensington Electricity Supply Co. appealed against the increase of £1,000 in the assessment of the rateable value of the company's property by the Kensington Assessment Committee. The Court decided to reduce the rateable value by £400, leaving a net increase of £600 upon the quinquennial assessment settled in 1910. The chairman stated that the Court was of opinion that an increase of value had taken place which justified the inclusion of the property in provisional and supplemental lists at an enhanced rateable value, but not to the extent claimed by the Assessment Committee.

Poplar.—Loan Sanction.—The L.C.C. has sanctioned a loan of £3,688 required for mains, subject to the B.C. agreeing to limit expenditure out of the loan during the war, and to provide out of funds under its control the amount authorised. It is proposed to advance the money out of the superannuation and pension funds, when a sufficient sum is available. The Committee has considered the question of consumers, who, taking supply under the contract system, have been compelled to restrict their lighting in accordance with police instructions. A reduction has already been made by the alteration of the fixed charge on capital expended by the Council for services, meters, and wiring installation, from 12½ per cent. to 8½ per cent. per annum, and the undertaking is one of the few that has not considered advancing charges owing to war conditions. The Committee does not recommend any reduction on the fixed kw. charge, which is at present £8 for inside lighting and £6 10s. for outside lighting. Every consumer has a right to change over from the contract system at the expiration of his agreement to the flat rate of 3d. per unit plus 8½ per cent. per annum on the capital expended by the Council for wiring premises, but any change of this sort must be for a period of not less than 12 months. Under the circumstances, the Committee does not consider it advisable that any rebate should be made in the kw. charge under contract for shop lighting. It suggests, however, that consumers should be allowed to purchase installations if they elect to change over to the flat rate system, at the original cost, less 5 per cent. per annum for depreciation.

St. Pancras.—On July 14th the L.C.C. sanctioned the borrowing of £15,000 for a 5,000-kw. turbo-generator, subject to the acceleration of the repayment of the loans for plant and machinery for which 42 years had been granted. The Electricity Committee has considered the question, and decided that it would be purposeless to proceed further with any opposition to the terms of the L.C.C., only to such an extent as would be applicable during the course of the next three years, *i.e.*, the completion and putting in working order of the new turbo-generator. The Committee reports that it would cost about £3,000 per annum for the next 13 years to adopt the proposals in full of the L C C. in making the accelerated payments, and recommends that an offer of increased payments of £1,500 per annum for the next three years, commencing April 1st, 1916, be made on account of the 42 years' loans, and thereafter to make the accelerated payments in full as suggested by the County Council.

L.C.C.—The Finance Committee recommends the Council's sanction to the borrowing of £5,455 by the Islington B.C. for mains for electricity supply purposes.

Manchester.—Barton Scheme.—The letter of protest respecting the continuance of the work in connection with the erection of the new generation station at Barton, which was recently forwarded to the L G.B. by the Ratepayers' Association (and referred to in this column a few weeks ago) has drawn from the L.G.B. a reply which was received in Manchester on Friday last. In this the Board states that it is satisfied that the T.C. has proper grounds for proceeding with the full scheme at this time, and it is not prepared to intervene further in the matter.

On the 17th inst. the city was enveloped in dense fog throughout the day, and the electricity consumption amounted to 709,400 units—a record. By comparison with the previous record this consumption was 10 per cent. higher, and the increased consumption compared with the corresponding dates of 1914 and 1913 was 20 per cent. and 27 per cent. respectively. In the neighbouring county borough of Salford, also, record figures were reached by the electricity department.

The consumption of current during the past six months is stated to be 30 per cent. higher than in the pre-war period, and an even larger demand than is now being met is expected.

Mayo.—The County Council has decided to install electric light in the Courthouse at Castlebar.

Newport (Mon.).—Year's Working.—The annual report of the general manager, Mr. N. J. Young, and borough electrical engineer, Mr. A. Nichols Moore, on the year's working of the Corporation electricity department, shows a net profit of £744, as against a deficiency in the previous year of £1,240. The gross receipts were £44,615, and the gross profit £23,460 (slightly above the previous year's); interest, sinking fund and other charges—the latter being much less than in the previous year—amounted to

£22 716, as against £24,462. The department lost one of its largest consumers during the year, and thus despite the new business done, the units sold reached only 4,789,240, as against 4,929 683 in the previous year, the maximum demand also falling from 3,078 KW. to 2,909 KW. The generating costs show a very considerable decrease, amounting to £1,822, chiefly due to reduction in coal cost, which averaged ·32d. per unit, as against ·34d. in the previous year. The coal per unit generated fell from 5·05 lb. to 4·35 lb. An analysis of the output shows 1,107,315 units sold for lighting; 1,051,600 for power; 587,586 for public lighting; 1,178,500 for traction; 166,054 for heating; and 698,185 for bulk supply. The average price obtained per unit, calculated on the total revenue, was 2·24d., as against 2·17d. in the previous year.

Peterborough. — Year's Working. — The annual accounts of the Corporation electricity undertaking for the year ended March 31st show expenditure amounting to £5,647, and receipts to £10,403. Loan charges amounted to £4,398; including the balance brought forward from last year, £346, and £696 revenue contribution to capital expenditure, the undertaking just paid its way. The number of units sold during the year was 973,752, against 920,488 in 1914.

Shanklin.—Street Lighting.—The U.D.C. has decided to offer the Electric Light Co. £25 quarterly for street lighting during the continuance of the present conditions, plus the units consumed at the fire station. If these conditions are accepted, the Council will extend the contract after the war for a period equivalent to the entire close period now in operation on the contract terms existing before the war commenced.

Stalybridge.—At the annual meeting of the Stalybridge Joint Tramways and Electricity Board, last week, Mr. T. Perrin (chairman) spoke hopefully of the prospects of the Board's future operations, and stated that the electricity department was getting back its full load again.

Torquay.—Cable Loans.—The L.G.B., in intimating to the T.C. that no further objection would be raised to the completion of the laying of a new E.L. main in the town, has requested the Council, before a consent order can be issued, to submit a statement showing the total amount which will actually be required to meet all liabilities and how it is made up, as at present it is not quite clear to the Board that the Council will require to raise the whole sum of £18,000 sanctioned last February.

Walthamstow. — The Lighting Committee of the U.D.C. has considered the report of the electrical engineer as to the advisability of installing a water-softening plant for dealing with the circulating water for condensing purposes, and has recomended that a plant of a capacity of 5,000 gallons per hour be installed, at an estimated cost of £450. The Finance Committee recommends that the cost be met out of the revenue.

Whitstable.—Street Lighting.—At a special meeting of the U.D.C. on November 16th, a notice was received from the Electric Supply Co. to the effect that after seven days it intended to apply to the president of the Institution of Civil Engineers for an arbitrator to be appointed to decide the dispute that has arisen with the Council as to the public lighting agreement. The Council decided to forward the letter and a copy of the clause in the agreement which is in dispute to Mr. McCardie, who previously advised the Council that, under the present conditions of restricted lighting, the agreement was null and void. The Council's offer is to pay the company 10s. per lamp for the six months' period in question.

Wirral.—Prov. Order.—The R.D.C. has deferred for a month consideration of an application from Messrs. Melling and Moss, of Northwich, for the Council's consent to the granting of a provisional order to Messrs. Johnson & Phillips, to supply electricity in the parishes of Hooton, Eastham, Childer Thornton, Willaston, Great Sutton and Little Sutton. Meanwhile further information is to be obtained from other authorities.

Wolverhampton. — Breakdown. — A considerable portion of the town suffered from a failure of the electric supply on Wednesday evening last week. The trouble was stated to be due to the breakdown of an overloaded feeder cable, the electricity department being very much pressed by the supply required for local works.

Worcester.—Street Lighting.—The street lighting is to be reduced by one-half, except at certain specified points. The reduction in lighting previously effected resulted in a saving of £398 in the cost of coal at the city electricity station, and a further saving of £139 is anticipated.

TRAMWAY and RAILWAY NOTES.

Bexley.—Female Labour.—The U.D.C. has decided to employ women conductors on the Council's cars during the period of the war, the rate of pay to be 5½d. per hour.

Bingley.—The Council has decided to apply to the B. of T. for an extension of the period for the completion of the tramway round the Ryshworth Hill corner at Crossflats, until 12 months after the end of the war.

Bournemouth.—The Tramways Committee has recommended that the tramway service be suspended at 10 p.m. instead of 11.30 p.m., on and after December next.

Bradford.—Wages.—The local branch of the Amalgamated Association of Tramway and Vehicle Workers has applied to the Corporation on behalf of the employés, for an increase of 5s. per week for employés paid weekly and 1d. an hour additional for men paid by the hour, in place of the bonus granted. A special meeting of the Committee is to be held on Monday to consider the question, and also the manager's report on the shortage of labour and the effect of recruiting on the tramway service. The cost to the department of the proposals, if carried out, would be about £12,000 a year.

Burnley.—Wages.—The tramway workers and enginemen have asked the Corporation for an advance of 3s. per week in their wages.

Croydon.—Female Labour.—The B.C. has sanctioned the engagement of women as conductors, at the same rate of pay per hour as men. Their terms of duty, it was stated, would be 8 or 8½ hours, and all the available male conductors (where ineligible for military service) would be retained.

Glasgow. — Women Drivers. — The local Trades Council has entered a protest against the T.C.'s appointment of women car-drivers, and from the official minute of the latter body it appears that so far no definite decision as to the employment of such women has been come to. It is believed, however, that the engagement of the women is of an experimental character, and that meantime they are undergoing a further course of training before the T.C. finally approves of their being put on the driving platform as qualified drivers.

Halifax.—Recruiting and Women Conductors.—The recruitment of men from the Corporation tramway department is having a deleterious effect upon the working of the undertaking. More than half of the male conductors and drivers have joined various units in the Army and Navy, and some of those remaining are working 73 hours per week. On some of the routes the late cars are being taken off, and it appears to be evident that more women conductors will have to be secured to assist in maintaining an efficient service of cars.

Following upon the lead given by several other municipalities, women conductors have made their appearance on the Hebden Bridge route of the Halifax tramways, and are giving complete satisfaction.

Japan.—The annual report of the British Commercial Attaché in Tokio contains some particulars regarding the Tokio-Yokohama Government electric railway, to which reference has been made in these notes. The following may be of interest:—This railway, which runs side by side with the existing steam track, is 19 miles long; between the two termini there are 14 stations and trains will stop for 30 seconds at each. The power for driving the railway is derived from a gas-power station situated about midway between the two main stations, and containing four Lilleshall tandem double-acting gas engines direct coupled to 1,500-K.V.A. 11,000-volt three-phase 25-cycle alternators, three of these generators being in daily service and one spare. The gas is produced in three Mond gas producing ammonia recovery plants, two of these plants being in daily service and one spare. It is noteworthy that the whole of the steam required is raised in boilers using the waste heat from the gas-engine exhaust. From the power-house the high-tension current is distributed to four substations, and there converted to 1,200 volts direct-current for supply to the trolley wire. The car motors are designed for 600 volts and run two in series on the line voltage of 1,200. The overhead collector for the car is of the pantograph type.

Unfortunately, the electric railway had only been in operation for a few days at the end of the year when it became necessary for the authorities to discontinue the service. As far as it is possible to ascertain, the whole of the trouble lay with the overhead equipment, which at the time of opening to public service appears to have been in an unfinished state. Since the line has been shut down it has been found that the height of conductor from rail level varied considerably, especially under bridges, this proving very troublesome when the trains were in rapid motion, causing the pantograph collector to oscillate badly and thereby to stress the conductor unduly. It was also found that the conductor varied from the mid position between rails, with the result that the conductor had a great tendency to creep along the collector and in many cases actually to slip entirely off. The conductor hangers from the catenary wire gave trouble, owing to insufficient latitude or play being allowed in the loops encircling the catenary, and in many places the thrust of the pantograph distorted these badly, thus raising the height of the conductor in these places.

London.—All the L.C.C. tramwaymen of military age have been ordered to submit themselves for medical examination, and if unfit for military service to get a certificate to that effect. —*Daily Chronicle.*

The *Railway News*, in its current issue, states that in view of the completion of the electric power station at Wimbledon, the London and South-Western Railway has decided to shut down the generating station of the Waterloo and City line very shortly, the power supply therefor being obtained from the Wimbledon station.

Lowestoft.—Female Labour.—The general manager of the tramways undertaking has been authorised to employ female conductors if he finds it necessary to do so.

Preston.—The Tramways Committee has recommended the purchase of a pair of jacks for each of the tramcars, the estimated cost being £250.

S.W. Railway Electrification.—Two trial trips were run with six-coach electric trains on the Kingston loop, on November 19th; it is intended to supersede the steam service on the 28th inst An accelerated service is to be given to Teddington, Kingston, Hampton Wick &c. with a train to and from Waterloo every five minutes. On the Thames Valley line there will be half-hourly services, which will be diverted through Kingston to Waterloo, instead of through Richmond.

Stockport.—Female Labour.—More than a 100 motormen and conductors have enlisted since the outbreak of the war, and the staff has been so seriously depleted, that it has now been decided to engage women car conductors.

Newport.—Year's Working.—During the year ended March 31st last, the Corporation tramways department had a total revenue amounting to £42,704, while the gross profit was £11,748, as compared with £6,697 in 1913-14, and after meeting the usual financial charges the year's working resulted in a surplus of £2,417, as compared with a deficit of £2,616 in 1913-14. The revenue was somewhat higher, more passengers being carried despite a decrease in car-milage. The passengers numbered 9,410,109, the receipts averaging 10·6d. per car-mile. The compensation and renewals funds now amount to £3,480.

Middlesex.—The Metropolitan Electric Tramways, Ltd., is applying for an Act for extending the time for completion of certain tramways, trolley vehicle equipment, &c., authorised under the previous Acts.

West Ham.—Female Labour.—The Corporation has been recommended to authorise the engagement of women as tramcar conductors, at the same rates of wages per hour as now paid to male conductors. The Tramways Committee proposes to purchase additional plant, at an estimated cost of £800.

TELEGRAPH and TELEPHONE NOTES.

Code Telegrams.—The arrest of Victor Sly, on a charge of carrying on unauthorised negotiations for dealing in war material. has brought to light a secret code in "open language," code words being provided for all kinds of things connected with munitions of war. As we have pointed out, there is no difficulty in devising such codes, and the use of "open language" is an utterly ineffective safeguard against communication with the enemy by cable.

Secret Wireless.—The British Ambassador in the United States has drawn the attention of the Government to a private German wireless station which is said to be secretly operated in a suburb of Portland, Maine, and American Navy inspectors have been ordered to investigate the matter.

Singapore.—A wireless station has just been erected at Singapore for public service.

Wireless Telephony.—It is reported that two Swedish Army officers have invented a simple apparatus by means of which wireless telephonic messages may be dispatched from trains or automobiles travelling at high speed.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—November 30th. Pea coal for mechanical stokers for the U.D.C. Electricity Works. Electrical Engineer, Laburnum Road.

Athy.—December 6th. U.D.C. Tenders are invited for lighting the town with electricity. Particulars from Mr. J. A. Lawler, Town Clerk.

Australia.—December 20th. P.M.G.'s Department, N.S.W. 4,250 telephones (Schedule 454).*

Adelaide.—January 19th. P.M.G. Common-battery switchboard. See "Official Notices" November 19th.*

January 26th. Deputy P.M.G. Twenty tons of galvanised-iron wire. 400 lb. to the mile.*

Brisbane.—P.M.G. January 26th.—Galvanised-iron wire. December 1st.—Measuring instruments. January 5th.—Jointing sleeves and copper-clad steel wire. See "Official Notices" November 19th.

January 26th. Deputy P.M.G. Telephone instruments, parts and accessories.*

Sydney.—December 20th. Metropolitan Board of Water Supply and Sewerage. Three centrifugal pumps and electric motors, with switchboards, starters, &c., for the pumping station at Marrickville, N.S.W. Deposit £10. Tenders to the Board, at 341, Pitt Street, Sydney, N.S.W.*

January 31st, 1916. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

Melbourne.—December 14th. Deputy P M G. Eleven sections of a lamp-signalling trunk-line switchboard, and other material necessary for increasing the equipment of Melbourne Trunk Exchange from 108 to 240 lines. Schedule 1,207.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

Dundee.—November 29th. Town Council. 600 tons steel tramway rails, 15 tons steel tie bars. Forms of tender from Mr. Jas. Thomson, City Engineer, Municipal Offices.

Enniskillen.—December 1st. Sligo, Leitrim and Northern Counties Railway Co. Twelve months' supply of telegraph materials. Mr. J. Duff, Secretary's office.

London.—December 9th. H.M. Commissioners of Works. Twelve months' supply of electric cable and wire. Forms of tender from the Controller of Supplies, H.M. Office of Works. 18, Queen Anne's Gate, Westminster, S.W.

Natal.—December 1st. The Corporation of Durban. Tenders for underground cables and cast-iron pipes for telephone cables. Particulars from Messrs. Webster, Steel & Co., 5, East India Avenue, E.C.

Spain.—November 30th. The municipal authorities of Villanueve de Castellon (Province of Valencia) are inviting tenders for the concession for the electric lighting of the town during a period of five years.

CLOSED.

Bedford.—Messrs. W. S. Wilton & Co. have secured the contract for the electric light installation in the steam and electric pumping stations for the Corporation.

Edinburgh.—The City Council has accepted the tender of Messrs. C. Brand & Son for shafts and tunnels in connection with the condensing plant for Portobello power station, at £24,515.

Glasgow.—The T.C.'s Committee on Works and Stores has recommended the acceptance of the offer of Messrs. Pirelli, Ltd., to supply rubber-insulated cables.

Government Contracts.—List of new contracts, October, 1915:—

War Office.

Insulator brackets.—Bullers, Ltd.; Douglas Bros., Ltd.; Vulcan Co.
Electric cable and wire.—British Insulated and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Craigpark Electric Cable Co., Ltd.; I Frankenburg & Sons, Ltd.; W. T. Glover & Co., Ltd.; A. Green, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Liverpool Electric Cable Co., Ltd.; C. Macintosh and Co.; Western Electric Co., Ltd.
Commutators (telegraph).—Automatic Telephone Manufacturing Co., Ltd.; S. G. Brown; H. White & Co.
Dynamos.—Austin Motor Co., Ltd.; Fyfe, Wilson & Co.
Insulators.—Litholite, Ltd.; T. De la Rue & Co., Ltd.
Lamps (electric).—British Thomson-Houston Co., Ltd.; General Electric Co., Ltd.
Switches.—Berry & Hayward; General Electric Co., Ltd.; Laing, Wharton, Ltd.; Veritys, Ltd.
Works services.—Accumulators, Park Hall Camp, Oswestry: Chloride Electrical Storage Co., Ltd. Electric lighting, Wimbledon Common: Borough Electrical Engineer, Wimbledon. Infantry Barracks, Redford: Lowdon Bros. & Co.

India Office Store Department.

Apparatus.—Elliott Bros.
Coils, &c.—Marconi's Wireless Telegraph Co., Ltd.
Condensers.—Peel-Conner Telephone Works, Ltd.
Insulators.—Taylor, Tunnicliffe & Co.
Wire.—R. Johnson & Nephew, Ltd.

H.M. Office of Works.

Engineering works.—Ministry of Munitions Electric Passenger Lift.—Medway's Safety Lift Co.

General Post Office.

Apparatus (protective).—Siemens Bros. & Co., Ltd.
" (telephone).—Automatic Telephone Manufacturing Co., Ltd. British L. M. Ericsson Manufacturing Co., Ltd.; Siemens Bros. & Co. Ltd.
Cable (submarine).—Telegraph Construction and Maintenance Co., Ltd.
" (telephone).—W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd; Telegraph Construction and Maintenance Co. Ltd.; Union Cable Co., Ltd: Western Electric Co., Ltd.
Cords (telephone).—British Insulated and Helsby Cables, Ltd.
Lamps (telephones).—General Electric Co., Ltd
Wire (bronze).—T. Bolton & Sons, Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. and Smith's, Ltd.).
Electric lighting, Superintendent Engineer's Office, Denman Street, S.E.—A. Hawkins & Sons.
Laying pipes, ducts, and "U" troughing, Deptford.—Foote & Milne, Ltd.
Replating battery, Avenue Telephone Exchange.—Tudor Accumulator Co Ltd
Telephone Exchange equipment, Manchester.—Peel-Conner Telephone Co., Ltd.
Telephone Exchange extension, Norwich.—Western Electric Co., Ltd.

London.—The tender of Messrs. Finch & Wheeler has been accepted by the London Insurance Committee, at £459, for carrying out lighting work at certain premises taken over for additional office accommodation. The contract includes £244 for electric fittings.

St. Pancras.—The B.C. has accepted the offer of the General Electric Co. for the balance of the carbons tendered for, at £1,022.

Walthamstow. — The Lighting Committee of the U.D.C. has accepted the tender of Messrs. Cleeves & Co. for the supply of 300 tons of West Hallam small nuts, at £1 2s. 10d. per ton.

FORTHCOMING EVENTS.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 26th. At 7.30 p.m. At Bolbec Hall, Newcastle. General Meeting.

University College, London.—Fridays, November 26th and December 3rd. At 5 p.m. Fourth and fifth lectures on "Electric Heating and Electric Furnaces," by Prof. J. A. Fleming, F.R.S.

Manchester Association of Engineers.—Saturday, November 27th. At Grand Hotel, Aytoun Street. Paper on "Design and Application of Ball-bearings," by Mr. H. J. Moysey.

Royal Society of Arts.—Monday, November 29th. At 4.30 p.m. At John Street, Adelphi. Cantor Lecture, on "Optical Glass," by Dr. W. Rosenhain, F.R.S.

Institution of Civil Engineers.—Tuesday, November 30th. At 5.30 p.m. At Great George Street, S.W. Papers on "Harbour and Coast Defence Works at Alexandria," by Mr. D. E. Lloyd-Davies; and "Galvan Port, Bahia Blanca, Argentine," by Mr. C. A. Terry; and Special General Meeting.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, November 30th. At 7 30 p.m., at the Engineers' Club. Paper on "Some Difficulties of Design of High-Speed Generators," by Prof. A. B. Field.

Chemical Society.—Thursday, December 2nd. At 8 p.m. At Burlington House. Ordinary Scientific Meeting.

Salford Technical and Engineering Association.—Saturday, December 4th. Visit to the Salford Corporation Cleansing and Flag-Making Department, Langley Road Depôt, and Annual Meeting.

ELECTRICAL ACCIDENTS IN 1914.

The report of Mr. G. Scott Ram for 1914 shows that 65 electrical accidents took place in public electricity supply and traction power stations, of which three were fatal; 34 took place in other generating stations, with one fatality. Non-electrical accidents numbered 381, of which 10 proved fatal; this total is less than in the preceding year by 58, but the electrical accidents showed an increase of five. One of the mechanical accidents was due to the bursting of a steel bottle of compressed air for starting a gas engine, and resulted in two deaths. In factories other than electrical stations there were 350 electrical accidents, involving 16 deaths, a reduction of 68 on the aggregate.

All the fatalities due to electric shock (20 in number) occurred in connection with alternating current, in 15 cases at a pressure of 440 volts or less. In several instances artificial respiration was not tried, or was discontinued after a short period, on the statement of a doctor that the victim was dead, and Mr. Ram, pointing out that patients may often be revived after as long as two hours from the time of the accident, remarks that the medical profession appears to be somewhat ignorant on this matter.

As usual, an extraordinary amount of carelessness and ignorance on the part of men regarded as skilled, not only in the operation but also in the design and construction of electrical plant, is revealed by the report, which we shall reproduce in an early issue.

NOTES.

B.E.A.M.A. Annual Dinner.—The B.E.A.M.A. will not hold an annual dinner for the session 1915-16.

Properties of Tungsten.—At the annual meeting of the American Physical Society, on October 30th, reading a paper on "Radiation from Tungsten Filaments and the Mechanical Equivalent of Light," Dr. Irving Langmuir (of the research laboratory of the General Electric Co., Schenectady, N.Y.) stated that the resistivity, radiant energy (watts per sq. centimetre) and intrinsic brilliancy (candles per sq. centimetre) of tungsten filaments had been determined up to the melting point of tungsten, 3,560° K. (absolute). The resistivity increases accurately with the 1·24th power of the temperature; the corresponding exponent for the energy radiated is variable and decreases from 5·6 at 1,000° to 4·75 at 3,500° K. Under normal operating conditions (1 watt per candle in vacuum) tungsten radiates 32 per cent. as much energy as a black body at the same temperature. The light radiated from tungsten is bluer than that from a black body at the same temperature, and matches that from a black body at a temperature from 50° to 80° higher. By comparing the measurements of brilliancy with a result calculated from the Planck equation and visibility curve, the mechanical equivalent of light is found to be 0·00121 watt per lumen, or 0·0152 watt per mean spherical candle.

A second paper by Dr. Langmuir, on "Heat Conductivity of Tungsten at High Temperatures and the Wiedemann-Franz Relation," showed that by a development of the mathematical theory of the temperature distribution along a tungsten filament near a cooling junction, it has been possible to recalculate the heat conductivity of tungsten from the experimental data of Worthing. The new result is 1·14 watts per centimetre per degree at 2,200° K., and is practically independent of the temperature. The relation between the heat conductivity and the electrical conductivity is thus found to be in good agreement with that which has been obtained with other metals.—*Electrical World.*

Electrical Prosperity Week.—The elaborate preparations which are being made in the United States for "Electrical Prosperity Week" are practically completed, and the celebration will take place from the 29th inst. to December 4th. According to the *Electrical World*, "workmen in hundreds of cities throughout the nation are actively engaged upon the construction features, while committees and executives are giving the final touch to arrangements which will enable the event to measure up to expectations.

"Brooklyn, N.Y., is to have an electrical show. Another feature will be a far-reaching house-wiring campaign conducted by the Edison Electric Illuminating Co., of Brooklyn, in conjunction with the contractors, as announced in these columns last week. Electrical dealers will co-operate by window displays designed especially for the week, and the public interest in the celebration will be further intensified by illumination of prominent buildings and arches.

"In Philadelphia the electrical interests will conduct a wiring campaign, in which a discount of $1 per outlet will be allowed on the wiring of all ready-built dwellings and stores. The Philadelphia Electric Co. will hold special appliance exhibits and demonstrations, including window displays and exterior decorations. Advertising giving publicity to Electrical Prosperity Week, and to electricity in general, will be conducted in the street cars. The newspaper advertising of the electrical interests will also be greatly increased. Plans are also under way in Philadelphia to construct four allegorical, electrically-lighted floats to parade in various sections of the city on different nights during the week. One float will be devoted to general lamp illumination; another will depict allegorically electric power; a third will be devoted to a general figurative display of illumination, while the fourth float, with the assistance of a trailer, will give motion-picture demonstrations of domestic applications of electricity. . . . .

"It is announced by the Denver Gas and Electric Light Co. that a grand celebration will be held in Denver, the climax being a prosperity show to be held on the last four days of the week under the auspices of the Colorado Electric Club. An electric-automobile parade is also contemplated. Various spectacular features are being prepared which are likely to draw crowds to the electrical show and its vicinity. Some of the features planned are the showing by wireless, on a miniature scale, of the manœuvres of a battleship, a facsimile of a submarine, an aerial or Zeppelin battle, and various high-frequency electrical-discharge features of a nature to interest the public. . . .

"Thus far definite plans have been formulated for holding electrical shows in more than 22 leading cities of the United States. Many others have this feature under serious consideration. Many mayors of cities, together with many civic organisations, have endorsed the plan, and are actively engaged in carrying out various measures for its support.

"Electrical interests are enthusiastic over the celebration, and the event is expected to surpass all trade movements conducted heretofore, and to prove highly creditable to the electrical industry."

And all this is only the climax of an unprecedented advertising campaign.

Rifle Club Friendly.—A friendly post match took place between teams representing the British Thomson-Houston and the British Electric Transformer Companies' Rifle Clubs, on Saturday last. The teams consisted of eight members, the best six cards only to count. The result was that the B.T.H. Club scored 562, while the British Electric Transformer Club totalled 566, on the best six targets, that is an average of 93·6 and 94·3 respectively. The British Electric Transformer Club, whose address is Hayes, Middlesex, is anxious to arrange some friendly matches, and will be glad to hear from any miniature rifle club in the trade which has any dates vacant either for shoulder to shoulder or post matches.

Assault on a Woman Tramcar Conductor. — At Salford, on Saturday, a collier named Wm. Glass was charged with drunkenness and with assaulting a woman car conductor employed by the Salford Tramways Committee. After tendering an insufficient amount for his fare, he caught hold of the conductor by the throat. She fell into the road and was rendered unconscious, and her uniform was damaged to the extent of £3. The Stipendiary sentenced Glass to two months' imprisonment.

Electric Shipping Cranes.—There are steam shipping cranes still to be seen at wharves on many of our important rivers. It will be of interest to record some details of the operation and maintenance of electric shipping cranes. Two 5-ton cranes come under review in these notes. No. 1 crane was put to work in August, 1902, and No. 2 crane in June, 1905. Both cranes were constructed by Messrs. Cowan, Sheldon & Co., and, except in the height of the structures, are identical one with the other. The hoisting motors are 35 B.H.P. at 260 R.P.M., and the travelling motors are of 6 B.H.P. at 1,250 R.P.M. They operate on a 240-volt D.C. supply. The operations of both cranes working on the loading of pig-iron from bogies on a wharf to the hold of a ship will be considered. Each sling of metal weighed about two tons. The time occupied from the sling leaving a bogie, depositing the metal in the ship and the empty chain arriving back at the bogie averaged 90 seconds. This would give 40 slings per hour per crane, or 80 tons of metal shipped per hour per crane. This quantity does not, of course, work out in actual practice, as it would mean constant operation of cranes, whereas small delays are inevitable, such as barring bogies into position, &c., but with good cranemen, slingers and stowers, an average shipment of 50 tons of metal per hour per crane can be maintained. Power is only used for hoisting and slewing for a few seconds with each shipment of a sling, momentum in the case of slewing carrying the crane a considerable portion of its travel. The lowering of the metal is controlled by hand brake, no power being used from the supply mains.

The total number of Board of Trade units used in shipping 700 tons of pig-iron was 52, and at, say, 2d. per unit, the total cost for power was 8s. 8d. In the particular case dealt with power is supplied at ½d. per unit.

No. 1 crane, put to work in 1902, had new bushes fixed in the hoisting motor, and the armature re-wound in 1914. No other repairs except of a trifling nature have been necessary. No. 2 crane, erected in 1905, has required no repairs to motors up to the present time, and the mechanical repairs have been such as are not worth mentioning. Apart from the shipping of pig-iron, these cranes have unloaded tens of thousands of tons of iron ore. In the case of general cargo, a crane is often 15 to 20 minutes in dealing with one piece goods of heavy weight and large dimensions, and during the majority of this time no power is being used. The steam crane, which commences to burn coal two hours before it does any work and burns it continuously through periods of idleness, compares very unfavourably in every way with the electric crane, which consumes power only when useful work is being done and works at a high efficiency.

Compressed-Air Explosions.—In the annual report of the Chief Inspector of Factories and Workshops for 1914, several instances of explosions of cylinders containing compressed gases are briefly described. An explosion in Kent partially wrecked a Diesel engine; cylinders containing compressed air were being used to start the engine, and one of them was found to have held oxygen. On the ss. *Mauretania* a cylinder which had contained oxygen, and had originally been painted black, was in use to feed a blow-pipe, when it exploded, killing four men; it was found that the cylinder had been painted red by a previous customer of the gas company, and thus got amongst the coal-gas cylinders, and was charged with coal-gas, which formed an explosive mixture with the residual oxygen. Although this cylinder had a right-hand screwed connection, to distinguish it from the coal-gas cylinders which have left hand threads, the person who charged it succeeded in making the connection with the compressing machine, and the workman who used it made an adapter in order to use it on the wrong connection with the blow-pipe. An air receiver, used for starting three large gas engines in Staffordshire, exploded, and killed two men; the accident was ascribed to lubricating oil. A similar explosion took place in Leeds.

Institution and Lecture Notes.—Institution of Electrical Engineers.—On Thursday last week, at the first meeting of the Session, which was very well attended, Sir John Snell invited the members to pass a vote of condolence with the family of the late Hon. Treasurer, Mr. Robert Hammond, by rising to their feet. He then announced that the Council had elected Mr. J. E. Kingsbury to fill the vacant office, and the choice was endorsed by general applause; he also announced that M. Maurice Leblanc had been elected an honorary member of the Institution. Mr. J. D. Blaikley, the husband of the last surviving niece of Michael Faraday, presented a valuable collection of Faraday's papers to the Institution, and in doing so described his personal recollections of Faraday and of his family. Prof. S. P. Thompson, who, as the author of a life of Faraday, was well acquainted with the collection, expressed the gratitude of the members to Mr. Blaikley, and was supported by Mr. W. M. Mordey, who also was familiar with the papers, and the members signified their approval in the usual manner. Mr. Mordey also presented two interesting relics of Faraday to the Institution, one being a note-book and the other a piece of heavy glass made by Faraday and believed to be the identical piece with which the scientist discovered the principle of magneto-optic rotation and the diamagnetism of glass, for which the donor was cordially thanked. The retiring president then presented the premiums to the winners, and installed Mr. C. P. Sparks in the chair.

Mr. W. Duddell moved a hearty vote of thanks to Sir John Snell, which was seconded by Mr. J. S. Highfield and enthusiastically accorded, and the new president then delivered his inaugural address, which is abstracted elsewhere in this issue. A vote of thanks to the president was moved by Mr. C. H. Wordingham, seconded by Dr. Alex. Russell and unanimously adopted by the meeting.

Before dealing with the main subject of his address ("Electricity Supply"), Mr. Sparks reminded the members of the importance of every individual member working in the best way he could for the good of King and country, and mentioned that 1,150 members were on active service. He also impressed upon the younger members of the electrical profession the importance of joining the Institution, and expressed the view that the commercial engineer was just as much a recognised member of the profession as a pure scientist. In this connection he entered a protest against the prevailing practice of accepting the lowest tender, pointing out that if a reasonable margin of profit was not secured the contractor could not do his duty by the purchasers, and provision could not be made for development and improvement. "The national interest would be better served by encouraging private enterprise to develop invention, by allowing manufacturers a reasonable margin of profit, than by securing—for the moment only—slight fractional reductions in the costs of public service undertakings through acceptance of the lowest tender, which was not always necessarily the most favourable."

Electric Engine Starters.—Dealing with the recent lamentable accident at Beachy Head, and the need for safeguards against similar fatalities, *The Motor* says that the electric starter lends itself particularly well to the safety principle; the closing of the starter operating circuit can be made absolutely dependent on the movement of the gear lever to neutral position. This simply means that instead of having one break in the circuit, as represented by the starter pedal, or, in the case of some cars, a starter switch on the dash, there are two breaks, and one of these must be closed by a "safety" movement of the gear lever. It might be contended that an ignition switch—preferably a plug or key switch—should be sufficient safeguard if the driver had to leave his car, and were he remiss enough to leave it in gear; but, even in this condition, there still lies a hidden danger, because most electric starters are very powerful, sufficiently so, in fact, to move the car when in first, or even second gear, and against the resistance of a non-firing engine. Thus, it is clear that on a slightly falling gradient a car could easily get away with the starter driving through the first or second gear. So powerful are these starters that, as an experiment, a large car has been driven a distance of a mile on low gear before the battery became exhausted. Obviously, it depends on the size of the battery as to how far it will run the car, and users of starters are, as a rule, warned against trying the experiment, as it damages the battery. The problem, on the whole, is a simpler one to solve than rendering a car safe from starting in gear from the ordinary starting handle, because, as stated, the electrical circuit contains inherently in itself the basis of safety, and it only requires proper application to ensure success.

The Fixation of Nitrogen.—A further step in connection with the scheme projected for the fixation of nitrogen in the district of the lignite mines of Bitterfeld has been taken by the registration of the Electro-Salpeter Works Co., with headquarters at Zschornewitz Bitterfeld. The share capital is £150,000, and the names of the promoters are mostly persons associated with the A.E.G. and the Berlin Electricity Works Co. It will be remembered that these two companies some months ago formed the Electro-Works Co., of Golpa-Jessenitz, to acquire possession of the lignite mines in question for the purpose of using the fuel for the production of electrical energy, which is to be furnished, among others, to undertakings for the fixation of atmospheric nitrogen, of which the Electro-Salpeter Co. appears to be the initial concern.

Electrochemistry as a Day Load.—In Switzerland the difficlties encountered in securing a large load throughout the year are reported to be much greater than in other countries, as the demand is only heavy during a portion of the year (in the season), and is insignificant during the remainder of the year. The idea has consequently arisen to dispose of the energy at lower prices during the period of slack demand, and thus obtain a better load factor. As the price under individual enterprise in this direction would still be relatively dear, it is intended to overcome this obstacle by means of united efforts. The question was recently considered at a meeting held at Zurich of representatives of 12 Northern and Eastern Swiss electricity works, who suggested that the available energy should be combined in the period of low demand, and be utilised in a joint undertaking for the production of nitrogen from the atmosphere, or for the manufacture of ferro-silicon and chrome iron. The necessary mains leading to the suggested electrochemical works would also be used in case of necessity, such as a breakdown, overload, &c., for rendering mutual aid to the associated works. A committee has been appointed to ascertain the power available, and to approach an electrochemical works on the matter, and in the event of an initial experiment being successful, it is proposed to endeavour to introduce a similar scheme in the other parts of Switzerland.

Organising British Engineering Industry.—The Engineers' Club, Manchester, held a meeting last Friday, to consider the report of its Special Committee which, after sitting for some months past, has prepared a number of recommendations. The Committee, after elaborating very ambitious proposals in some detail, says that it considers the multiplication of organisations undesirable. Yet it is convinced that "advantage can best be taken of the present opportunity by the formation of an association on a non-trading and non-interference-with-prices basis." We shall refer to the matter in a later issue.

Inquiries.—Makers of electric hair dryers and of the "Darling" electric radiator are asked for.

Appointments Vacant.—Telephone inspector, for the City of Birmingham electric supply department; temporary clerks (50s. and 30s.), for the Borough of Swindon electricity and tramway department; electrical engineer for Mexborough U.D.C. (£200). Particulars are given in our advertisement pages to-day.

Patent Application.—Application has been made to the Board of Trade for the avoidance or suspension of Patent No. 605/09 granted to Messrs. Siemens Bros. & Co., Ltd., for the electrolysis of aqueous saline solutions, by the Refractory Zinc Ore Treatment Co.

German Interests in British Companies.—In the House of Commons on Tuesday, a discussion took place on the above question, a member calling attention to the decision of the Court of Appeal in the case of the Continental Tyre and Rubber Co. (Great Britain), Ltd., *v.* the Daimler Co., and asking that the Attorney-General should advise the Government to carry the case to the Lords at once, or to promote legislation to bring the law of the country more in accordance with public policy. The Attorney-General, in the course of his reply to the discussion, said, according to the report in the *Times* for Wednesday, that the legal point at issue was extremely disputable. To get a decision in the House of Lords would take weeks, in the most favourable circumstances, and might take months. "When hon. members asked why, after the war, should money made by these companies be paid to the enemy, the answer he would give was that we were not dealing here with one separate subject-matter, and that the whole topic of the treatment of alien enemy property which was within the jurisdiction of this country was a very complicated one. It applied to all the German assets in the country, and under the custom of nations which had been observed in many wars it had not been the practice to confiscate—unless under exceptional circumstances—the property of the enemy. The question had not been neglected for a moment. An inspector had been appointed under the Trading with the Enemy Act, 1914, in the case of every company in which the majority of shares was held by enemies or in which the majority of the directorate consisted of enemies. Inspectors had also been appointed, even where the majority of directors did not consist of enemy aliens, where there was any ground for suspicion. In every case where an inspector had thought it desirable to appoint a supervisor one had been appointed in order to keep watch over everything that took place. In most cases it had not been thought necessary. In the case of 492 companies inspectors had been appointed; in the case of 232 companies supervisors had been appointed; in the case of eight companies controllers had been appointed; and in the case of enemy firms or persons 185 inspectors and 86 supervisors had been appointed. When hon. members talked of legislation they should have in their minds a clear idea of the legislation they meant. He, personally, was not at all indisposed to consider any reasonable practical suggestion, but he only knew of one which would meet the case to any extent. That was that they should take a certain proportion, and say, if the alien holding passed beyond that, then the company should not be treated as being a British corporation. It might be possible to do something on these lines, but it should not be forgotten that by the transfer of four or five shares the company might always be made to pass the dividing line. It was when one tried to draft a Bill that one saw the practical difficulties, but he assured the House that the matter was under most careful consideration."

Electric Heating and Electric Furnaces.—In his third lecture on this subject at University College, London, Prof. Fleming dealt with various types of electric furnace, commencing with resistance furnaces. The Acheson furnaces for the production of carborundum and graphite were described, as well as the Kryptol furnace for heating crucibles, &c., by contact, and the Heraeus laboratory furnaces with platinum heating spirals. The use of carbon as the resistance material for large operations, and of a bath of molten salts for tempering tools, &c., was also described; in the latter case the latent heat of the fused salt can be utilised to maintain the bath at a constant temperature, no rise in temperature being possible so long as any unfused salt is present.

Induction furnaces were next dealt with, beginning with the invention of the type by Dr. S. Z. de Ferranti in 1887. Furnaces of this kind are made in large sizes, a Kjellin furnace for making steel from pig and scrap iron, with a power input of 736 KW, being referred to; the iron core of the transformer in this case weighed 35 tons. The Frick furnace is of similar design, and both these are mainly used in Sweden for making high-class steel. The Röchling-Rodenhauser furnace has a melting channel in the shape of the figure 8, the centre portion forming a convenient chamber in which a large quantity of steel can be held in a molten condition; auxiliary conduction heating of this central hearth is provided by iron electrodes built into the furnace walls and connected to heavy secondary coils on the transformer. A furnace capable of producing a ton of steel per heat consumes 90 amperes at 3,000 volts; the heat lasts four to six hours, and the energy consumption is about 930 KW.-hours per ton. The steel costs £7 per ton. In the Hjorth induction furnace the cores of the transformer are stationary, clearance holes in the furnace structure allowing the bath to be tilted for pouring. The primary coils consist of copper tube through which water circulates, a heavy current at low voltage being supplied by a separate transformer. A 5-ton furnace of this kind is in use at Jossingford. Lastly, the lecturer explained the operation of the Hering pinch-effect furnace, which was described in the ELECTRICAL REVIEW of October 23rd, 1914.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—Orders for Week commencing November 29th, 1915.—By Lieut.-Col. C. B. Clay, V.D., Commanding.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

Monday, November 29th.—Sections 1 and 2, Technical; Sections 3 and 4, Squad, Signalling Section and Recruits.

Tuesday, November 30th.—School of Arms with Architects' Corps, 6 to 8 p.m.

Wednesday, December 1st.—Opening of New Headquarters (see below), at 6.25 p.m.

Thursday, December 2nd.—Sections 3 and 4, Shooting.

Friday, December 3rd.—Sections 3 and 4, Technical; Sections 1 and 2, Squad, Signalling Section and Recruits.

The opening of the new Headquarters takes place on Wednesday, December 1st, at 6.25 p.m. All members are requested to attend in uniform if possible. Members are requested to bring as many recruits as possible on this occasion.

Members desirous of applying for commissions in the technical branches of the Army should apply immediately to the Commandant or Adjutant, who will give them all the information they require.

E. G. FLEMING,
Company Commander and Acting Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, November 25th, 1915:—

Week-end Parades.—Saturday.—Field Operations. A company will parade at Baker Street Station at 2.30 p.m., and proceed by through train to Wembley Park. Umpires to accompany this party—Capt. Eastwood, Mr. H. O. King and the Adjutant. B, C and D Companies, rendezvous at Queen's Park Station, at 2.45 p.m., under the command of Mr. Ridd.

Instructions have been issued to the Officers concerned.

Sunday.—All day Outpost Scheme.

A, B, C and D Companies will parade at Wembley Park at 10.30 a.m. to be in position by 12 noon. North London and Blackheath Platoons will represent the Enemy, and will rendezvous under special instructions issued separately.

Refreshments to be supplied on the Ground by the Quartermaster for A, B, C and D Companies. North London and Blackheath Platoons to take their own provisions, and to provide themselves with a narrow white tape hat band.

Musketry.—There will be no shooting at Acton on Saturday next, the 27th inst.

Bisley.—The range will be open all day for members of the Corps. Names to be sent in to Headquarters, as usual. Members going down in the morning, should report to Sergeant Cotter at the barrier of No. 9 Platform, Waterloo Station, at 9.15 a.m. Those unable to travel at that time should apply for travelling vouchers at Headquarters not later than 5 p.m. on Friday next, the 28th inst.

A. G. JOINER, *Major and Adjutant*, O.B.C.

Books for British Prisoners of War.—A further appeal is made by the Board of Education for books of an educational character for the British Civilian Prisoners of War (of whom there are some 4,000) now interned at Ruhleben, in Germany. Under the auspices of a Camp Education Department, a school and a Science and Art Union have been organised among the prisoners, and in them are enrolled 1,500 students with 150 lecturers and teachers. The educational work covers nearly all the usual subjects of a school or college curriculum. Persons willing to contribute either books or money to this interesting and most deserving effort to help our unfortunate fellow-countrymen in Germany to relieve in a profitable manner the tedium of their confinement, may obtain a circular giving full information on the subject, by addressing a post-card to Mr. Alfred T. Davies, Board of Education, Whitehall, London, S.W., who is in charge of the arrangements for obtaining and forwarding the books to Ruhleben.

Petrograd Electric Light Economies.—In order to save coal and electric power for the factories and workshops that are working for the national cause, the Governor of Petrograd, Major-General Prince A. N. Obolenky, decreed, on Oct. 11th last, the prohibition of the use of illuminated advertisements and sign boards, as well as the exterior lighting of houses (excepting lamps with numbers), industrial and trading concerns, restaurants, theatres, and entertainment houses. The posters fixed on such premises may be illuminated with one lamp having an incandescent light of not over 100 C.P. He prohibits the interior lighting of mercantile establishments whilst these are closed, excepting such lighting as is necessary for purposes of security; he also prohibits the use of arc lamps in shop windows, but such premises may use three incandescent lamps not exceeding 100 C.P. per lamp for each window. The lighting of entrances can only be allowed if the nearest street lamp does not suffice for such a purpose. Infringements of the decree will subject the offenders to imprisonment for a period up to three months, or to arrest for such period, or to a fine up to 3,000 roubles (about £320)

Accidents.—Mr. Wm. Sample, electrician, Dungiven, Co. Londonderry, while attempting to free an obstruction in the working of an engine at a generating station, had his arm caught in the machinery. The limb was badly lacerated

The *Times* states that by an explosion due to an accumulation of gas in a ship at Wallsend, one man was killed, and five other workmen, all electricians, were injured.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. E. S. Riley, station superintendent at the Walthamstow U.D.C. electricity works, has resigned his position and enlisted in the Army.

The Holmfirth District Council has appointed Mr. A. C. Bott resident electrical engineer.

At the electricity works, Stamford, recently, Mr. A. Emerton, the fitter, was presented by the staff with a clock on the occasion of his marriage. Mr. J. E. Edmundson, the engineer, made the presentation.

Mr. H. M. Taylor having resigned his appointment as chief electrical engineer to the Middlesbrough Corporation, Mr. R. A. Scotson has been appointed his successor at £300 a year.

General.—Mr. B. Sleath, who travels for Messrs. Venner & Co. and for their principals, Messrs. Chamberlain and Hookham, Ltd., in the West of England and South Wales, and Mr. J. S. Carter, who has recently been travelling in many parts of the world for Messrs. Chamberlain and Hookham, Ltd., have both joined the Motor Transport Section of the A.S.C., and are at present stationed temporarily at Grove Park.

In consequence of the absence of Captain Wallis-Jones on active service, Mr. Harold W. Couzens, of the firm of Couzens & Brown, has kindly undertaken to execute, on behalf of Messrs. Wallis-Jones & Dent, Westminster, all work now in hand and any future work that may be entrusted to that firm. Mr. Couzens will have the services of Mr. Tate, for so many years the firm's chief assistant engineer. The firm's address is: 50, Queen Anne's Gate, S.W. Telephone number: Victoria 5029.

Since our last issue more municipal bodies in Lancashire have appointed committee chairmen for the ensuing year as follows:—

Salford.—Electricity Committee, Coun. G. Billington (chairman) and Coun. McDougall (vice-chairman); Tramways Committee, Ald. Linsley (chairman) and Coun. Barrett (vice-chairman).

Oldham.—Electricity Committee, Coun. C. Hardman (chairman) and Ald. Ward (vice-chairman); Tramways Committee, Ald. Isherwood (chairman) and Coun. Elliot (vice-chairman).

Bury.—Electricity Committee, Coun. Jamieson (chairman) and Coun. T. Holt (vice-chairman); Tramways Committee, Ald. Collinge (chairman) and Coun. Hargreaves (vice-chairman).

Preston.—Tramways Committee, Ald. Omerod (chairman) and Coun. Parkinson (vice-chairman).

Southport.—Tramways Committee, Ald. Griffiths (chairman) and Coun. Clayton (vice-chairman).

Stockport.—Electricity Committee, Ald. George Ball (chairman) and Coun. J. W. Booth (vice-chairman); Tramways Committee, Ald. C. Sharples (chairman) and Ald. W. E. Hamnett (vice-chairman).

Mr. T. Perrin has been re-elected chairman of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, and Mr. H. Sykes has been re-elected vice-chairman.

Coun. A. J. Beckett has been appointed chairman and Coun. J. Bavin vice-chairman of the Fulham B.C. Electricity Committee.

Mr. Bruce Lindsay has been elected Convener of the Edinburgh Corporation Electric Lighting Committee.

Ald. Vorley has been appointed chairman and Ald. Myers vice-chairman of the Islington B.C. Electricity Committee.

Coun. Brook has been appointed chairman of the Electricity Committee of the Todmorden T.C.

Mr. H. R. Barge and Mr. W. F. Bate have been appointed chairman and vice-chairman respectively of the Poplar B.C. Electricity Committee.

Mr. Arthur Bridge has been appointed chairman of Battersea B.C. Electricity Committee for the ensuing three months.

The friends of Mr. A. V. Gifkins, the well-known electrical contractor who was so seriously injured on the night of October 13th, will be pleased to hear that he is making excellent progress, and hopes to leave the hospital within the next fortnight. In the meantime, he tenders his most sincere thanks to the very large number of those who have written to him expressing their sympathy, and hopes to deal more fully with their letters at a later date.

Mr. H. Perkins, electrical traveller in the Midlands and the Eastern Counties for Messrs. Falk, Stadelmann & Co., Ltd., has joined the Royal Engineers, Electrical Section, for the duration of the war. He will resume his duties with the firm after the war.

Mr. C. F. Anderson has resigned his position with the B. & K. Co. to join the 26th Royal Fusiliers.

The following notice appears in the *London Gazette*:—Territorial Force, Tyne Electrical Engineers: Richard Garratt Ellis to be Second-Lieutenant, September 15th, 1915.

M. Georges Claude, the inventor of the neon lamp, has been made a Chevalier of the Legion of Honour, and awarded the War Cross. He is a lieutenant in the air service.—*Lumière Electrique.*

Mr. J. W. Meares, electrical adviser to the Government of India, is to proceed on seven months' leave this week. Mr. C. C. T. Eastgate, electric inspector, Punjab, will officiate in Mr. Meares's absence.

Mr. Thomas A. Edison has recently been appointed Chairman of the Naval Advisory Board, U.S.A., which Board comprises a number of prominent engineers and scientific men of U.S.A. Dr. Willis R. Whitney, Ph.D., Director of the Research Laboratory of the General Electric Co., Schenectady, New York, has been appointed a member of the same Board. Among the many important developments and inventions made in the above laboratory under Dr. Whitney's direction have been the drawn-wire tungsten filament and the gas-filled (half-watt) lamp. Dr. W. L. R. Emmet, chief engineer of the lighting department of the General Electric Co. (U.S.A.), Schenectady, has also been appointed a member of the Naval Advisory Board. Dr. Emmet is a graduate of the United States Naval Academy, and served as an officer in the United States Navy, which position he resigned to take up engineering work with the General Electric Co. (U.S.A.) at their Schenectady works. He was responsible for the development of the Curtis steam turbine as applied to the driving of electric generating machinery, and was specially engaged on this work for a number of years. His most recent development is the mercury vapour turbine, a paper on which was presented before the American Institute of Electrical Engineers during the past year.

Mr. Ernest W. Dunton, of the British Thomson-Houston Co., Ltd. (Madza House staff), has been appointed electrical engineer to the Anglo-Saxon Petroleum Co., Ltd., for service in Sarawak, and he is leaving this country very shortly to take up his new post and erect the electric lighting plant at Sarawak, and afterwards take charge, in accordance with the plans and specifications of the consulting engineers for the scheme, Messrs. Albion T. Snell & Partners.

Roll of Honour.—Private Alfred Griffiths, who, before the war, was in business as an electrical engineer in Manningham Lane, Bradford, and has been serving in the Motor Transport Section of the Army Service Corps, has died of wounds received whilst on service in France.

Corporal Leonard S. Newns, of the Royal Flying Corps, formerly a wireless operator, has been awarded the D.C.M. for gallant conduct and coolness when carrying out his duty under fire, and for the conspicuous thoroughness and efficiency for which his work has been noticeable.

Private Archer Watson, of the 6th Battalion Lincolnshire Regiment, who is reported missing, was, prior to enlistment, engaged with Messrs. Cutting Bros., electrical engineers, of Stamford. He was present at the Suvla Bay landing at the Dardanelles, and although previously reported wounded, no news of him has been received since August 6th.

Sergeant Chas. L. R. Haines, of the Royal Engineers, who has died at Netley Hospital from shrapnel wounds received in action on September 25th at Loos, was formerly engaged at the Rugby works of Messrs. Willans & Robinson, Ltd.

Lieutenant C. P. B. Ogilvie, Mechanical Transport Section, Army Service Corps, has been wounded in France, and is now in the British Red Cross Society's Hospital, at Eastbourne, with a bullet wound in the head. Prior to the war he was an electrical and motor engineer in Belfast.

Obituary.—Dr. Paul Rasehorn.—The death is reported from Berlin, at the age of 50 years, of Dr. Paul Rasehorn, the chief engineer of the Siemens & Halske Co.

Dr. Henry Charlton Bastian.—We tender to Mr. C. Orme Bastian our sincere sympathy on the occasion of the death of his noted father, Dr. Henry Charlton Bastian, which occurred in his 79th year on Wednesday last week.

Ex-Bailie James Alston.—Ex-Bailie J. Alston, who a fortnight ago was appointed Convener of the Glasgow T.C.'s Tramways Committee, died at his residence, Carmunnock, Busby, this week.

Mr. Fred. Hawkins.—The death occurred on 18th inst., at the age of 86 years, of Mr. Fred. Hawkins, who was in the employ of the India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd., for 60 years. He joined the company when it was known as S. W. Silver & Co., and served almost continuously until within a few weeks of his death. He was for many years manager of the cable-making and battery department. The funeral ceremony took place on Wednesday at West Ham Cemetery. With the death of Mr. Hawkins there has passed away another of the highly-esteemed old guard of Silvertown whose departure we record with feelings of personal regret.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Renew Electric Lamp Co., Ltd.—Mortgage dated November 17th, 1915, to secure £337 7s. 3d., and further advances up to £500, charged on the benefit of a certain agreement, being a contract for the purchase of a licence to work the company's process for renewing electric lamps in Russia. Holders: Haughton, Dickson & Co., Ltd., 3, Mumford Court, Milk Street, E.C.

Llangollen and District Electric Light and Power Co., Ltd. (75,384).—Capital, £6,000 in £1 shares (2,500 pref.). Return dated September 21st, 1915. 2,114 shares taken up; £2,110 15s. paid, leaving £3 5s. in arrears. Mortgages and charges: £2,800.

Halifax and Bermudas Cable Co., Ltd. (28,972).—Capital, £50,000 in £5 shares. Return dated September 30th, 1915. All shares taken up; £50,000 considered as paid. Mortgages and charges: Nil.

New Liverpool Rubber Co., Ltd. (109,933).—Capital, £150.000 in £1 shares (52,000 pref.). Return dated October 13th, 1915. 58,502 ord. and 51,410 pref. shares taken up; £58,502 paid; £51,410 considered as paid. Mortgages and charges: £25,705.

North Melbourne Electric Tramways and Lighting Co., Ltd. (85,463).—Capital, £200,000 in £1 shares (100,000 pref.). Return dated July 16th (filed September 2nd), 1915. 67,257 pref. and 100,000 ord. shares taken up; £52,257 paid; £115,000 considered as paid. Mortgages and charges: £167,000.

CITY NOTES.

Edison & Swan United Electric Light Co., Ltd.

Mr. C. J. Ford presided, on November 18th, at the annual meeting held at Winchester House, E.C. In referring to the balance sheet, he said that the item of sundry creditors and credit balances stood at £80,814, against £48,174 last year. The increase was wholly due to the larger turnover, and was correspondingly represented on the other side of the account by increases in the items of stock and sundry debtors, the first of which had increased from £184,989 in 1914 to £211,273, and the debtors from £64,831 to £89,792. With a view to extending the company's manufacturing facilities, £8,690 had been expended on additional buildings to cope with the increased trade, which expenditure was included under the item of freehold and leasehold property, which now stood at £73,036. Plant and machinery for a similar reason had been increased by £8,700, bringing that item up to £84,613. One of the principal items included in that additional expenditure had been in respect of their glass furnaces, which were now equipped for an output of lamp bulbs of practically double the capacity which existed heretofore. Whilst on that subject, he might tell them that they had in the past year found no difficulty whatever in disposing of the whole of their output, and could undoubtedly have sold more if their manufacturing capacity had been greater; but it was only within the last few months that the additional furnaces and plant had been available, and further moderate expenditure would be required. In normal times the sales of lamps they had made would undoubtedly have shown them a considerably greater profit, but they were in the position that the selling price of the drawn-wire lamp could not be increased; in fact, it was more likely to be reduced. On the other hand, the cost of manufacture had risen to an abnormally high figure in consequence of increase in wages and the cost of raw material. Anyhow, the company had undoubtedly established the reputation of the "Ediswan" drawn-wire lamp, and unless something altogether unforeseen should happen in the future he saw no reason why the increased sales should not continue. With regard to the company's interest in the Altrincham Electric Supply, Ltd., the last balance sheet showed a holding of 10,060 fully-paid preference shares, and 5,000 similar shares on which a small amount had been paid, together with 6,669 deferred shares of 1s. each. In the present accounts it would be seen that they held in June 4,705 fully-paid and 5,000 10s. paid preference shares, the difference having been sold in the period under review. They had since disposed of the whole of the partly-paid shares, thereby cancelling £2,500 of the £2,785 liability referred to in the balance sheet, and they had reduced their holding in fully-paid preference shares to 1,505. With regard to the deferred shares in the Altrincham Co., of which they held the whole issue except one, they were, in the opinion of the board, a valuable asset, and when he told them last year that their dividend thereon amounted to 10s. per share they would agree with him. It they capitalised these shares to pay 10 per cent., which he did not think was unreasonable, their holding should be worth over £33,000. This would mean that they were worth £5 per share, but the difficulty was to obtain the price for them. The public would willingly pay £1 for a £1 share paying 10 per cent., but looked askance at paying £5 for a share of the face value of 1s. He did not think the dividend in the future on these shares should be less than that received in the past. The general expenses had been reduced by £4,825, and amounted to £17,038, and the balance of gross profit brought from trading account had been increased from £51,244 to £56,962, the net result being that they had made a profit for the year of £14,146, against £4,695 last year. He regretted that they could not recommend the payment of a dividend, but on previous occasions he had pointed out that it was absolutely essential before any dividend was paid that they should accumulate a very substantial reserve fund and employ it as additional working capital. For this reason they recommended that a start be made by transferring £15,000 to reserve account. During the year they had had an anxious and trying time, and had experienced great difficulty in finding adequate labour. Their anxieties had been accentuated by reason of the great rise in the price of raw materials, and in many instances the difficulties of obtaining them, even at any price, which, coupled with the heavy rise in the price of labour, had tended at times to severely tax their financial resources. If the business increased in the future as it had during the past two years, the question of finance would become a still more urgent one. Unfortunately, there did not appear to be any existing means of providing further working capital except through the medium of holding up profits. One of his colleagues, Mr. Gimingham, in the early part of the year made a tour of inspection of the company's Australian and New Zealand branches and agencies, and visited the chief commercial centres there, and he thought that in due course a considerable expansion of the company's trade in Australia should result therefrom. In conclusion, the Chairman referred to the nomination of Mr. John Cross to a seat on the board, and explained that several large shareholders considered that no addition should be made at present, and consequently Mr. Cross withdrew his candidature.

Mr. E. B. Ellice Clark seconded the motion.

In the course of his reply to remarks by shareholders, the Chairman said that the public seemed to think that because a concern was doing a huge trade it was necessarily making a huge profit. That might be the case in normal times, but not in such times as the present. As an instance, he might tell them that they had had to send their own motor vans to Birmingham from London to fetch metal. Wages had gone up after contracts had been secured to a very high figure indeed, and raw materials had also gone up after contracts had been made. It was impossible for any business of that sort to cover itself absolutely for the whole of the contracts it had in hand. They could do it to a certain extent, but they would want a colossal amount of working capital if they were to do so entirely. Although they had a very big business, there had not been the profit that might have been expected. Lamps were practically their main article, and the price of the lamp was fixed and could not be raised, whilst the cost of producing the lamp had gone up 33 per cent.

Mr. Lowry asked if there was any prospect in the coming year of a dividend being paid, or of the contracts they had entered into, and which had not been profitable, being put on a better basis?

The Chairman said he could not forecast anything about a dividend. He had put it plainly that day, and in the past, that no dividend could be paid until they had got sufficient working capital, and this could necessarily only be provided out of profits. He saw no possibility of a dividend until they had at least £50,000 reserve. When he became chairman there was a sum of £45,000 put down in the reserve account, but on looking into the whole matter most carefully he found it had been accumulated out of so-called profits made by not adequately depreciating stock. If the stock had been taken at the proper figures the profit would not have existed as shown, and consequently they would not have had the £45,000 reserve at all. The profit shown that day was after taking stock and debtors and all their assets at the most conservative figure, and there was no doubt about it that they had the profit there. They had not taken any contracts which were not profitable. What he intended to convey was that they were not as profitable as in normal times.

The report was then adopted.

Allgemeine Elektricitats Gesellschaft.

The directors of the A.E.G., of Berlin, have issued a statement referring briefly to the working results in the year ended with June 30th, 1915. It announces that the workshops, from which 23,908 employés were absent owing to the call to the Army, were adequately occupied on peace work, and were at disposal for the defence of the country to a wide extent. The bank credit is claimed to have amounted to £5,165,000 at the end of the year, as against £3,850,000 in 1913-14. The sum expended for the support of the families of employés reached £230,000 in the first year, and had been defrayed out of revenue. The book value of a number of industrial investments had been written down by £100,000, so as to bring them to the nominal value. After deducting general expenses, taxes, interest on loans, and provision for depreciation, the accounts are said to show net profits amounting to £1,069,000, as contrasted with £944,000 in the preceding financial year. It is proposed to pay a dividend of 11 per cent. on the ordinary share capital of £7,750,000, as compared with 10 per cent. in 1913-14 and 14 per cent. in each of the two preceding years. It is added that the recent increase of £1,450,000 in the share capital had been registered after shares for £1,738,000 in the Berlin Electricity Works Co. had been notified in exchange for A.E.G. new shares for £1,303,000, and the balance of £147,000 had been taken over by a banking syndicate. A proposal to amend the company's statutes is to be made at the forthcoming general meeting, so as to extend the objects of the undertaking.

Southern Brazil Electric Co., Ltd.

Mr. E. H. Tootal presided at the annual meeting, held in London on 22nd inst. He referred to the valuable assistance rendered by the company's brokers throughout an anxious and trying period. They had been compelled to husband their resources, and delay and curtail the development and extension work contemplated, until their finances were placed upon a better footing. The balance of £2,127, which was to be carried forward, did not represent the result of a full year's working, for in the case of Campinas, Paranagua, and Byington & Co., which closed their accounts on December 31st, only profits for the six months ended December, 1914, had been taken into account. It was proposed to alter the date of closing the company's financial year so as to coincide with that of the Brazilian concerns. The report was adopted.

Provincial Tramways Co., Ltd.—The report for the year ended September 30th, 1915, states that the net revenue received from the local companies has been £48,789, against £40,297 last year and £41,683 in 1913. The directors have set aside to reserve and depreciation account £12,000, and have added to reserve account for third party insurance or other purposes £4,000. They now recommend a dividend on the £1 ordinary shares of 10d. per share, making with 8d. per share paid in June last 1s. 6d. per share, or 7½ per cent. for the year, leaving £11,800 to be carried forward. Having regard to the uncertainty of the current year as to traffic, and also as to the probability of greatly increased taxation, the directors consider it prudent to carry forward this substantial amount.

Mexico Tramways Light and Power Companies.—At the request of the holders of large amounts of the bonds of the various companies constituting the Mexico Tramways, Light and Power group, the following gentlemen will act as a committee to co-operate with the trustees, the receivers, and the boards of directors, in taking such measures from time to time as will best safeguard the interests of the security holders:—Mr. E. R. Peacock (chairman), Messrs. Stanley Boulter, H. F. Chamen, Robert Fleming, H. Malcolm Hubbard, and A. F. P. Roger.

Richard Hornsby and Sons, Ltd.—For the year ended September 30th there was a disposable balance amounting to £52,762, as compared with £25,745 for the previous year. A distribution of 6¼ per cent. on the ordinary shares is recommended, as compared with 2½ per cent., carrying forward £27,547.

Callender's Share and Investment Trust, Ltd.—The directors recommend a dividend at the rate of 5 per cent. per annum, less income-tax, for the half-year, making 5 per cent. for the year, placing £500 to reserve, writing £741 off preliminary and other expenses, and carrying forward £3,010.

Electric Construction Co., Ltd.—The directors have declared an interim dividend at the rate of 7 per cent. per annum on the preference shares for the half-year to September 30th.

Victoria Falls and Transvaal Power Co., Ltd.—The net earnings, including those of the Rand Mines Power Supply Co. for the quarter ended September 30th, amounted to £184,798.—*Financial Times.*

Power-Gas Corporation, Ltd.—A dividend on the ordinary shares for the year ended September 30th last at the rate of 6 per cent. per annum, less income-tax, is announced.

Ruston, Proctor and Co., Ltd.—An interim dividend of 2½ per cent. is announced.

Anglo-Portuguese Telephone Co., Ltd.—The directors announce an interim dividend of 3 per cent., less income-tax.

STOCKS AND SHARES.

TUESDAY EVENING.

Stock Exchange business is moving on lines rather slower than those which have distinguished it during the first half of the month. For this the vacillation of Greece and the advance of the enemy into Serbia are in the main responsible, having combined to check investment and to lay a hand upon the spirit of optimism which had been current previously in most of the Stock Exchange markets.

At the same time, the Treasury have just introduced an unexpected factor into Capel Court conditions, because, taking the Stock Exchange by surprise, they have given permission for minimum prices to be removed in the cases of Consols and various other fixed-interest securities which have lain under the shelter (or the ban, from whichever point of view one looks at it) of the Treasury regulations since January 4th last. It will be recalled that the Treasury practically sold to the Stock Exchange the privilege of reopening the House, in exchange for certain severe restrictions, of which the establishment of minimum prices in scores of stocks formed one of the number. We dealt fully with the matter at the time, and have recurred to it on subsequent occasions when indicating the mechanical difficulties under which Stock Exchange transactions at present creak.

The Treasury have removed these restrictions from only certain stocks, of which Consols are the chief. None of the Home Railway fixed-interest issues—*e.g.*, Metropolitan District prior lien debenture, Central London 4½ per cent. preference, London Electric 4 per cent. debenture—are affected, although it is thought probable that if the removal of the minima from Consols, Foreign Government bonds, and the like, should turn out to be a discreet step, the Home Railway prior-charge lists will shortly be brought into line with the rest. Consols promptly fell 7 points from their previous minimum, so it may be guessed what would happen if Railway stocks were freed entirely.

The feature in the Home Railway market this week is another substantial rise in Underground Electric 6 per cent. income bonds, the price of which has jumped up 4 points to 78½, while the £10 shares rose to 40s. and the shilling shares to 6s. 7½d. We take no credit to ourselves for pointing out the obvious cheapness of the bonds when they stood in the neighbourhood of 70, because there was so little reason for the overdone depression, and so much likelihood of its being rectified. The advance has been assisted by various rumours, one of which hears that fares are going to be raised on the Underground Electric Railways and omnibus systems; and if this is so, the security of the income bonds would certainly be improved, because, in present conditions, a slight advance in fares would make little perceptible alteration in the number of passengers, although the total carried is so enormous that a scarcely-felt rise in the price of a ticket would make a huge difference to the aggregate receipts of the associated companies.

Districts and Metropolitans are both better, Central Londons gained 2½, and most of the Steam stocks present a more healthy appearance than they have been doing of late. This is consequent upon a little investment inquiry by those who regard the stocks as cheap, seeing that current prices are full of the dividend earned during nearly five months of the fat half of the year.

How the provinces are making money and putting it by—at all events, some proportion of it—is seen in the constantly-increasing difficulty of obtaining good-class stock at the present range of prices. Anglo-Argentine Tramways debenture stocks make a good illustration. Not long ago, it was difficult to get a bid for the 5 per cent. debenture issue; now, the trouble is to get the offer of it. The same remark applies to one market after another throughout the Stock Exchange. The public want sound securities paying 5½ to 6 per cent. on the money, but holders are apparently not eager to sell, nor obliged to do so.

Go into whatever market one may choose, the really good investments are only to be picked up—at attractive prices, that is—more or less by accident. "We cannot get stock," murmured a jobber the other day, "until a few more holders die"; and the grim comment gives an effective idea of the principal source from which supplies are to be expected. New issues cannot be made; foreign holders cannot sell; some of the provinces are prospering by reason of the war, and so there is not enough good stock to go round.

There is not much doing in the market for domestic electrical shares. No changes have occurred in prices; and, although a few buyers come in occasionally for the preference issues, the ordinary shares are still neglected. London Electric 4 per cent. debenture has gone back 3 points to 77, but this is exceptional, because for most of the good debenture stocks there is demand and no supply.

Telegraph stocks are mostly good. The Eastern group is better, and both classes of Globe Telegraph and Trusts have risen ⅛. Western Telegraphs hardened to 12½. New York Telephone bonds remain at 101¼, but the market for most American securities is a little shaky in consequence of a rise in the exchange. American Marconis receded to 16s. 6d., while the price of the parent shares, at 37s. 6d., is also lower. Anglo-American Telegraph deferred at 22¾ has gone back ¼, and at the present price it looks tempting, by reason of the excellent yield that it affords.

Mexicans are looking more healthy again, and some of the utility issues are a point or so better on the week, this applying rather to the common and preferred stocks, because the bonds are offered. Brazil Tractions stick at 57½. To our price lists over-leaf we add four of the most negotiable stocks of the British Columbia Electric Railway. The company has so far paid the full dividend on its 5 per cent. preference stock, but whether this performance will be repeated in respect of the current half-year is considered highly doubtful. Castner-Kellners are good at 3⅛, Babcock & Wilcox are retaining all their firmness, British Westinghouse preference put on a florin, Electric Constructions rose 1s. to 14s., and there has been an improvement in Telegraph Constructions.

The rubber share market was buoyant until the price of the raw stuff bounded up to 3s. 7d. a pound. This was held to be a significant red light, showing the danger of buying overmuch in a market where the inflation of the raw stuff began to wear a very artificial aspect. Difficulty in securing ships for transport of the rubber to the United States and to these shores, plus the renewed activity of the German submarines in the Mediterranean, are holding up large quantities of rubber in the Middle East; and although the companies producing rubber at 1s. per lb. or less would be making huge profits if they could get anything like 3s. 6d. per lb., it is not clear that in the majority of cases they are able to obtain it from their estates. So that, while the prices are good, the buying is more cautious than it was ten days ago; and it seems to us that the careful attitude is eminently correct.

In copper shares, the tendency is rather reactionary. The United States has had a bearish fit in consequence of a rise in exchange between New York and London, but this phase is not likely to be more than temporary; prices will probably recover again, whatever the exchange happens to be. Armament shares are also quiet, and as a whole, though keeping on a steady keel, they fail to attract any noteworthy attention.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend, 1914.	Price Nov. 23, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	7¼	—	£6 18 4
do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	3½	—	7 2 10
do. do. do. 4½ Pref. ..	4½	3¾	—	6 0 0
do. do. City Pref.	4½	3½	—	6 8 7
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4¼	—	5 17 8
do. 4½ Deb.	4½	87	—	5 3 6
City of London	9	12¼	—	7 7 8
do. do. 6 per cent. Pref. ..	6	10¾	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10	—	7 0 0
do. do. 6 per cent. Pref. ..	6	10¼	—	5 17 8
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	83 xd	—	5 8 0
Kensington Ordinary	9	6	—	7 10 0
London Electric	4	1⅜	—	8 3 4
do. do. 6 per cent. Pref. ..	6	4¼	—	7 1 2
do. do. 4 Deb.	4	77	−3	5 4 0
Metropolitan	3½	2¼	—	7 15 7
do. 4½ per cent. Pref. ..	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	85	—	5 6 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6½	—	7 13 10
do. do. do. 7 per cent. Pref.	7	6	—	5 16 8
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6½	—	6 18 6
do. 4½ Pref.	4½	4⅛	—	5 9 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	101½	—	5 18 0
do. Def.	1½	22¼	— ¼	6 11 10
Chile Telephone	8	6¼	—	6 8 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	12	+ ⅛	*6 13 3
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord...	7	125	+1	*6 8 0
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	10⅝	—	*6 12 2
do. Pref.	6	10⅜	—	5 15 8
Gt. Northern Tel.	22	33½	—	6 11 4
Indo-European	13	46 xd	—	6 18 4
Marconi	10	1⅞	— 1/32	5 6 8
New York Tel. 4½..	4½	101¼	—	4 8 9
Oriental Telephone Ord.	10	1 15/16	—	5 3 1
do. Pref.	6	⅞	—	6 17 2
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5⅝	—	*8 2 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	⅛	—	8 17 9
Western Telegraph	7	12½ xd	+ ⅛	*6 8 0
do. 4 Deb.	4	80	—	5 0 0
Home Rails.				
Central London, Ord. Assented ..	4	70½	+2½	5 13 6
Metropolitan	1¼	25	+ ½	5 0 0
do. District	Nil	15	+ ½	Nil
Underground Electric Ordinary ..	Nil	2	+ ⅜	Nil
do. do. "A"	Nil	6/7½	+1/7½	Nil
do. do. Income ..	6	78½	+4	*8 16 1
Foreign Trams, &c.				
Adelaide Sup. 6 per cent. Pref. ..	6	5	—	6 0 0
do 5 Deb.	5	97	—	5 8 0
Anglo-Arg. Trams, First Pref. ..	5½	4	—	6 17 6
do. 2nd Pref.	5½	3½	+ ⅛	7 17 2
do. 4 Deb.	4	76	—	5 5 8
do. 4½ Deb.	4½	75	—	6 5 0
do. 5 Deb.	5	82	+2	6 2 0
Brazil Tractions	3½	57½ xd	—	6 1 9
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
British Columbia Elec. Rly. Pfce. ..	5	53	—	9 11 4
do. do. Preferred ..	—	37	—	Nil
do. do. Deferred ..	—	33	—	Nil
do. do. Deb. ..	4½	62	—	6 17 1
Mexico Trams	Nil	42	+2	Nil
do. 5 per cent. Bonds ..	—	41	−1	Nil
do. 6 per cent. Bonds ..	—	44	—	Nil
Mexican Light Common	Nil	30	—	Nil
do. Pref.	Nil	42	+2	Nil
do. 1st Bonds	—	49	−1	—
Manufacturing Companies.				
Babcock & Wilcox	14	2 5/16	—	6 1 9
British Aluminium Ord.	5	1 1/16	—	4 14 1
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	10⅛	—	7 8 2
do. Pref.	6	5⅛	—	5 2 2
British Westinghouse Pref.	7½	86/-	+2/-	8 6 8
do. 4 Deb.	4	70	−2	5 14 3
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	10½	—	7 2 10
do. 5 Pref...	5	4½	—	5 11 1
do. 4½ Deb.	4½	85	—	5 6 0
Castner-Kellner	20	3⅛	—	6 8 0
Edison & Swan, £3 pd.	Nil	9/-	−1/-	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	57	—	7 0 4
do. do. 5 % Deb	5	60	—	8 6 8
Electric Construction	6	14/-	+1/-	8 11 6
do do. Pref.	7	19/9	—	7 1 4
Gen Elec. Pref.	6	9½	—	6 6 4
Henley	20	12¾	—	*8 19 4
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	7¾	—	6 5 0
Telegraph Con	20	8¼	+ ½	*8 1 6

* Allowance made for dividends being paid free of income-tax.

Dublin Electricians' Strike.—The Dublin electricians who struck for higher wages, returned to work on Tuesday at the old rate of pay, pending arbitration, at which the Recorder of Dublin (Right Hon. T. L. O'Shaughnessy) will preside.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 24th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a " Nitric	"	..	..
a " Oxalic	per lb.	1/1	..
a " Sulphuric	per cwt.	..	..
a Ammoniac Sal	"	..	..
a Ammonia, Muriate (large crystal)	per ton	£50	..
a Bleaching powder	"	..	..
a Bisulphide of Carbon	"	£23	..
a Borax	"	£23	..
a Copper Sulphate	"	£42	£6 10 inc.
a Lead, Nitrate	"	..	..
a " White Sugar	"	..	..
a " Peroxide	"	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	..	..
a Potash, Caustic (88/90 %) ..	per ton	..	..
a " Chlorate	per lb.	1/4½	..
a " Perchlorate	"	1/6	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	"	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers ..	"	£11 10	..
a " Recovered	"	..	..
a " Lump	"	£8 10	..
a Soda, Caustic (white 70/72 %) ..	"	..	..
a " Chlorate	per lb.	1/3½	..
a " Crystals	per ton	45/-	..
a Sodium Bichromate, casks ..	per lb.	6½d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	..	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	..	..
b " Sheet, in ton lots ..	"	..	..
p Babbitt's metal ingots	"	..	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/1¾ to 1/2	¾d. inc.
c " Tubes (solid drawn) ..	"	1/2½ to 1/2¾	¾d. inc.
" Wire, basis	"	1/2 to 1/2¼	¾d. inc.
Copper Tubes (solid drawn) ..	"	1/2½ to 1/2¾	¾d. inc.
g " Bars (best selected) ..	per ton	£112	£5 inc.
" Sheet	"	£112	£5 inc.
" Rod	"	£112	£5 inc.
" (Electrolytic) Bars ..	"	£97	£5 inc.
d " " Sheets ..	"	£115	£6 inc.
d " " Rods ..	"	£104	£[illegible] inc.
d " " H.C. Wire	per lb.	1/0½	1/16d. inc.
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	1/10	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	3/-	4½d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	71/6	3/10½ inc.
i " Wire, galv. No. 8, P.O. qual.	"	£28	£2 inc.
g Lead, English Pig	"	£28 10	£2 15 inc.
g Mercury	per bot.	£16 15	..
e Mica (in original cases) small ..	per lb.	6d. to 3/-	..
e " " " medium	"	3/6 to 6/-	..
e " " " large ..	"	7/6 to 14/- & up.	..
o Nickel, sheet, wire, &c.	"	Nom.	..
p Phosphor Bronze, plain castings	"	..	..
p " " rolled bars & rods	"	..	..
p " " rolled strip & sheet	"	..	..
o Platinum	per oz.	210/-	12/- inc.
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	"	£165 10 to £166 10	£3 10 inc.
n " Wire, Nos. 1 to 16	per lb.	2/8	1d. inc.
p White Anti-friction Metals ..	per ton	..	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

An Empire Fair.—We have received a copy of the preliminary prospectus of the Industries of the Empire Fair, 1917. The title may be clumsy, and while war is raging 1917 may seem a long way off, but for the information of those interested, we may say that it is proposed to hold the event at Willesden Green, and copies of the pamphlet before us may be obtained at Lincoln House, High Holborn, W.C. If peace is proclaimed by the date named, the event may be timely.

Industrial Diseases.—In the report of the Medical Inspector of Factories for 1914 it is stated that 41 cases of lead poisoning occurred in connection with the manufacture of electrical accumulators, compared with 44 in the previous year. The claim of Sir Thomas Oliver that lead could be eliminated from the body with the aid of the electric bath has been investigated, and is regretfully dismissed as groundless, the experiments failing to show that any practical benefit was derived from the treatment. There were 21 cases of poisoning by carbon monoxide from power plants, the same number as in 1913; none of them were fatal.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING OCTOBER, 1915.

We publish herewith the October figures of electrical export and import business.

As regards the former, it will be noted that they show a satisfactory improvement over the previous monthly returns, the totals for the last three months being: October, £406,132; September, £374,418; August, £346,318.

The electrical imports, on the other hand, have gone back considerably as compared with September, the October total of £146,281, being a substantial drop on the previous month's total of £211,488.

The re-exports, at £20,122, show a small advance on the September total of £19,885. The outstanding feature of the exports was the large machinery export amounting to over £161,000, and advances were also shown in telegraphic, battery and instrument exports; a considerable drop occurred in the value of cable exports, which, however, reached £85,000 in value.

The falling-off in electrical imports was fairly general in character, although mainly due to the much smaller value of American material entering this country, the U.S. being responsible for only £87,379 worth, as compared with £127,379 worth in September. An exception to the rule was Holland, which did a considerably increased business with us, including £12,536 worth of lamps imported into this country.

Our best customer during the month was India, but export business was better than usual in almost all directions.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	3,538	22,700	220	48	839	2,059	6,433	11,903	254	228	4,635	4,236	57,093
German West Africa	...	...	...	...	...	...	...	...	...	...	...	43	43
Netherlands, Java and Dutch Indies ...	206	8,661	719	11	...	172	956	...	1,080	...	764	205	12,774
Belgium	23	...	...	...	...	...	60	...	...	...	...	...	83
France	1,514	...	509	62	108	79	6,832	6,037	1,476	...	769	5	17,391
Portugal	22	3,266	409	117	...	248	206	...	120	48	1,506	31	5 973
Spain, Canary Isles and Spanish N. Africa...	357	11	143	33	...	186	2,244	503	...	69	266	3,374	7,186
Switzerland, Italy and Austria-Hungary ...	672	180	204	47	...	478	1,204	...	...	112	283	...	3,180
Greece, Roumania, Turkey and Bulgaria ...	44	37	20	196	...	...	199	278	...	...	30	160	964
Channel Isles, Gibraltar, Malta and Cyprus...	142	307	76	146	...	...	...	...	74	...	177	14,692	15,614
U.S.A., Philippines and Cuba	68	...	19	23	...	...	5,440	4	291	...	304	2,394	8,543
Canada and Newfoundland	192	20	306	129	...	684	2,260	...	291	...	38	986	4,906
British West Indies and British Guiana ...	124	133	38	81	39	...	...	...	24	68	65	92	664
Mexico and Central America	...	62	...	20	...	140	258	...	...	...	...	45	525
Peru and Uruguay	3	68	32	44	...	...	14	...	39	16	89	18	323
Chile	19	554	63	45	...	297	1,362	4,200	77	73	200	18	6.908
Brazil	119	172	210	229	...	10	488	14	90	11	...	...	1.343
Argentina	1,656	1,212	1,317	712	...	890	27,251	234	949	11	3,884	733	38,849
Colombia, Venezuela, Ecuador and Bolivia...	39	46	...	...	...	...	9	...	32	9	33	...	168
Egypt, Tunis and Morocco	198	340	48	252	...	28	602	5	325	...	478	477	2,753
British West Africa	...	55	26	42	...	...	269	1,200	74	...	67	240	1,973
Rhodesia, O.R.C. and Transvaal	273	3,267	499	1,300	...	181	469	243	1,494	...	172	...	7,898
Cape of Good Hope	619	1,811	280	978	...	832	412	1,400	1,318	65	1,037	205	8,957
Natal	38	2,703	191	124	...	...	9,223	...	41	20	92	38	12,470
Zanzibar, Brit. E. Africa, Mauritius & Aden	71	...	35	34	...	...	923	...	69	...	16	173	1,321
Azores, Madeira and Portuguese Africa ...	37	75	34	344	...	16	1,108	...	27	...	78	46	1.765
French African Colonies and Madagascar...	...	...	...	...	...	...	14	...	...	...	...	...	14
China and Siam	761	1,951	433	732	57	452	2,359	60	62	18	100	268	7 253
Japan and Korea	600	254	...	...	23	138	2,728	1,389	1,567	41	52	162	6 954
India	2,122	7,206	4,959	3,407	105	1,863	31,242	2,139	4,481	67	491	1,734	59,816
Ceylon	179	394	112	114	...	...	1,792	36	16	...	27	1,283	3,953
Straits Settlements, Fed. Malay States and Sarawak	176	891	444	260	...	94	309	665	24	...	144	741	3,748
Hong Kong	235	3,808	355	10	...	35	993	55	...	29	34	...	5,554
West Australia	162	1,410	175	722	...	150	883	108	217	51	7	...	3.885
South Australia	285	450	176	...	490	...	638	...	199	...	174	44	2,456
Victoria	3,315	9,923	1,545	2,242	...	1,946	10,820	42	561	242	330	859	31,825
New South Wales	1,455	9,419	1,286	2,855	85	946	4,137	1,423	465	390	3,286	2,776	28,523
Queensland	91	748	17	547	11	55	667	1,400	440	44	1,716	...	5,736
Tasmania	6	32	145	107	...	...	258	13	...	325	...	...	886
New Zealand and Fiji Islands	1,608	3,227	2,524	1,442	556	876	3,069	324	453	12	11,754	17	25,862
Total, £	20,969	85,393	17,569	17,455	2,313	12,858	128,131	33,775	16,630	1,949	33,098	36,095	406,132

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Norway, Sweden and Denmark ...	135	...	...	375	274	...	3,326	...	15	479	9,722		14,326
Germany	...	...	...	...	...	...	...	...	...	...	...		...
Holland...	...	3,685	117	12,536	647	...	344	...	468	...	...		17,797
Belgium	...	...	...	...	...	...	...	...	...	...	10		10
France	350	71	10	1,484	472	484	168	18	3,417	2,989	92		9,555
Switzerland	1,249	994	218	956	220	2,722	443	...	...	910	1,070		8,782
Italy	105	2,874	...	...	...	...	1,342	...	35	17	...		4 373
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...		...
United States	4,601	2,412	1,775	1,366	3,523	426	8,618	47,835	3,197	8,163	5,463		87,379
Total, £	6,440	10,036	2,120	16,717	5,136	3,632	14,241	47,853	7,132	12,558	16,357		142,222

Additional imports.—Spain, electrical goods, £12; fittings, £43; carbons, £1,680; telephone and telegraph material, £10; Canada, electrical goods, £145; wires, £300; glow lamps, £4; machinery, £16; telegraph and telephone material, £1,849.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above... ...	1,351	407	...	4,128	284	95	12,147	...	100	418	1,192		20,122

Total Exports: £406,132 Total Re-Exports: £20,122 Total Imports: £146,281

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

DECIMAL COINAGE AND THE METRIC SYSTEM.

(*Concluded from page* 646.)

The idea that the adoption of the metric system can be arrived at by a process of evolution, as suggested by Mr. W. Sisson, is, we regret to say, impracticable. One or the other system must be the prevailing one, and to prolong the period of thinking and working on a dual system would be highly detrimental to efficiency.

While, as we have mentioned, there is no need to alter the established dimensions of machines, such as lathes, dynamos, engines, etc., the case is different with regard to manufactured materials such as bar iron, girders, etc. Existing sizes could certainly be used for a time, redimensioned in millimetres, but as the new system came into general use, in all new work round figures would be employed, and instead of 1-inch diam. steel rod, for instance, 25-mm. rod would be called for. Here again the necessity of avoiding the prolongation of the period during which double stocks have to be carried is obvious.

We may mention that it is a known fact, proved to demonstration, that large orders for bridge-work, pipes, etc., have been diverted from this country solely on account of the inability of our manufacturers to supply them to the metric measures specified.

Perhaps one of the most serious obstacles to the general introduction of the metric system would be found in the necessity of replacing all the standard weights of retail traders. Their balances would not be affected, but a new set of weights would cost from 16s. to £2, say 30s. on the average. A Government grant might facilitate the conversion.

It is impossible in the retail trades to introduce the metric system except at one stroke; to keep two sets of weights on the counter is out of the question.

As regards the textile industries, formerly regarded as inveterate opponents to the metric system, in 1913 the Bradford Textile Society and other associations passed resolutions advocating the compulsory adoption of the metric system.

Attempts have often been made to decimalise our existing system, and an association was formed for the purpose of promoting this object. All such attempts are doomed to failure, for they would lead to endless confusion. To decimalise the inch would still leave all the disadvantages of the foot and yard. The Armstrong works have used the decimal divisions of the inch for years, and rightly, as they thus get rid of thirty-seconds and sixty-fourths. But to alter the inch, even slightly, would be fatal; the new unit would be too nearly like the old, and endless confusion would result. Germany actually attempted to do this very thing, but gave it up after inquiry, and adopted the metric system. There was no friction due to its adoption, nor was there any in Austria. In fact, wherever the system has been introduced, objections have quickly died away, and no country which has adopted the metric system—since the early struggles of France—has ever given it up. Germany finds no difficulty in manufacturing with these units; if she did, we should find her competition less effective than it is.

Many of the advantages that would ensue from the adoption of a decimal system of coinage are identical with those mentioned in connection with metric computations, such as the absence of troublesome reductions, the simplicity of addition of columns of figures, and the abolition of compound arithmetic. Decimal coinage can be handled with the slide rule, a powerful argument in its favour, and interest calculations lose all their terrors. A long time ago a first step was made towards decimalising our coinage by the introduction of the florin, which was marked "one-tenth of one pound." By increasing the number of farthings in £1 from 960 to 1,000, the thing is done. We then have the florin equal to 100 farthings, or mils, the shilling equal to 50, sixpence equal to 25, and so on. Accounts would be kept in pounds and mils, or in florins and mils, precisely as in dealing with dollars and cents, or francs and centimes. The saving in time and labour would be enormous, and foreigners would have no difficulty with our coinage, neither should we be "at sea" in foreign lands.

In 1824 the question of adopting decimal coinage in this country was broached in the House of Commons, and the "pound and mil" scheme was recommended. In 1841 the Commissioners for the Restoration of the Standards of Weights and Measures that were destroyed in the fire at the Houses of Parliament reported most strongly in favour of decimal coinage, as well as of the decimal scale in weights and measures, and their successors in 1843 repeated the recommendation, which they renewed in 1853. A Select Committee was then appointed and reported to exactly the same effect. In 1855 the subject was again raised, and in 1856 the City of London presented a petition to the House of Commons for the introduction of decimal coinage; in the same year a Royal Commission was appointed, and three years later it reported against changing the coinage while the weights and measures remained unreformed. In 1862 a Select Committee recommended the adoption of the metric system, in order to facilitate both our internal and our external trade. Many other reports on the subject were drawn up, and in 1892 the Conference of the Chambers of Commerce of the Empire passed a resolution declaring that the introduction of the decimal system of weights and measures and money was urgently needed in order to facilitate commerce. In 1893 the Trade Union Congress advocated the system, and in 1895 a Select Committee of the House of Commons was appointed, which reported that the metric system should be at once legalised for all purposes (this was done in 1897), and that after a lapse of two years the system should be made compulsory. In 1900 and 1903 the Congress of Chambers of Commerce of the British Empire again called for the adoption of the metric system, to be made compulsory after two years. In 1902 sixty municipalities petitioned the Board of Trade in favour of the compulsory adoption of the metric system throughout the Empire, and 292 members of Parliament expressed their approval of the proposal. In the same year (and also in 1903 and 1904) the Associated Chambers of Commerce declared that the adoption of the metric system was imperatively necessary in the interests of our foreign trade, and the Association of Trade Protection Societies resolved that the time had come for the compulsory adoption of decimal coinage and the metric system. In the following year the Council of the Institute of Chartered Accountants passed a similar resolution. In 1904 the second reading of a Bill for rendering compulsory the use of the metric system was carried unanimously in the House of Lords, the General Medical Council unanimously resolved that it was desirable that the metric system should be the only legal system for the dispensing of drugs, and the Chambers of Commerce of Australia resolved that the British Government be urged to recognise the necessity of adopting the metric system. In 1907 a metric system Bill was rejected in the House of Commons by a majority of 32, but in 1910 a resolution in favour of compulsory adoption passed the Australian House of Representatives by 35 votes to 2. In 1912 once again the Chambers of Commerce of the British Empire unanimously passed a resolution emphasising the growing necessity of uniform systems of weights, measures, and currency, and recommending that the question be brought before the Imperial Trade Commission which was then about to sit. At the Imperial Conference held in London in 1902, the Colonial Premiers passed a resolution urging the adoption of the metric system throughout the Empire.

The metric system was made compulsory in France on January 1st, 1840. In Germany a law passed in August, 1868, made the use of metric units optional from January 1st, 1870, and compulsory from January 1st, 1872; previously a Commission had investigated the question with a view to creating a national system, but found it preferable to have an international system, and concluded that the only possible international system was the metric system. Thus Germany, at the close of a great war, and with the most diverse systems of coinage in vogue in many different States, in the course of four years carried through the whole change of coinage, weights and measures; the change coincided with the commencement of that successful industrial career which has provided her with the resources with which to make a determined bid for the empire of the world. We cannot doubt that her industrial and commercial development was intimately connected with the reform of her systems of measurement. It is interesting to observe that, in spite of the fact that the metric system was of French origin, even at that date the Germans found it preferable to adopt it rather than to range themselves in line with the British, as they had thought of doing—when they investigated our "system," naturally they were horrified.

In 1895, as a member of a deputation to Mr. Balfour, the then Prime Minister, Mr. T. Richardson, M.P., President of the North-East Coast Institute of Engineers and Shipbuilders, said that the shipbuilding and engineering interests of the North-East of England were unanimously in favour of adopting the metric system. They were willing to bear the expense of the change; in the case of his own works, where the wages bill was £2,500 a week, the cost would be a little over £100. Captain Sankey, giving evidence on behalf of Messrs. Willans & Robinson, stated that the men were not only satisfied but pleased, and had no difficulty in working to metric measures after the first few days. The Association of Inspectors of Weights and Measures expressed a strong opinion in favour of the compulsory adoption of the metric system.

It may be interesting to mention that the Decimal Association, of Finsbury Court, Finsbury Pavement, E.C., reports that never in the history of the Association "has there been so much public interest displayed in the metric system as there has been since the outbreak of the war, mainly arising from the conviction of merchants and manufacturers that we are on the threshold of a still greater era for British trade, and that we should be prepared to enter upon it with up-to-date methods."

"Much correspondence has appeared in various organs, debating the question, and canvassing from various points of view its probable effect, but the trend of opinion is that if decimal coinage were adopted in this country its advantages would be so obvious that as soon as the general public became accustomed to it, they would clamour for the adoption of a decimal system for weights and measures. This being the case, the Association has resolved to give precedence to the question of coinage, whilst at the same time in no way slackening its efforts to bring about the desired change in our system of weights and measures."

At the annual meeting of the Association of Chambers of Commerce of the United Kingdom, on March 17th, 1915, the following resolution: "That the general and immediate adoption of the metric system would be a valuable means of assisting British firms in their competition—especially with Germany and Austria—in countries where that system is in vogue, and that the Association be urged to renew its representations to the Government, and especially to the Board of Education with that object," was carried unanimously.

The metric carat came into force on April 1st, 1914; this was the first time that any part of the metric system of weights and measures had been brought into compulsory use in this country. The new carat has been a great success, the whole trade has adopted it, and people are quite used to it and are pleased with the simplification it affords in calculations; it has also had a beneficial effect upon trade.

From May 1st, 1914, recording of the barometer in inches was discarded, and in substitution therefor an absolute unit of pressure founded on the centimetre-gramme-second system was officially adopted; rainfall measurement is now given in millimetres.

In the new "British Pharmacopœia" all weights and measures are given in the metric system, "in the expectation that in the near future the system will be generally adopted by British prescribers."

His Majesty's Legation at Buenos Aires reported recently that complaints were constantly received about the attitude of the United Kingdom manufacturers in refusing to adopt the metric system in their exports to Argentina, and at a meeting of the Committee of the British Society in the Argentine Republic, held on January 11th at Buenos Aires, after a long discussion regarding the best methods to be adopted by British manufacturers to secure an extension of trade in those markets, it was unanimously decided that the most expeditious way to capture German trade in Latin America would be the adoption by Great Britain of the decimal and metric systems.

The importance of immediately adopting the metric system of weights and measures is being strongly pressed home on the United States of America by their consuls abroad.

China, by a new Weights and Measures Act, has instituted a system of weights and measures that is based entirely on the metric system.

Finally, many sympathisers, hitherto unknown to the Decimal Association, have written urging that the present time (when there is such a universal upheaval) is a golden opportunity for changing our monetary system and our weights and measures to a more rational form.

The last paragraph contains precisely the reason which has led us to advocate at so great length the early adoption of these reforms. In face of an earth-shaking catastrophe, in the presence of governmental restrictions, requirements, and regulations such as no citizen of our Empire had ever contemplated or imagined, but which everyone has readily submitted to and endured for the sake of the nation's welfare, and in view of the extraordinary rise in prices which has upset all our established conceptions of value there could not possibly be a more favourable opportunity for consummating a reform which is widely regarded as inevitable, and which is known by the whole commercial community to be of the utmost importance to our future prosperity. In the new-born German Empire the new system was adopted during and immediately after the close of a great war, not by caprice, but as part of the considered policy of the nation, which has since contributed in no small measure to its commercial success. A people which has gracefully accepted a rise in prices amounting to about 30 per cent. without complaint will not quarrel with a change which, at the cost of a decrease of 4 per cent. in the value of the *copper coinage alone* (for the gold and silver money will not be changed) will bring so great benefits; and for the same reason no better time could be chosen than that immediately following the restoration of peace for adopting metric weights and measures; the prices of commodities will then be falling, and the slight relative loss on the copper coinage will be far more than compensated for by the real increase in its purchasing power due to this circumstance.

It is not absolutely necessary that both coinage and weights and measures should be simultaneously changed; the coinage should come first, and the rest should follow either separately or *en bloc* as might be thought advisable—subject to the proviso, we suggest, that the whole conversion should be completed within a period of twelve months from the beginning, after twelve months' warning. It is absurd to suggest that our people are less intelligent than those of the many nations that have already adopted the international system; and our native conservatism has received the greatest shock recorded in its history. Now, therefore, is the time! We earnestly urge our readers to join with us, and, by writing to their favourite papers, technical and lay; by pressing the matter on the attention of their Parliamentary and municipal representatives, and by utilising every opportunity of making converts and enlightening those who are ignorant of the advantages of reform, to create a mass of public opinion which shall prevail against the inertia of a Government which never acts until it is compelled to act. There is no time to be lost—immediate action is essential.

THE PRODUCTION AND PROPERTIES OF ELECTROLYTIC COPPER.

By B. WELBOURN.

(*Abstract of Chairman's Address, delivered to the* Manchester Local Section of the Institution of Electrical Engineers, *November 16th,* 1915.)

(*Concluded from page* 649.)

Elasticity of Copper.—In view of the extensive and increasing use of copper conductors on overhead lines, railways and tramways, and the great importance of the elastic properties of the wire in relieving strains, it seems desirable that any definition of hard-drawn wire should also include a reference to its "limit of proportionality" (elastic limit), as do many foreign specifications, and also, at first sight, to its modulus of elasticity. There are, however, practical difficulties in making these delicate measurements in works routine, and further reference will be made to these points.

The ratio of elastic limit-breaking strength, *i.e.*, the limit of proportionality, varies from about 50 per cent. for wires of 0·08 in. diameter to about 70 per cent. for wires of 0·5 in. diameter when measured on 10-in. samples. The Engineering Standards Committee might stipulate for a minimum limit of proportionality for all hard-drawn wires and state the conditions under which the test should be carried out.

These should include—

1. A statement as to the temperature, although the percentage extension does not appear to be affected by variations within the atmospheric limits in the United Kingdom.
2. The type of apparatus and the conditions under which it should be used.
3. A statement of the length of the test piece.

An excellent basis for the above is to be found in the Engineering Standards Committee's Report No. 55, which contains the results of an investigation carried out by the National Physical Laboratory on some of the standard sizes of wires used by the British Post Office.

I would suggest that this Institution (through the Research Committee) would confer a great boon on the electrical industry if it would carry through an investigation on similar lines for all standard circular wires from No. 5 S.W.G. (0·212 in. diameter) to 7/0 S.W.G. (0·500 in. diameter).

The values could then be interpolated for all other sizes of wire by using a large scale curve which embodied the results of the two investigations.

I would also suggest that the investigation should include work on stranded conductors. From the small amount of work which I have done on this point, there seems reason to believe that the limit of proportionality is higher for a given section of stranded conductor than it is for the corresponding section of solid conductor.

On all strands containing more than three wires a considerable number of tests show that the effective strength should be taken as 10 per cent. below that of the same number of straight wires. This appears to be due to the difficulty of getting the strain evenly distributed among the wires of a strand by any form of grip, and to the fact that the layers of wires are of unequal length, especially in the case of a large strand.

In the United Kingdom the regulations of the Board of Trade provide that the conductor shall be erected with such a minimum sag that at 22° F., and with a wind pressure of 25 lb. per sq. ft. of effective area, the stress in it (*excluding its elasticity*) shall not be more than one-fifth of the breaking load, and that an accumulation of snow may be ignored. The rule has the virtue of being simple, and on the safe side for English conditions, but it results in abnormal and unnecessary dips on small wires, of which No. 11½ S.W.G. is the smallest allowed.

It may be suggested for consideration that the proper procedure would be to decide what would be the worst conditions under which a conductor would have to work, and then to erect it so that, under those conditions, it would not be stressed beyond its limit of proportionality. For instance, the engineers of some of the most important Canadian power transmission lines have decided, after long experience, that, for the ordinary sizes of conductors used, the worst conditions may be taken as ⅜ in. thick of sleet collected on the wire at 32° F. and a wind pressure of 11 lb. per sq. ft. of effective area, and that under these conditions a factor of safety of 2 is required, and this is within the limit of proportionality.

But, whether the sag under the worst conditions is calculated one way or another, the fact remains that the elasticity of the wire ought to be taken into consideration in arriving at the correct sag to be given when the wire is erected, so that, under the worst conditions, the sag will not be greater than that calculated. The wire cannot possibly be erected under the assumed worst conditions, and it has to be sagged on comparatively still days at temperatures of, say, 50° to 70° F.

Suppose a wire has been erected with the requisite sag under the worst conditions, then when the wind drops the wire is relieved of a certain amount of stress and it contracts by an amount depending upon the stress it has been relieved of and the modulus of elasticity, but in the very act of contracting it diminishes the sag, and this again puts a greater stress on the wire and tends to stretch it back to its original position; consequently, the actual sag taken up by the wire is a matter of somewhat intricate calculation.

Again, suppose a wire is hanging with a certain sag at a certain temperature and the temperature rises, say 20° F., the length of wire in the span will increase by an amount depending on the coefficient of expansion of the metal. This lengthening would increase the sag, but increasing the sag reduces the tension in the wire, and again the wire by reason of its elasticity will contract by a certain amount depending on the stress it has been relieved of by the lengthening of the wire and the modulus of elasticity.

It is rather a long and wearisome matter to calculate from the worst sag under windage and low temperature what the erecting sag will be at, say, 60° F. with no wind, but the following formulæ will be found both useful and accurate, and they afford a ready means of obtaining the result. It may be said that the most convenient way to use the second formula is by assuming values of d_2 and plotting a curve from the values of t_2 so obtained, from which curve can be read the sag at any required temperature.

d = sag in feet under the worst conditions as calculated from the usual formula $d = l^2 \mathrm{W}/8\,s$, where—

l = span length in feet.

W = resultant of weight and wind pressure in lb. (per foot).

s = tension in conductor in lb.

d_1 = corresponding sag at same temperature when wind and ice are removed.

W_1 = weight per foot of wire only.

M = modulus of elasticity (say, 18,000,000).

A = cross-section of wire in sq. in.

Then to find d_1 use the formula:— $\frac{\mathrm{W}_1}{d_1} - \frac{\mathrm{W}}{d} = \frac{64\,(d_1^2 - d^2)\,\mathrm{M\,A}}{3\,l^4}$.

From d_1 it is possible to find the sag d_2 at any other temperature from the formula:—

$$t_2 - t_1 = \frac{8\,(d_2^2 - d_1^2)}{(3\,l^2 + 8\,d_1^2)\,c} + \frac{s}{\mathrm{M\,A}\,c}\left(1 - \frac{d_1}{d_2}\right)$$

t_1 = temperature in ° F., with sag d_1.

t_2 = any other temperature in ° F.

d_2 = sag at temperature t_2.

c = coefficient of expansion per ° F.

An examination of the stress-strain curve of any hard-drawn copper wire will show that the modulus must be constant for the particular size, since the curve is a straight line up to the elastic limit, but the modulus is not necessarily the same for different sizes of wire.

In making measurements for true modulus values, it is, in my opinion, necessary to work on long lengths of wire which approximate to the span length employed on a tramway or other overhead line. I have been led to this conclusion by a study of the results recorded by the National Physical Laboratory in the Engineering Standards Committee's Report No. 55 on lengths of wire up to 50 ft., and of the method described by Mr. W. B. Woodhouse before this Institution, in the paper already referred to. His tests were made with No. 6 S.W.G. wire on a span of 110 ft., and, assuming the correctness of his measurements, it may be deduced from them that the modulus varied from 18,700,000 to 20,700,000, and gave an average value of 20,000,000. The method and the long length of the test piece would tend to eliminate sources of error.

The moduli given in the Engineering Standards Committee's Report No. 55, Table No. 10 vary between 17,200,000 and 18,200,000 on the second and third applications of the load, and particular attention is drawn to the different values of the readings on the first and subsequent applications of the test load. On the first application of the load, the kinks in a coil of wire were pulled straight, and the "apparent moduli" varied from 12,300,000 to 15,300,000, while on the subsequent loadings the values were as stated, viz., 17,200,000 to 18,200,000.

In the report referred to, the following statement is made:—

"It is thought, however, that the values of the 'apparent moduli' will be of interest and use, since it is these which must be taken into account in the erection of long lengths of wire."

I venture, with all respect, to express strong disagreement with this statement, because on all well-constructed overhead lines the wires should first be strained to a tension higher than that at which they will be permanently bound in. The object of this is to get rid of the kinks referred to in the report, and to allow the wires, especially stranded conductors, to "settle down." This procedure makes it permissible to take advantage of the real modulus value.

In view of the figures and considerations quoted, I consider that it is permissible to adopt an all-round value of 18,000,000 in future, instead of the usual text-book figure of 16,000,000.

I am afraid, however, that it will not be practicable to embody a *minimum* modulus value in ordinary specifications of hard-drawn copper, in view of the difficulties and delays which would occur in most works in carrying out the sensitive tests required. In special cases, however, it might be advisable to specify a minimum value and to make arrangements with the National Physical Laboratory or other testing institutions to provide the necessary apparatus and carry out the tests on specimens provided for the purpose.

Tensile Strength.—An interesting point arises out of the widely-held belief that the strength of hard-drawn wire lies in its skin being hardened during the drawing process. An examination of the matter does not disclose any conclusive evidence in support of this theory. I have investigated the matter and obtained the following results, starting with a length of .400 in. diameter hard-drawn circular trolley wire. Six pieces were turned down to different diameters with great care, in order to avoid undue heating of the specimens.

Test No.	Dia. ins.	Area sq. in.	Breaking load.	Breaking stress, tons per sq. in.	Percentage elongation on 10 in.
			lb.		
1. Original wire...	·400	·1257	6,950	24·70	2·50
2. Turned down...	·376	·1110	6,190	24·85	—
3. Do.	·351	·0967	5,520	25·42	—
4. Do.	·326	·0834	4,745	25·40	—
5. Do.	·301	·0711	4,100	25·70	—
6. Do.	·276	·0598	3,425	25·60	1·66
7. Do.	·250	·0491	2,840	25·80	

This result is not, of course, absolutely conclusive because the work done on the wire in the lathe will have some effect in hardening the skin at each stage.

The question whether the strength of copper wire is uniform throughout its cross-section is of great importance in connection with the contact wires on railways and with trolley wires on tramways, because they are subject to wear from pantographs, slider bars and trolley wheels. An investigation was made on this point recently on a 0·25 sq. in. grooved contact wire in connection with a railway electrification scheme which is now under construction. The wear on the wire was reproduced by gently filing away the face, and the cross-sectional area was accurately determined by weighing the specimens. The results are shown on fig. 1. The tensile strength of the original section of this wire was 21·8 tons per sq. in., and the extension was 6 per cent. on a 10-in. piece. It also withstood the following severe torsion tests without showing any signs of fracture: the wire was given 3½ complete twists in a length of 8 in.

Test.	Amount filed off working face.	Cross-sectional area, sq. in.	Maximum load, lb.	Maximum stress, tons per sq. in.	Yield load.	Yield stress, tons per sq. in.	Limit of proportionality.
A	Original wire	·246	12,150	22·0	9,500	17·2	78 %
B	·030	·234	11,900	22·6	9,500	18·1	79 %
C	·060	·226	11.650	23·0	9,500	18·7	81 %
D	·090	·221	10,900	22·0	9,500	19·2	87 %
E	·120	·207	10,300	22·2	9,000	19·4	87 %
F	·150	·195	9,600	22·0	8,500	19·5	88 %

Effect of Temperature.—The current which any bare overhead conductor will carry for a specified temperature rise under still air conditions can be predetermined by the use of Prof. George Forbes's formula:—

$I^3 = D^3\, t\, \pi^2 H/(4\, R \times 0{\cdot}24)$ where—

I = Current in amperes.
D = Diameter of solid wire in cm.
t = Temperature rise in °C.
H = Coefficient of radiation (0·0003 for solid wire or 0·00344 for stranded conductors).
R = Specific resistance of copper per cb. cm. at limiting temperature.
·24 = Calories in a joule.

$t\, \pi^2 H/(4\, R \times 0{\cdot}24)$ = 44,250 for a limiting temp. of 125° F. (for solid wire).
= 50,750 „ „ (for stranded wire)
= 80,840 for a limiting temp. of 175° F. (for solid wire).
= 92,300 „ „ (for stranded wire).

The question of the maximum permissible temperature of hard-drawn copper is of importance on overhead power lines because of the effect of heat in reducing its tensile strength.

The National Physical Laboratory found that on wires up to ·194 in. diameter "the reduction in breaking load due to temperature appears to be approximately one-tenth of 1 per cent. of the breaking load at normal temperature per degree Centigrade rise of temperature."

I have carried out a series of tests on specimens of 4/0s. copper trolley wire, diameter 0·400″, using apparatus which did not admit of any such refinements as those at the disposal of the National Physical Laboratory, and have obtained results which, so far as they go, seem to confirm that the National Physical Laboratory's determination, quoted above, will hold good for all sizes of circular copper wire.

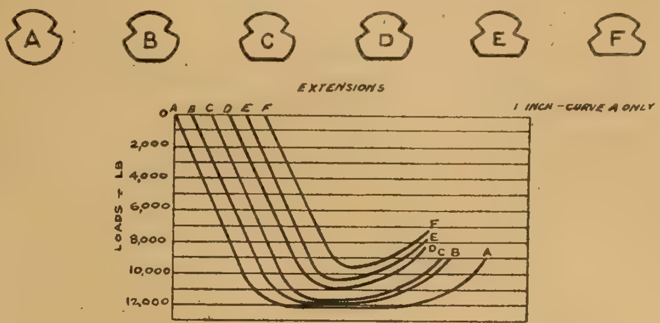


Fig. 1.—Autographic Record of Tensile Tests on H.D. Copper Trolley Wire (Grooved Section).

A number of experiments have been carried out by Dr. F. J. Brislee to determine the permanent effects of prolonged heating on the strength of wire, and he has very kindly given me the results of experiments on trolley wires.

From these results it appears that with 1/0 s.w.g. trolley wire, the permanent decrease in strength after two hours' heating at 150° C. (302° F.) is only 0·5 per cent., while a 4/0 s.w.g. wire was not affected after four hours.

Among tramway engineers it is generally understood that the temperature of trolley wires never exceeds 220° F. (say, 105° C.), and it is a fair deduction from the above tests that the limiting temperature is not reached. In view, however, of the fact that the temperature rise occurs on wires while under strain, it would not appear to be advisable to exceed a temperature of 250° F. in practice. At this temperature the tensile strength of the wire would be about 10 per cent. less than at normal temperature, but the strain would be relieved by the expansion due to heating.

In this connection, it may be noted that the Engineering Standards Committee's Report No. 55 gives the coefficient of expansion of copper per 1° C. as varying between 0·0000163 and 0·0000167. The average of these is equal to 0·0000093 per 1° F. The voltage drop due to resistance would appear to be the limiting feature in overhead wires, rather than the question of temperature. In case it should be necessary to know the resistance of copper resulting from change of temperature, this formula may be used:—

$$R_t = R_o(1 + 0{\cdot}0042\, t),$$

Where R_o = the resistance at o° C.
R_t do. at t° C.

RUSSIAN ELECTRICITY WORKS STATISTICS.

The statistical statement of central electrical stations in Russia for the year 1913 appears in the *Elektrichestvo*, No. 11, July issue, which has been late in appearing, due, no doubt, to the war situation, but partly, it is explained, to the installation of electrical driving plant in the printing office.

The statement is of considerable extent, and the most interesting features are reproduced in the accompanying table. It may be stated, by way of explanation, that the populations of the communities served vary between 3,000 (Balaclava) and 2,073,800 (Petrograd). Further, 54 of the 80 stations of which particulars are given supply direct current, 22 supply alternating current, and four supply both. Respecting the motive power, it appears that 47 have steam power, 16 gas, 16 steam and gas, and only one has water power—that of Suchum Kale; 59 of the stations, again, are specifically designed for lighting and power, 10 for tramways, and 11 for lighting, power, and tramways. The period during which exploitation has been exercised varies from one year, as in the cases of Grodno and Elabug, to 24 years in the case of Kieff.

The favourite type of oil engine appears to be the Diesel, and the storage battery usually employed is the Tudor. The Suchum-

RUSSIAN ELECTRICITY WORKS.

Place.	Supply authority.	Year of opening.	Supply pressure, volts.	Frequency and phase.	Total capacity of plant in KW.	Total connections in KW.	Units sold for all purposes, per annum.
Alexandrovsk	Town Council.	1910	2 × 220	Direct.	373	712	413,302
Baku, White Town	Electric Power Co.	1900	1,000 and 2,000	3-phase.	29,000	57,904	73 081,333
Bibi Eybat					3,000	10,682	15,539,102
Warsaw (Tramways) ...	Warsaw Magistracy.	1908	6,000	Direct.	4,000	8,832	8,559,390
Grodno	Town Council.	1912	2 × 220	Direct.	183	558	193,540
Elabug	Town Council.	1913	110	1-phase.	88	78	69,638
Kazan	Belgian Co.	1896	2 × 150	Direct.	1,372	2,548	1,466,363
Melitopol	Town Council.	1901	250 and 500	Direct.	300	—	344,587
Mohilieff, Podolia Govt.	Electric Light Co.	1912	—	Direct.	200	217	108,242
Moscow (Tramways) ...	Town Council.	1907	600	25 ~ 3-ph. and direct.	23,877	57,510	56,380,032
Nachichevan-on-Don ...	Town Council.	1910	2 × 220 (500 st. lg.)	Direct.	479	1,055	713,600
Odessa	Odessa Electrical Co.	1910	—	50 ~ 3-phase.	7,500	7,292	4,634,407
Orenburg	Town Council.	1898	120	1-phase.	616	592	483,033
Penza	Y. Milman and Ph. Titoff.	1907	220	Direct.	90	—	—
Pernau	Town.	1907	2 × 220	Direct.	260	496	221,375
Petrograd (Tramways)	Town Council.	1907	600	3-phase.	7,500	22,844	34,872,337
"	Petrograd Town Electric Lighting Co. (Belgian Co.)	1898	110	42·5 ~ 1-phase.	18,460	32,058	—
"	1886 Co., Electric Lighting.	1898	120	—	25,000	57,562	53,430,850
Pskoff	Town.	1907	2 × 250	Direct.	1,190	1,158	899,009
Riga	Town.	1904	120	3-phase.	7,060	13,271	6,371,625
Rostoff (Jaroslav) ...	Town Council.	1905	2 × 220, 2 × 250	Direct.	275	627	529,895
Rybinsk	Town Council.	1907	2 × 220	Direct.	512	835	480,822
Stavropol (Caucasus) ...	Town.	1909	250	Direct.	135	692	297,540
Suchum Kale	Suchum Electrical Co.	1909	125 (500 st. lg.)	3-ph. and direct.	435	452	431,222
Armavir	Armavir Electrical Power Co.	1905	220	Direct.	350	720	422,907
Balaclava	Town Council.	1911	—	—	49	44	26,000
Batoum...	Town Council.	1900	2 × 250	—	195	188	224,290
Bisk	Electric Light Co.	1900	—	1-phase.	154	—	62 500
Warsaw (Lighting) ...	Warsaw Electric Co.	1903	125	50 ~ 3-phase.	11,590	—	11,199 350
Vilna	Town Council.	1903	2 × 220	Direct.	1,025	—	1,547,362
Vladivostok	Town Council.	1912	220 lg. and pr.; 550 tr.	3-ph. & direct.	1,350	1,509	1,080,614
Vologda	Town Council.	1904	220	Direct.	118	93	149,361
Voronezh	Russian Siemens & Halske Elec. Works.	1899	—	1-phase.	825	1,123	933,235
Ekaterinodar (Lighting)	Town Council.	1906	—	—	820	1,144	1,128,060
" (Tramways)	Belgian Tramways & Electricity Co.	1900	500	Direct.	1,150	3 583	2,367,743
Ekaterinoslaff (Lighting and Power)	Central Electric Co.	1902	525	Direct.	3,990	6,528	5,894,000
" (Tramways)	Ekaterinoslaff Tramways Co.	1897	—	Direct.	1,185	—	1,995,000
Zhitomir	Russian Town & Roads Co.	1899	2 × 230 lg. and pr.; 550 tr.	Direct.	750	1,156	950,241
Irkutsk...	Town Council.	1910	115 (& 275 arc lg.)	1-phase.	847	1,765	1,012,693
Kovno	Kovno Electric Light Co.	1900	2 × 110	Direct.	742	1,001	608,508
Kieff	Kieff Town Tramways Co.	1890	600	Direct.	4,220	14.043	13,378.971
Libau	Continental Traction & Elec. Lighting Co.	1899	2 × 220 lg.; 500 tr.	Direct.	1,903	3,715	2,133,788
Lodz (Lighting) ...	1886 Co, Lodz Branch.	1908	120	50 ~ 3-phase.	15,000	26,011	31,701,417
" (Tramways) ...	Lodz Electric Tramways Co.	1898	—	—	1,750	—	3 994,300
Moscow (Lighting) ...	1886 Electric Lighting Co.	1897	120	3-phase.	35,000	71,149	53,002 360
Novgorod, Sieversk ...	Town Mutual Insurance Co.	1901	500	Direct.	90	—	56,000
Novocherkask	Town Council.	1900	2 × 110	Direct.	670	896	588,689
Pavlovsk	Pavloff Electric Co.	1911	2 × 240	Direct.	174	162	103,075
Petrograd	Petrograd Electrical Works Co.	1897	3,000	—	12,320	—	22,903,666
Poltava...	Town.	1900	2 × 125 D.C.; 190 and 110 A.C.	3-ph. & direct.	416	658	411,013
Poti	Town.	1906	480	—	106	63	186,400
Rostoff-on-Don (Light)	N. V. Smirnoff.	1909	2,000	50 ~ 3-phase.	2,600	2,376	—
" (Tramways)	Belgian Rostoff-on-Don Elec. Trmwys. Co.	1901	550	—	2,100	4,000	3,041,000
Smolensk	Smolensk Electric Co.	1901	2 × 220; 550 tr.	Direct.	500	1,573	1,032,148
Tver	Tver Electric Tramways & Lighting Co.	1901	110 D.C.	3-ph. & direct.	135	1,319	605,294
Tomsk	Tomsk Electric Lighting Co.	1895	110	1-phase.	1,058	—	700,000
Chavarovsk	Electric Power Co.	1906	2 × 220	Direct.	389	767	496,700
Karkoff...	Town.	1896	125 & 250 lg. and pr.; 600 tr.	Direct.	2,490	8,674	4,991,952
Cherson	Town.	1908	2 × 275	Direct.	487	1,125	718,773
Tzechotzinsk	Tzechotzinsk Government Water Cure Establishment.	1902	—	Direct.	84	—	26,240
Chernigoff	Town.	1893	2 × 220	Direct.	573	542	260,499
Yalta	Town.	1904	2 × 220	Direct.	515	880	466 000
Elizabetgrad	Town.	1908	2 × 220	Direct.	387	—	689 294
Minsk	Town.	1904	—	—	300	—	638,781
Nikolaieff	Town.	1902	2 × 220	Direct.	804	—	1,888,967
Jaroslav	Town.	1900	2 × 230	—	1,420	2,189	(1,510,000)
Bielostok	Electrical Enterprises Co., Berlin.	1910	—	—	830	1,114	697,362
Vladimir	K. A. Russakoff.	1908	2 × 220	—	168	—	106,330
Viatka	Town.	1903	2 × 220	Direct.	440	965	553,852
Kishineff	Town.	1909	2 × 220	Direct.	532	671	423,000
Nikolsk Ussurisk ...	Ussurisk Electric Co.	1908	—	Direct.	193	302	231,000
Upha	N. V. Konshin.	1898	2 × 220	Direct.	635	607	130 860
Chita	N. P. Polyskoff Co.	1906	2 × 250	Direct.	285	500	36,000
Astrachan (Tramways)	Private.	—	—	Direct.	500	—	1,424 550
Berdiansk	Town.	—	2 × 220 (540 st. lg.)	Direct.	110	125	134,869
Kieff (Lighting) ...	Private.	—	3 × 190 A.C.; 2 × 110 D.C.	3-ph. & direct.	—	14,271	10,946,507
Taganrog	Private.	—	2 × 110	Direct.	—	(151)	40 000
Perm	Town.	—	2 × 220 D.C.; 110 A.C.	3-ph. & direct.	—	1,192	722,611
Radom	Private.	—	2 × 220	Direct.	—	571	401 000
Riga (Tramways) ...	Private.	—	—	—	—	—	—
Samara...	Town.	1899	—	3-ph. 2,000/120	—	372	222,445

Kale plant is driven by the water of the river Besletka; the current generated is used for lighting the streets with arc lamps.

Although the statement generally refers to the working year 1913, there are some exceptions, due, doubtless, to particulars not having been received for that year in time.

It will be understood that great modifications will be observed in statements for 1915, for many of the stations included in the statement are situated in territory now occupied by the enemy; even when the time comes to re-establish the stations, it will in all probability be found that the plant has not been removed with sufficient skill to restore it as it stood, and the probability is that where it is hoped to reinstate the stations, entirely new ones will have to be equipped.

It is also gathered from the statement that machinery or apparatus has been supplied to the various stations by Phelzer, Bergman, Siemens-Schuckert, Nobel, Siemens & Halske, A.E.G., Tudor, Volta Works, the Kolomensk Factory, the Diesel Co., the Augsburg Works, the Glieboff Works, Westinghouse, Brown-Boveri, Bromley Bros., Babcock & Wilcox, Fitzner and Hamper, the Tosi Works, Van der Kerk, the Goerlitz Engine Works, Krupp, Sulzer, Escher-Wyss, Helios, Steinmuller, Brun, Borman and Schwede, Robey & Co., Hindley, Philips, Wolf, &c.

LEGAL.

Dexter *v.* Aldershot Urban District Council.

In this case, which came before Mr. Justice Neville, in the Chancery Division, on several days last week, plaintiff, Mrs. H. M. Dexter, of Cargate House, Aldershot, claimed an injunction to restrain the Aldershot U D.C., their servants and workmen, from working the plant and machinery at their electric light station in such a way as to cause nuisance or injury to the plaintiff.

Mr. Jenkins, K.C., and Mr. Church appeared for the plaintiff, and defendants were represented by Mr. Peterson, K.C., and Mr. Stamp.

Mr Church, in opening the case, said that the nuisance complained of was with regard to the engine house, and a water tower, respectively. The water tower discharged vapour which settled and caused considerable nuisance. Plaintiff's house was one of eight rooms and it adjoined the defendants' premises. The defendants' shed, in which a Diesel engine was running, was 155 ft. from the back of plaintiff's garden, and the condensing water tower was 66 ft. 9 in. from the plaintiff's premises. Plaintiff owned the freehold, her late husband having had the house built in 1887-8. They were away from the house from 1890 until 1909. Some of plaintiff's paying guests would give evidence. She did not make any complaint of loss of business by reason of the nuisance. Under a provisional order dated 1912 defendants put down the plant referred to. The water tower was not then in existence, and it was not until after the pleadings in the action were closed that it was erected. The writ was issued in June, 1914, and afterwards leave was obtained to amend the pleadings, so as to include the water tower. Sec. 70 of the Act under which the provisional order was granted provided that nothing in the order should exempt the undertakers from the consequences of any nuisance if they committed one. There was not any dispute about that. The simple question was nuisance or no nuisance. In their statement of defence the Council admitted that there had been some vibration from their engine, but denied that there had been enough to cause injury to the plaintiff or her house. They had done their best to cease all vibration, and hoped in time to be perfectly successful. At present they were only working from 6 a.m. until 9 30 p.m., on Saturdays, and from 6 a.m. until 8 p.m. on other days, and they were willing to undertake to restrict their working to these hours until means had been found for satisfactorily preventing any vibration. They had also paid £5 into Court to satisfy any damage the plaintiff might have suffered.

Several witnesses gave evidence as to the existence of noise and vibration. Plaintiff was called. She said that she first noticed vibration in July of 1912. She had experienced noise before that. She had been troubled by noise as early as 1911, when her husband was lying ill. When she experienced the vibration in 1913 she wrote to Mr. Garside, the manager of the works, and afterwards Mr. May, the chairman of the Council, visited her house. She pointed out to him certain cracks that had been caused by the vibration. Pointing began to drop out of the brickwork of her house about 12 months ago. It came principally out of the drawing room. It was still dropping out, some coming out as recently as two or three days ago. A joint inspection of the house took place on March 19th this year and October 25th, and between those dates a new noise made itself manifest from the defendants' works—a sort of whirling noise.

Evidence of the plaintiff's experts who attended the joint inspections was to the effect that both noise and vibration were distinctly noticeable in the house. On placing a hand on a mirror on the wall vibration could be distinctly felt. The noise from the exhaust, however, was not loud when the windows were closed. The moisture from the water tower was plainly visible, and fell in the form of a Scotch mist. The vibration ceased when the defendants' machinery was stopped. There was still noise and vibration discernible after the engines had stopped, presumably coming from the condensing plant. Mr. Dykes, who had also inspected the defendants' premises, said that he found there four Willans-Parker continuous-current machines (three 460 volts, 165 amperes, and 1,160 R.P.M., and one 460 volts, 435 amperes, and 350 R.P.M.). There was also a Carels-Diesel set (440 volts, 307 amperes, and 220 R.P.M.). All were set in substantial buildings. On the visit made in March to the plaintiff's house these engines were run at varying speeds, and though the vibration was noticeable the whole time, the difference in the running did not make any appreciable difference in the vibration. It was less, however, when the Diesel engine was not running.

At the conclusion of the Witness's evidence, Mr. Justice Neville asked whether, when the Diesel engine was stopped, and the steam engines were still running, the vibration was still noticeable.—Witness said No.

His Lordship: Then, speaking with regard to the state of things as they exist at present, the vibration is caused by the Diesel engine alone?—Witness said that he would not go so far as that, but the vibration was much less when the Diesel engine was not running.

Opening the case for the defence on November 18th, Mr. Stamp submitted that the plaintiff was not entitled to an injunction, as having regard to the character of the neighbourhood there was no such noise or vibration experienced in her house as would entitle her to relief.

His Lordship expressed the opinion that if the plaintiff was entitled to relief at all it was a case for an injunction and not for damages.

Mr. Stamp said his submission was that there was no such nuisance as would justify the action at all.

Mr. Garside, engineer to the defendant Council, said he had visited the plaintiff's house in conjunction with others. He heard nothing that would justify any complaint, nor could he detect any vibration.

Prof. Boys, who had also visited the plaintiff's house, said he went there with a number of other people present. He was unable to detect any vibration or noise, but he agreed that he might if he had been in the room by himself at night when everything was quiet, presumably have been able to detect something. He did not, however, believe that it would have disturbed him at all.

His Lordship held that upon the evidence there was an actionable nuisance, and he must grant an injunction. He would suspend its operation, however, to give the defendants an opportunity of abating the nuisance. He saw the difficulty they were in owing to the shortage of labour at the present time, and would accordingly suspend the operation of the injunction until three months after the termination of the war.

Osram Lamp Works, Ltd., *v.* Merryweather & Sons, Ltd.

A pending action in which plaintiffs claimed an indemnity was mentioned to Mr. Justice Scrutton, in the King's Bench Division, on November 18th.

Mr. Harold Brandon (for plaintiffs) stated that the defendants were installing a fire apparatus for the Osram Co., when some coal fell upon one of the plaintiffs' employés. She was seriously injured and plaintiffs had to compensate her, in respect of which they claimed an indemnity from the defendants. The girl had now named a lump sum which she would accept in full satisfaction, and the parties had arrived at a settlement. In the ordinary course, the girl being an infant, the arrangement would have to be approved by the Court, and that being done, it would be binding upon the girl. Notice to that effect would have to be given to the girl, and he, therefore, asked that the case might stand out of the list to enable it to be done.

His Lordship ordered that the action should stand out generally with liberty to the parties to apply to restore it when ready.

A Manchester Tramway Compensation Award.

At Manchester Assizes last Friday, Wm. S. Hopkinson claimed damages from the Manchester Corporation for personal injuries received in a tramcar accident. Plaintiff is 62 years of age, and a coal carter. On October 15th of last year he was proceeding along Holme Hall Lane with his horse and cart when a tramcar collided with the vehicle in the rear. Hopkinson was knocked down by the cart, and a wheel passed over his leg, with the result that the limb had to be amputated. For the defence it was alleged that there was room for the tramcar to pass the horse-drawn vehicle, but the cart was pulled into the middle of the road, and the car driver was unable under those circumstances to avoid a collision.

Mr. Justice Ridley gave an award in favour of the plaintiff for £650, and granted a stay of execution.

Munitions Case.

At the Oldham Munitions Tribunal last week, Messrs. J. P. Hall & Co., electrical engineers, of Blackridings Ironworks, Oldham, brought a complaint against Leonard Barber, an apprentice armature winder, who was alleged to have neglected to obey the lawful orders of a person having authority over him. It appeared from the statements of representatives of the firm's that Barber had to work overtime four hours every night, and on November 10th he asked permission to leave at 5.30 p.m. He did not say why he wished to leave early, and he had previously had two hours off on two nights in the same week. Permission was refused. Mr. Alfred Marland, the secretary of the firm, said that when told he could not have the time off Barber said he would go whether he was allowed or not. During the past 12 weeks Barber had averaged 59½ hours per week, which meant about five hours' overtime each week.—Barber told the chairman (Mr. W. Sellars) that he had been on overtime for about 12 months, with the exception of one fortnight. Every week they were allowed one night off overtime, and he had recently been having the Wednesday evening off. When he sought permission on November 10th it was refused. He had been secretary to a Red Cross comforts organisation and had been organising a dance, and that was why he wanted the Wednesday evening off. He did not, however, tell the foreman this. He alleged that the foreman swore at him, and in return he said he would take the night off whether he received permission or no.—Mr. Sellars said he did not think it was a good excuse to ask off, even if the dance was in aid of the Red Cross.—The chairman added that he and his colleagues were satisfied there had been a breach of the rules, and they were not going to encourage insubordination in the works. They did not, however, regard this as a serious case, and considering Barber's previous good character they did not think the firm would wish for a heavy penalty.—Mr. Marland said that Barber had been warned of the consequences. All the firm wanted was to maintain discipline.—A fine of 5s. was imposed.

Osram Lamp Works, Ltd., v. Pope's Electric Lamp Co., Ltd.

The hearing of this case was continued in the Court of Appeal, composed of the Master of the Rolls and Lords Justice Bankes and Warrington, on Thursday last week, upon the appeal of the plaintiffs from the judgment of Mr. Justice Joyce, holding that the defendants had not infringed the plaintiffs' patent.

Mr. Terrell, K.C., on behalf of the respondents, contended that there was no invention in the selection of tungsten for lamp filaments. There was nothing new in the treatment with an organic binding material—the carbonising process was known. The patentees had made it an essential part of their process that the electric current should be passed through the filament. It was not known that the only object of passing the current through was to heat the filament, or that external heating would have the same effect. Defendants did not use the equalising process, which was an essential part of the invention. Defendants had not used any of the three points put forward by the patentees as being essential. The process of building up a filament was well known. Welsbach's process was known to be applicable to many metals, and all that the patentees did was to tell one to try it on another metal. There was no subject matter in merely taking a substance well known to be suitable for a particular purpose, though it might not have in fact been used for that purpose, and applying it to a well-known purpose. Counsel contended that the defendants did not infringe because they did not use an atmosphere of steam and hydrogen. Defendants did not infringe because they did not carbonise.

An Electrical Company Fined.

At Woolwich Police Court on 19th inst., Mr. Hay Halkett concluded a long hearing of several summonses brought by the Commissioners of Customs and Excise against the Western Electric Co., Ltd., and inflicted fines as under: For sending, on January 2nd, certain prohibited goods, viz., parcels of materials for telephones, to the North Woolwich Sub-Post office, for exportation to Norway, £15 and £12 12s. costs; for a similar offence on January 9th, £1; for a similar offence on March 15th, £1; for causing to be made a declaration that the parcel on March 15th contained no prohibited goods, this being false in that it contained rubber, £15; and for sending, on June 17th, to the Royal Albert Docks for exportation prohibited goods, viz., parts of telephone sets, £10.

Mr. G. E. Thompson, one of the company's managers at their North Woolwich works, was fined £5 for aiding and abetting in the commission of the first offence, and 10s. in respect of the second offence.

Mr. Simpson, for the prosecution, said there was no suggestion that any of the goods were intended for the enemy, but proceedings had been taken because the authorities considered that there had been gross carelessness on the part of the defendants in dealing with prohibited goods.

For the defence, it was contended that the offences had been committed through misunderstandings on the part of certain of the company's staff.—*Daily Telegraph.*

The British Electric Traction Co., Ltd.

In the Chancery Division last week, Mr. Justice Astbury had before him a petition to sanction a scheme of arrangement and to confirm a reduction of the capital from £4,000,000 to £2,998,398. The petition was opposed by certain persons who held income certificates. According to the *Financial News*, his Lordship said that the Registrar had been bombarded with reasons why the petition should be opposed. Mr. Clauson, K.C., who appeared for the income certificate objectors, raised a point which Mr. Russell, K.C., for the company, said he could not discuss then as it would necessitate going into evidence as to the reserve fund. The petition was allowed to stand over in order that that point might be met.

Tramway Companies and Lost Property.

At Edinburgh, Sheriff Guy gave his decision in a case which concerned the liability of Musselburgh Tramway Co. for a passenger's belongings which went amissing. A lady sued the company for £5 odd, representing the value of a bag containing a sum of money, &c. The bag was left on the seat of a tramcar by the lady. The conductor placed it at the end of the car in a box where he kept his spare tickets. Later he found that the bag had disappeared. The Sheriff said before the law of deposit could be held to apply to the tramway company, it would be necessary to charge them as depositaries, and if the articles had been taken to the company's offices the case might have been different. But the conductor was the depositary. There was no deposit with the defenders. In these circumstances, he found that the defenders were not liable.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

15,737. "Semi-obscured reflecting electric incandescent lamp." F. T Harris & G. W. Smith. November 8th.

15,740. "Electric overhead tram trolley." W. Cayless. November 8th.

15,759. "Cathode for electrolytic cells." F. G. Wheeler. November 8th. (Convention date, January 25th, 1915, U.S.A.) (Complete.)

15,761. "Replenishing electrolytic cells." W. S. Smith. November 8th. (Convention date, June 3rd, 1915, U.S.A.) (Complete.)

15,762. "Electrically-controlled clutches." W. Langdon-Davies and A. Soames. November 8th.

15,792. "Electric motors." F. J. Osius. November 9th.

15,810. "Control of alternating-current motors." P. S. Turner. November 9th.

15,824. "Construction of grids for secondary batteries." G. A. Smith. November 9th.

15,842. "Electrically-driven adding and listing machines, copying machines, typewriters, addressing, talking, or other like machines." J. Drucquer. November 10th.

15,863. "Pocket lamps." Dr.-Ing. Schneider & Co. Elektrizitats Ges.m.b.H. November 10th. (Convention date, December 3rd, 1914, Germany.) (Complete.)

15,873. "Sparking arrangements for electric ignition devices." H. W. F. Ireland. November 10th.

15,878. "Electric switches." British Thomson-Houston Co., Ltd. November 10th. (General Electric Co., U.S.A.)

15,883. "Electric switches or bell pushes." W. R. Bloxam, November 10th.

15,915. "High-frequency alternating-current relays for radio-telegraphy and the like." A. W. Sharman. November 11th.

15,922. "Combination electric turn switch and wall plug." C. E. Begg. November 11th. (Complete.)

15,930. "Electric cells." C. Fery. November 11th. (Complete.)

15,971. "Trolley collectors for overhead tramway, railway, and like vehicles." P. W. Steele. November 12th.

15,978. "Electro-chemical microphones, principally for use in connection with wireless telephony and telegraphy." A. F. Sykes & S. Ford. November 12th.

15,985. "Electric lamp holders for vehicle head lamps." F. E. Wilson, W. A. Shepherd, and Powell & Hanmer, Ltd. November 12th.

15,986. "Electrical connections for use in the electric lighting of automobiles." F. E. Wilson, W. A. Shepherd, and Powell & Hanmer, Ltd. November 12th.

15,989. "Construction of terminal for electric switches, couplings, and the like." G. Markt. November 12th. (Complete.)

16,017. "Combined air and electric triple valves." W. G. Cannon. November 12th. (Complete.)

16,044. "Electric fly-traps." J. Satinover. November 13th. (Convention date, November 27th, 1914, U.S.A.) (Complete.)

16,053. "Automatic protective gear for electrical systems." M. Rosenbaum & F. A. Couse. November 13th.

16,057. "Venting appliance for use in connection with accumulators or secondary batteries using wet acid." A. E. Nevill. November 13th.

16,058. "Electric meters." H. O. Merriman & T. Speirs. November 13th. (Complete.)

16,060. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., & S. R. Smith. November 13th.

PUBLISHED SPECIFICATIONS.

1914.

10,048. Device for use in connection with Electric Motors directly Coupled with Pumps, Water Sirens, and the like. Signal Ges. April 23rd. (August 18th, 1913. Addition to 7,821/14.)

10,562. Double-pole Electric Rotary Converter, also applicable as a Double Current Generator or Motor. J. L. la Cour. April 29th. Convention date not granted.)

11,837. Apparatus for Converting Direct into Alternating Currents, and vice versa. E. Falkenthal. May 13th.

16,850. Manufacture of Incandescent Electric Lamps. H. G. Finch (Lord Guernsey) and J. F. Poynter. July 15th.

20,009. Thermopiles and Thermo-electric Measuring Apparatus. H. Hausrath. September 21st.

21,143. Electrically-actuated Tools. W. J. Mellersh-Jackson (Commonwealth Electric Tool Co.). October 17th.

21,338. Telephone Systems. A. B. Smith. October 21st. (October 22nd, 1913.)

21,474. Receiving Arrangements for Wireless Telegraphy. T. W. Stratford-Andrews & A. Orling. October 24th.

21,509. Regulators for Charging Electric Secondary Batteries. E. B. Jacobson. October 26th. (December 3rd, 1913.)

21,512. Electric Starting Systems for Internal-combustion Engines for Automobiles. E. B. Jacobson & C. J. Gustafson. October 26th. (December 3rd, 1913.)

21,609. X-ray Apparatus. E. E. Greville. October 27th.

21,761. Electrical Switches. Midland Electric Manufacturing Co. & W. L. Barber. October 30th.

21,978. Electrical Switches. Midland Electric Manufacturing Co. & W. L. Barber. November 4th.

22,639. Coil-winding and similar Machines. G. P. Thompson & M-L Magneto Syndicate, Ltd. November 17th.

23,485. Secondary Batteries or Accumulators. J. C. A. Ward & Richard Pape, Ltd. December 3rd.

24,419. Moulded Compositions for Electrical Insulation, and the Process of making the same. British Thomson-Houston Co. (General Electric Co., U.S.A.). December 21st.

1915.

378. Electric Cable Joint Boxes and the like. A. H. Ralling & C. C. Garrard. January 9th.

900. Distribution Fuseboards for Electrical Circuits. Midland Electric Manufacturing Co. & W. L. Barber. January 20th.

901. Electrical Switches. Midland Electric Manufacturing Co. & W. L. Barber. January 20th.

3,513. Electric Heating Element. Cable Accessories Co. & F. H. Reeves. March 4th. (Addition to 24,565/13.)

3,570. Electric Motor Control Systems. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). March 5th.

5,395. Electric Batteries. H. G. C. Thofehrn. April 9th.

6,217. Wireless Telegraphy. C. M. Agner. April 26th. (June 8th, 1914.)

7,244. Means for Starting Electric Motors. G. A. Yarwood. May 14th.

8,173. Vapour Electric Rectifier Systems. British Westinghouse Electric and Manufacturing Co. June 2nd. (July 11th, 1914.)

8,203. Telephone Transmitters. P. J. Hackett. June 2nd.

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Vol. LXXVII.] CONTENTS: December 3, 1915. [No. 1,984.

Page
The Magnetic and Electrical Properties of Pure Silicon-Iron ... 705
Lead ... 706
Italian Engineers and the German Yoke ... 706
To Organise British Engineering Industry ... 707
An Underground Telegraph Cable Installation in Puebla, Mexico, by W. B. Hale, (*illus.*) ... 708
Electrical Accidents in Mines ... 710
Our Trading Opportunities throughout the World (*continued*) 711
Correspondence—
The A.E.G. Meeting ... 711
Swiss or German? ... 712
Decimal Coinage and the Metric System ... 712
The Institution and Alien Enemy Members ... 712
Electrical Accidents in 1914 ... 713
New Electrical Devices, Fittings and Plant (*illus.*) ... 714
Legal... 715
War Items ... 716
Business Notes ... 717
Notes ... 721
City Notes ... 725
Stocks and Shares ... 727
Share List of Electrical Companies ... 728
Metal Market.—Fluctuations in November ... 729
Electricity in Agriculture: Its National Aspects (*illus.*) ... 729
The Faraday Society ... 731
Some Difficulties of Design of High-Speed Generators, by Prof. A. B. Field, (*illus.*) ... 732
The Electrical Industry and the War ... 735
Indian Notes ... 736
New Patents Applied for, 1915 ... 736
Abstracts of Published Specifications ... 736
Contractors' Column ... Advertisement page xx

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THE MAGNETIC AND ELECTRICAL PROPERTIES OF PURE SILICON-IRON.

FROM the point of view of the electrical engineer, no alloy of iron is more important than the low-hysteresis silicon steels, the remarkable magnetic properties of which were discovered by Sir Robert Hadfield nearly 30 years ago. The use of this material for the cores of transformers has in recent years increased by leaps and bounds, for high permeability, low hysteresis, and high electrical resistance are combined in the 2·5 to 4 per cent. alloys (of course, after special heat-treatment) in a way which renders them far superior to any other known material. From figures recently available, it would appear that not far short of 40,000 tons a year of this low-hysteresis material are being used in America alone, and there is a corresponding consumption in Europe. In a paper read before the Franklin Institute in 1910, the author, Mr. Martin G. Lloyd, estimated that there was then expended in America, to supply core losses in transformers alone, power costing nearly four million dollars annually. If one includes generators and motors, the figure for the present year may be anything from three to five times even this enormous sum. It is evident, therefore, that the use of low-hysteresis, high-resistance core material for electrical machinery is a matter of considerable national importance, and every improvement in existing materials must be eagerly studied by electrical engineers and quickly adopted if within the range of practicability.

In the current issue of the American Institute of Electrical Engineers, Mr. T. D. Yensen describes the magnetic and electrical tests which he has made on a series of *pure* instead of commercial silicon-iron alloys—that is to say, on alloys made in vacuo from pure electrolytic iron. The iron used in these experiments contained less than 0·01 per cent. carbon, and this fact is of peculiar interest, for it has been thought that the influence which silicon has on the magnetic properties of iron is to be ascribed, not to any direct action, but to the neutralising effect of the silicon upon carbon. It is evident from these experiments that some other explanation must be looked for. Microscopic examination shows that while a small part of the silicon reduces the iron oxide present, the remainder combines with the iron in solid solution.

Before being used, the electrolytic iron was crushed and thoroughly cleaned, and melted with the alloying element in a fused magnesite crucible in an Arsem electrical vacuum furnace working at a pressure of about 0·5 mm. of mercury. The ingots were forged into rods about ½ in. by 20 in., and from these rods 14-in. test pieces were prepared for the magnetic and electrical tests, and 2½-in. lengths for the mechanical tests; tests being made on the specimens (1) as forged, (2) after annealing in vacuo at 900° C. and cooling at 30° per hour, (3) after annealing at 1,100° C. and cooling at the same rate.

The addition of silicon increases the elastic limit and ultimate strength of pure iron in direct proportion to the amount added, reaching a maximum at about 4·5 per cent., where the yield point of the forged alloy is about 94,000 and the ultimate strength 105,000 lb. per sq. in., some 8,000 lb. per sq. in. higher than the values for iron-silicon alloys containing carbon. Annealing has the effect of diminishing the mechanical strength of these alloys.

As first shown by Hadfield in the case of commercial steels, the addition of silicon to pure iron considerably increases its specific resistance, by an amount approximately proportional to the silicon content. The specific resistance of the 4·5 per cent. alloy is about 58 microhms at 20° C. That of the 3·4 per cent. alloy is 48·5 microhms; while the corresponding figure for commercial silicon steel is 51·2 microhms.

It is with regard to magnetic properties that these alloys show the most remarkable qualities. The induction curves (H — B) show two distinct maxima, one for a silicon content of 0·15 per cent. and the other at 3·4 per cent. The former is no doubt the point at which the iron reaches its maximum purity on account of the neutralising effect of the silicon on the small amount of impurities—carbon and oxide—present. Mr. Yensen is of opinion that the second maximum may be due directly to the action of the silicon, as Gumlich has shown in the case of iron-cobalt alloys, although there is some evidence against this; but the whole subject needs further investigation. Silicon, of course, is very closely akin to carbon chemically, and the silicon-iron combination deserves to be studied with the same thoroughness as the carbon-iron alloys. The complete phase diagram needs to be worked out—an admirable research for some capable research student.

But to return to the 3·4 per cent. silicon alloys. The astonishingly high values obtained for the permeability are without precedent in the annals of the magnetic properties of iron and iron alloys, the maxima rising to the extraordinary figure of over 60,000 in the case of the 0·15 and the 3·4 alloys annealed at 1,100° C. Mr. Yensen himself last year found a value of 19,000 for pure vacuum iron, while Gumlich and Goerens in 1912 made silicon alloys which had a maximum permeability of 11,600 for the 0·4 per cent. alloy, and 9,400 for the 4 per cent. alloy. The comparison with ordinary commercial silicon steel is, of course, even more striking, for the maximum value in the case of the latter is some 3,000, or one-twentieth of that for the pure alloys; while the hysteresis loss is as 10 to 1, and the maximum value of B as 3 to 1 in favour of the vacuum alloy. Even for the maximum value B = 15,000 the permeability of the pure alloy is twice that of the commercial steel, while the specific resistance is only just a little higher, namely, as 51 is to 48 in the case of the latter.

The new alloys will doubtless be prepared by other investigators and their properties re-examined, but Mr. Yensen appears to have taken every precaution in his tests, and there seems no reason to doubt that he has put the coping stone on the pioneer work of Hadfield by giving the electrical engineer two new most valuable iron alloys, one low in silicon content, not very strong but extremely ductile, of high permeability, low hysteresis and low electrical resistance, and another and more important alloy fairly high in silicon-content, very strong, moderately tough, of extraordinarily high permeability and low hysteresis, and of high electrical resistance. Possibly the cost of manufacture may turn out to be so high as to be prohibitive, but, in spite of the fact that the raw material must be prepared electrolytically and the alloy melted in an electric vacuum furnace, there is no obvious reason why this should be so, provided the material is made on a sufficiently large scale. This at least is a possibility which merits the most serious consideration on the part of the makers of electrical machinery and of the raw material indispensable for their efficient working.

Lead.

There has been a marked advance in the price of lead during the past few weeks, an advance which has taken everybody completely by surprise, and under the influence of which prices were driven to £28 for near delivery, while it is expected that a still higher range of prices will be established before the war comes to an end. There is no doubt that the upward movement is based entirely upon war consumption and war conditions. With statistics of production practically unobtainable, and with the curtain rung down upon consumption in all markets, the student of price movements is practically thrown upon guesswork in arriving at his deductions. All sorts of unexpected difficulties have conspired to stiffen up the market. Shipments from abroad have been restricted in many directions, and have sometimes been held up altogether, while when vessels do come to hand, the utmost difficulties and delays are experienced in getting them discharged. There has been extraordinary activity in connection with the supply of Russian requirements, and large quantities of lead have been purchased for Archangel, while some shipments are also intended to be made from here to Vladivostock. It had been feared that navigation to Archangel would have ceased ere this, but a number of ice-breakers are at work, and there seems a reasonable chance of the waterway being kept in a navigable condition for some time yet. At any rate, one steamer left here last week, and there is a boat loading this week at Liverpool for this port. The arrivals of Broken Hill soft lead are much below expectations, the reason being that large quantities are being shipped direct to Japan in order to supply the works engaged there upon turning out munitions for Russia. There is no doubt that this factor is playing a part here in the maintaining of a high level of prices. Spanish exports have been irregular this year, and some very small monthly totals have been returned. The English refiners complain loudly of the difficulties they are experiencing in connection with the labour supply, having large quantities of silver-lead available for treatment, but not having the men to deal with the stuff. Consequently, furnaces are idle, and the output of pig-lead is reduced. All things tend to set up conditions of stringency. Lead is scarce, and Russian consumption is on such a scale as to preclude the probability of there being any surplus metal available.

Italian Engineers and the German Yoke.

The annual conference of the Associazione Elettrotecnica Italiana was held at Leghorn in the second week of November, under the presidency of Signor Semenza, of Milan, and in the presence of those whose names are well known both in Italian science and in electrical manufacturing in that country. According to a brief report of the proceedings which has come to hand, the most important question before the conference related to the nationalisation of the electrical industry, in regard to which much has been accomplished through the statistical documentation of the electricity works in Italy, the cataloguing of makers of electrical and accessory plant, and the study of Customs tariffs with respect to the development and protection of national industry, the results showing facts of great promise. The conference also discussed the problems of foreign patents, the formation of Italian syndicates of constructors of electrical machinery and plant, and measures for the promotion of the financial organisation of the industry. The final conclusion, which confirms what we have recently set forth in this journal in regard to Italian electrical engineering firms, was the expression of great confidence in the promise of the industry securing emancipation from the Teutonic yoke (l'emancipazione dell' industria elettrica Italiana dal giogo Teutonico). The Italians, it is evident, mean business in trade as well as in war, as the conference unanimously selected Trieste (Austria) as the locality for the next congress.

TO ORGANISE BRITISH ENGINEERING INDUSTRY.

Many an important movement has had its origin in a club room. Last week we referred to an interesting scheme for the reorganisation of the electrical industry which was advocated in a Birmingham club meeting. To-day we give some particulars of another and even more ambitious club proposal which has been under consideration at Manchester for twelve months. Its very worthy object is the organising of the British engineering industry, which naturally embraces the electrical as one section of the whole. It is interesting to note that each of these proposals wishes to absorb the existing organisations in its field, avoiding waste of effort in some directions and adding to their operations in others making for strength and influence.

The meeting of the Engineers' Club which was held at Manchester on Friday, November 19th, was attended by 150 members, and it resolved to take immediate steps along the lines recommended by its Special Committee. It formed itself into a council which met on the following Monday, 65 members being then present. Several offers of subscriptions towards the initial expenses were made. A provisional committee was appointed to act for six months, Mr. H. W. Brady, being elected hon. sec. *pro tem.*, Mr. H. T. Wilkinson, who had acted in that capacity to the Special Committee, being unable to carry on the duties. The provisional committee will doubtless have to report in due course regarding what measures shall be taken to carry the recommendations into effect. Manchester is, of course, a very important engineering centre, and as its works are, for obvious reasons, exceedingly busy just now, the large attendance at both meetings shows how keen is the interest taken in the matter.

If the whole-hearted support of the industry and adequate financial backing can be secured the Manchester Engineers' Club considers that the success of its proposed organisation is assured. And it considers that that support and backing will be forthcoming if every British engineer approaches the matter in a spirit of pure patriotism. Therefore, given patriotism, the object which has been the occasion of such deep thought on the part of the committee will be reached. We suppose, therefore, if the scheme does not succeed we shall have to ascribe the failure to lack of patriotism. Possibly some of us would have preferred that the proposal should not be introduced in this manner. It may happen that there are other schemes in preparation which also lay claim to our patriotic support, and in such a case patriotism may have to discriminate between them. As a matter of fact there are several projects before us at the moment aiming at the more efficient organisation of our industries, and already several associations are more or less actively engaged. Each of them is working, or is designed to operate, in its own particular way, and recognises, along with the Manchester Club Committee, "that the British engineering industry must organise without delay to take advantage of present opportunities and to meet the conditions which will follow the termination of the war." But none of them is as strongly supported as it would wish to be. Unfortunately, associations such as we have in mind are in danger of overlapping, and by their multiplication much wasted effort, and perhaps some annoyance, may be occasioned. If the Manchester idea of "some voluntary organisation of a whole industry"—taking the form of an Association "on a non-trading and non-interference-with-prices basis"—could be carried into effect, bringing all existing organisations together in one great national association, the idea in theory, at any rate, would be admirable. How it would work out in practice is quite another matter. The British independent spirit is still very strong and it will so continue after the war, among associations as well as among individuals. It is not intended to banish that independent spirit, but to so organise it that it shall not have destructive effects within the industry.

We agree that the multiplication of such organisations is undesirable, and the Club seems to entertain some idea that an existing association might so modify its constitution and extend its operations as to include the objects of the present scheme. It is felt that it would be better to adopt that course, if possible, rather than to establish a new Association. We remember that one of the Associations has already through the lips of its secretary expressed its conviction in favour of a Federation of all such Associations. We remember also that some existing organisations are considered to have succeeded or failed, whichever way we please to regard it, by reason of price-regulation efforts. Is modification of constitution intended to imply alterations in this respect?

The prefatory note of the green pamphlet that lies before us seems to express the view that German and Austrian foreign trade is waiting to fall into the British lap if only we can build up an organisation "that embodies a broader and loftier view of the responsibilities, the opportunities, and the powers of our engineering industry." Well, that may be the case—it all depends upon what our word "organisation" means, how long it takes to get the said organisation to work, whether it is able to secure "co-operation between competing firms," and so forth. Trusts or combines "that enforce uniformity and stifle individual initiative" are not advocated, but in place thereof there is suggested a huge voluntary organisation of the whole industry "based upon a recognition of the interests common to competing firms and common also to employer and employed." By such voluntary organisation and co-operation "a great deal can be done to improve manufacturing processes, to develop foreign trade, and to secure for employés better conditions of work and a larger share of the fruits of their labours."

It is proposed that the new Association should aim at the inclusion of every British manufacturing concern in every branch of engineering, and, reckoning the capital of these concerns at 300 millions sterling, it would have an income of £300,000 annually. With such an income, "adequate financial backing," and "an efficient and energetic management," what would lie beyond its powers of achievement? It would still require that "whole-hearted support of the industry." It will be agreed that the constitution of the Association would require careful framing. It is proposed to restrict membership to *approved* British engineering firms, though it says that it "aims" to get them all, and it considers that "a large majority, say three-fourths, of the beneficial owners of every company or firm seeking to become a member should be British subjects." But much appears to depend upon that "efficient and energetic management," that "thoroughly competent business man of unimpeachable integrity."

Having in the foregoing summarised in our own way the preamble and the conclusion, we may detail the work that it is intended to do through the medium of departments and standing committees.

The General Purposes Committee will endeavour to secure improved conditions and freights from railway, canal and shipping authorities; and by arbitration "or otherwise" it will settle disputes between its members, for it is recognised that even in an organised industry there will be differences arising.

The Intelligence Committee will control the Association representatives, will collect, analyse, and distribute technical and commercial information among members; it will analyse Consular reports, technical and commercial papers, and "other published matter," and circulate the result. It will receive "specific inquiries for business" and forward them to "firms indicated if earmarked," or to all members if not so earmarked. It will arrange conferences of members, and discuss general policy and joint action in connection with prospective business. It will send investigating engineering commissions to various parts of the world and will appoint individuals to report on particular fields, industries, or specific cases. It will give introductions, recommend agents, and make confidential inquiries regarding the standing of firms.

The Production Committee will first "promote a better feeling between manufacturers, to the mutual good," and, having done that, will raise the standard of manufacturing methods and organisation; it will stimulate manufacturers to adopt a progressive and enterprising commercial, technical, and manufacturing policy; it will induce members to experiment continuously, both on their own account and in co-operation with other firms or institutions, with a view to placing new or improved productions on the market. It will encourage its members to study customers' requirements more keenly and to try to satisfy them, to issue comprehensive catalogues, to send abroad qualified representatives, and to fulfil promises of delivery! Finally, it will recommend members to consider the advisability of marking their goods "British made."

The Inventions and Patents Committee will make recommendations to the Parliamentary Committee respecting the law relating to Patents, Designs and Trade Marks.

The Publicity Committee will circulate the information collected by the Intelligence Department; it will distribute at home and abroad printed information relating to British engineering industry for the purpose of increasing the demand for British products. It will organise schemes for advertising by means of exhibitions, showrooms, and otherwise, at home and abroad. It will translate and adapt members' catalogues for the foreign markets, using the language and units of those markets and giving full prices, code-words and data; this will be done by native engineers so as to secure technical accuracy and adequacy of description.

The Finance Committee will see that the Association stands upon a sound financial basis, but it will also, we suppose incidentally, arrange for the better financing of industry, both for manufacturing and for home and foreign contracts.

There will also be an *Education and Research Committee* which will do a great deal of useful work and will encourage research, and lastly, a *Parliamentary Committee.* To this last will fall the difficult task of inducing the Government to take an active interest in trade in general, and engineering in particular, persuading it to create a Ministry of Industry and Commerce, whose departments will take over the purely commercial matters now handled by the Board of Trade. It will induce the Government to reorganise the Consular service and make it more useful; to appoint the right men as commercial attachés, engineers as advisers of national representatives abroad; to appoint natural-born British subjects as Consular officers wherever possible, and to secure that the service shall be a special medium for the furtherance of British commercial interests. This committee will also advise the Government on engineering matters "when called upon to do so," and it will deal with recommendations from the Inventions and Patents Committee and take action thereon when necessary or advisable.

Now, there is so much in the foregoing programme that we have advocated at different times that we give the Committee unstinted praise for the exhaustive nature of its study of the position. It began its deliberations last winter with a series of debates, at the first of which it was decided that it was essential that the engineer put his house in order. Prolonged study has shown how vast a work lies awaiting the organisation which takes that task in hand. It is not only the engineer's own house that requires putting in order—that should be its foremost concern; and if it succeeds in such a connection and induces every firm to come under its Association roof and "co-operate with its competitors" "without interference with prices" it may be strong enough to move mountains—even Parliament.

AN UNDERGROUND TELEGRAPH CABLE INSTALLATION IN PUEBLA, MEXICO.

By WILLIAM B. HALE.

Puebla, a city founded by the Spaniards in 1532, with a population about 100,000, has shown few signs of progress until recent years, when many civic improvements have been carried into effect. Modern water supply and drainage systems have been installed, asphalt pavements and cement sidewalks have been laid, and the principal streets are curb lighted by tungsten clusters on ornamental cast-iron pillars. Underground cables have been laid by the electric light and telephone companies, and the network of overhead wires which formerly disfigured the city has been removed.

The lines of the Federal Telegraphs had entered the city through an old 21-conductor, lead-covered cable, unarmoured, which was in bad condition. Open wire lines, or an aerial cable, could have been substituted for the damaged cable, but the Mexican Government decided to ensure uninterrupted telegraphic communication by laying a high-grade armoured cable in Puebla. The writer was commissioned by the Director of Telegraphs, Camilo A. Gonzalez, a very able and progressive official, to undertake the installation of this cable, which was supplied by Messrs. W. T. Henley's Telegraph Works Co., Ltd., of London, and conformed to the following specifications:—50 conductors of 1·6 mm. diameter (No. 14 B and S. gauge) copper wire, insulated to a thickness of 1·6 mm. paper with nine wrappings; saturated core; lead-sheath 4 mm. thick; tarred jute serving; double steel-tape armour, and outer covering of jute over all. The outside diameter of the cable was $2\frac{1}{2}$ in. (6·3 cm.), and its weight was $7\frac{1}{2}$ lb. per ft. (11·2 kg. per metre).

Fig. 1.—Federal Telegraph Building, Mexico.

The old cable had been put down seven years before in a duct extending under the sidewalks from the telegraph office (fig. 1) to a cable house on the outskirts of the city—a distance of nearly one mile. At that time the sidewalks consisted of blocks of stone laid on the ground, and it was an easy task to raise these blocks, dig a trench from office to cable house, place in it semi-cylindrical tiles, lay the cable in this open duct, cover with flat tiles set in mortar, and fill up the trench. Since then, however, the stone pavements had given place to cement sidewalks and asphalted streets, and the writer was confronted by the

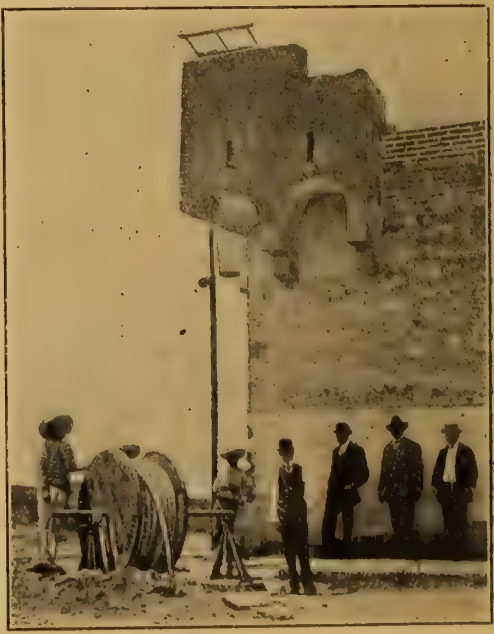


Fig. 2.—Cable Drum Mounted on Jacks.

alternative of opening up the conduit at a heavy cost, or of employing the drawing-in system. It was decided to adopt the latter method. Pits were, therefore, built at all street intersections to facilitate the work of installing the new cable. These pits are of brick, covered on the inside with a layer of cement. They are square, and have the following inside dimensions :—34 in. × 34 in. (86 cm. × 86 cm.), and 49 in. (1·25 m.) deep. The cast-iron pit frames are 39 in. (1 m.) square; and the iron covers, 33 in. × 21 in. (84 cm. × 53 cm.), were cast with hollow tops, which were filled in with cement to match the sidewalks. The laying of an armoured cable in a conduit is, of course, an unusual procedure; but, in this case, the ducts lacked the strength necessary to afford protection to an unarmoured cable, as shown by the fact that the old cable had been cut in many places by picks in the hands of the labourers who made the excavations for the water and drainage pipes.

As soon as the pits were finished, a small aerial cable was made by binding together eight No. 18 B. & S. gauge rubber-covered wires with insulating tape, and it was strung on the electric light company's iron poles from the telegraph office to the cable house. On account of its lightness, no messenger wire was needed to support this improvised cable, and it was rapidly strung by simply tieing it to the poles with pieces of No. 14 weatherproof wire. Temporary quadruplex communication was then established through the overhead cable, and the work of pulling out the old underground cable was begun. It was cut in all the pits, and drawn out in sections. To avoid the labour of rodding the ducts for the introduction of the steel hoisting rope which was used to install the new cable, a length of No. 8 B.W.G. galvanised iron wire was fastened to an end of each section of the old cable, and was drawn into the duct as the old cable was pulled out.

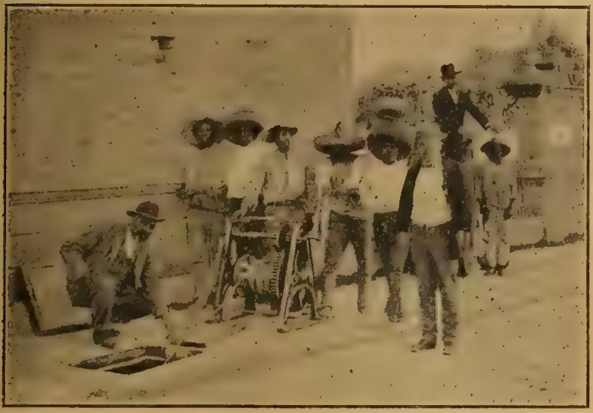


Fig. 3.—Drawing Cable into Duct.

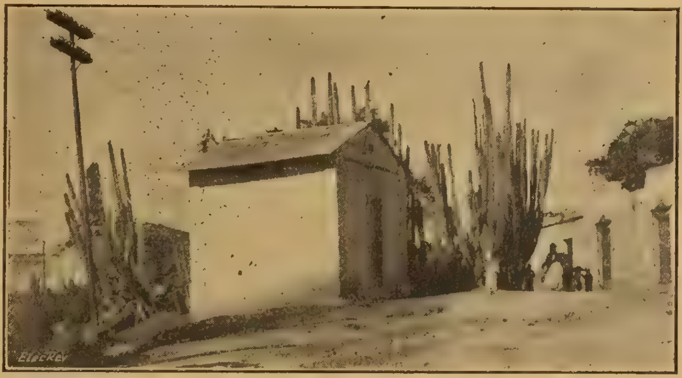


Fig. 4.—Cable House.

The installation of the new cable was carried out in the usual manner. Each drum, mounted on jacks, was placed by one of the pits corresponding to its section of conduit, a cable grip was attached, and the steel rope previously introduced into the duct was fastened to the grip, a swivel being inserted between the two. A cable winch was then mounted at the next pit, and, with two Mexican peons at each handle, the cable was pulled in. The drawing-in process, shown in figs. 2 and 3, occupied considerable time, the winch being too small for a cable of that weight. Much difficulty attended the laying of the last section of cable. The duct in this section contained a number of curves, and their resistance to the passage of the cable increased the tension to such an extent, that the winch was unable to move the cable. It was therefore necessary to open up the 420 ft. (128 m.) of conduit between the last pit and the cable house.

The jointing of the cable was done in the pits. Tinned copper sleeves were used to connect the wires, and every connection was carefully soldered and covered with a 3-in. (7·6 cm.) paper tube. The completed splice was thoroughly dried out by placing a lighted charcoal brazier on the bottom of the pit and covering the pit for about half-an-hour. The joint was then given two wraps of 2-in. (5·1 cm.) compound tape, and over this two wraps of $\frac{1}{2}$-in. (13 mm.) saturated paper tape, kept in place by binding with linen thread. The lead sleeve previously put on the end of one of the lengths of cable was then slid into place, and wiped solder joints were made at its extremities. Finally, the completed joint was enclosed in a cast-iron joint box, which was filled with hot insulating compound.

Tests of the completed cable, 4,330 ft. (1,320 metres) in length, gave the following results, the values noted being the means of measurements on the 50 wires :—Conductor resistance, 11·16 ohms at about 15° C. = 13·6 ohms per mile (8·46 ohms per km.). Electrostatic capacity, 0·09 microfarad = 0·11 microfarad per mile (0·068 microfarad per km.). The insulation resistance of the cable was considerably in excess of 500 megohms per mile, but the sensibility of the galvanometer employed in the test did not permit of a more exact measurement. The differences between the maximum and the minimum values obtained in the tests of conductor resistance and electrostatic capacity of the 50 wires of the cable were small, and this uniformity was due to the care with which the joints were made.

Upon the completion of the tests, the cable was put into service by connecting the office end to its switchboard and joining the other end to the telegraph lines in the cable house, shown in fig. 4. A pothead splice was made on the cable in this house, using for the purpose pieces of No. 14 B. & S. gauge rubber-covered and braided copper wire, the ends of which were connected to a terminal board fitted with suitable fuses and lightning arresters.

The cable house is situated north of the city, at the foot of the hill on which stands picturesque Fort Loreto. This ancient stronghold was the scene of a famous battle, when, on May 5th, 1862, the Mexicans, under General Zaragoza, repulsed the attack of the French army of invasion. And to-day, the tower of the modern waterworks reservoir rising beside the battle-scarred walls of the old fortress, and the cable house not far away, offer silent but eloquent testimony to the era of progress into which the Republic of Mexico had entered before the outbreak of the present deplorable revolutionary disturbances.

Municipal Electrical Trading in Australia.—The Council of the Sydney Chamber of Commerce has adopted a recommendation of its Electrical Engineering Sectional Committee, deprecating the tendency of governing bodies to enter into competition with ratepayers and citizens in trading undertakings. The attention of the Chamber was drawn to the matter by the Electrical Employers' Association of New South Wales. The activity among municipalities in applying for power to carry out installation work on consumers' premises and the sale of fittings and apparatus, &c., called forth the protest, and the Electrical Employers' Association is to receive support from the Chamber in any reasonable efforts that it may make to deal with the matter.

An Edison Celebration.—The opportunity afforded by the San Francisco Exposition has been taken to apotheosise "the greatest living American—Thomas Alva Edison." He was "greeted first of all by 50,000 souls on his arrival, then by over 90,000 on Edison Day, then by 75,000 school children," and was *fêted* by the city administration and his old friends of the telegraph. On the latter occasion the speeches and toasts were all ticked out by sounders, not a word being spoken until, at Mr. Edison's request, Mr. Samuel Insull made an oral response on his behalf.—*T. and T. Age.*

ELECTRICAL ACCIDENTS IN MINES.

During the year 1914 there were in the mines of Great Britain 47 accidents reported to H.M. Inspectors of Mines, eight of which were fatal. Four of the fatal accidents occurred below ground and four on the surface, while of the non-fatal accidents 19 were below ground and 20 on the surface.

In the Scotland Division there was one fatal and three non-fatal accidents below ground, and one fatal and three non-fatal accidents above ground. Regarding the fatal accident below ground, it appears a little doubtful whether the man's death should be attributed to electricity, but even if this should be the correct determination, the deceased must have been guilty of more than as the report says, "ordinary carelessness." The accident occurred in a roadway where there was a four-way box, from which two coal-cutters and a small pump were supplied with alternating current at 500 volts. The fourth way was not in use. The box was hung on standards to suit the incoming main cable and the three outgoing cables. It was very heavy and strongly made, with a lid weighing about 1 cwt. hinged at the top. One person could not hold the lid open and at the same time insert or draw fuses; either a second person was necessary or the lid had to be propped up. It would appear that the lid had been propped up. When a coal-cutting shift was finished it was the practice for the machineman not only to switch off the current at the gate end box, but also to draw the fuses in the box above mentioned.

On the morning of the accident, about 6.30, the man who was killed was on his way outbye with another machineman, when they met the day shift fireman who was on his way inbye. The second machineman stayed to talk to the fireman for a moment, and the other continued on his way outbye. A moment or two later the second man followed the first one outbye, and on arriving at the four-way box found him lying at the side of the box with the fingers of one hand touching the bottom flange. The lid of the box had been apparently opened, but had fallen, partly shut, and was held from closing by a sleeper which had to all appearance been used as a prop. He was drawn away from the box by his neighbour, who did not feel any shock whilst doing so, and he and the fireman applied artificial respiration, but to no useful purpose.

Mr. J. Masterton, senior inspector, made an investigation of the occurrence, and he reported as follows:—

> The fuse box was left just as it had been till I examined it. The lid was held 7½ in. open by an old pit sleeper 38 in. long. The sleeper was damp and greasy, and there was a mark inside the lid as if it had slipped there. One of the fuses of the pump circuit immediately under the end of the sleeper was pressed out of position, the knife edge of it was twisted, and the corresponding spring which should receive it was spread; the protecting insulating shield inside the box was bruised at the hole which the knife edge had been in.
>
> Two of the fuses on the coal-cutter circuit were drawn and lying in position, the third was only partly drawn, and it appeared to me as if the door slipped when he was just about to draw this fuse. Suppose this had occurred, the man would receive a very severe blow at the base of the skull. His chance, however, of receiving an electric shock, even when being knocked forward and down, was small, and his fingers would require to get through one of two 1¾-in. spaces between the insulating shields, which are purposely to prevent accidental contact. The fuses themselves are of the tubular porcelain type, with insulating protection outside the handgrips to prevent accidental contact with live parts. Suppose the man did come into contact with a live part, the voltage he would receive would be 290 volts, and the average man can stand this, even three-phase, if he is not held in contact.

Mr. W. E. T. Hartley also made an inspection of the plant, and he reported as under:—

> There are three points where a shock might have been received, but only by very considerable carelessness. The ebonite tubes on the fuse-holders are secured by two small roundheaded screws. These heads are live when in use, and a hand placed outside the porcelain could touch one of them; again, with a fuse-holder half drawn, it is possible to lift a finger over the protecting flange of porcelain and touch the blade of the holder, which would still be live. The third point is the line work behind the protecting shield. This could be got at deliberately with ease, but by no chance when withdrawing a fuse. The most probable place for anyone to get a shock is the small screw mentioned above, and the contact would be made by the fourth finger of the right hand; after that the blade of the fuse, which would be touched by the same finger. In either case, however, more than ordinary carelessness is needed.

A post-mortem examination was made, when it was found that there were no visible bruises on the body, but there were two little blisters on deceased's hand, one on his little finger and the other on his right finger; several unusual conditions in the heart and brain were revealed. There was nothing about the head or neck to show that he had received a blow. The brain showed a little more fluid than usual, and the distinction between the white and grey matter was more obvious than customary. The blood was more fluid than usual. The valves of the heart controlling the delivery of the blood to the aorta were malformed, this defect probably being congenital, and being a well-known condition though not a common one. This lobe of the heart was, as a result, enlarged. The conditions were such that an electric shock might easily cause death, though, on the other hand, death might occur without any such stimulus. It was not probable that a blow, such as from the falling of the door of the distribution box, would determine death in this case where the man was accustomed to pit work.

Deciding on the balance of probabilities, the case has been classified as one due to electricity.

Of the three non-fatal accidents below ground, one accident occurred whilst an unauthorised person was replacing a fuse; the second was the result of a man, a fireman, taking off the outer glass of a lamp fitting, removing the lamp bulb, and attaching an old length of twin cable, which had been out of use for two years, to the circuit. The twin cable was faulty, and the fireman received a shock which might easily have been a fatal one, the voltage of the alternating current being 500.

The third case would appear to have been the result of using poor quality cables of German manufacture. The voltage of the circuit was 500, and the system concentric. A brusher was placing loose stones in the waste and had his hand over the cable when, without him touching it or moving it in any way, flame burst from it and burned his arm. It was the practice of the owners of the colliery to buy cable in half-mile lengths; the length from which the piece which failed was taken had not given satisfaction previously. This experience corroborates the injured man's statement that he had not touched or injured the cable in any way. The moral is obvious.

Of the accidents above ground, the fatal accident was entirely due to a breach of the rules of the colliery, and occurred as follows:—An underground attendant, just prior to descending into the mine at 3 p.m., handed to a boy, a lamp cleaner, a box of matches and a cigarette, asking him to hide them for him, and suggesting that they be put on the top of the switchboard in the lamp room. The boy hid the articles in the place suggested, the man in charge of the lamp room not being present at the moment. The attendant came out of the mine a little earlier than usual, all the coal having been got out, and, going into the lamp room, climbed up on to a cast-iron bench, and reached for the cigarette and matches placed on the top of the switchboard. His foot slipped on the bench, and his left hand came in contact with the fuse terminals. At the time of the accident electricity was being supplied in the form of three-phase current at 500 volts pressure, with the neutral point earthed. A motor-generator in the lamp room, used for charging accumulators, had its bed-plate properly earthed, as were also other parts of the plant. The fuse terminals and ammeter were 7 ft. from the ground, and were thus out of reach except by direct intention.

The man in charge of the lamp room had been warned some time previously against storing matches and cigarettes in the lamp room, and did not allow that to be done. In this instance, advantage was taken of his momentary absence. In addition, the attendant had no right to enter the lamp room. This accident also points to an absence of discipline.

(*To be continued.*)

OUR TRADING OPPORTUNITIES THROUGHOUT THE WORLD.

(*Continued from page* 679.)

The Trade of Russia.

That American Consular representatives in Russia are alive to the possibilities of trade development by other than enemy countries after the war, and by neutral countries during the war, is shown by the frequency of their appeals to American business men in their reports. Two such reports which have recently come to hand point to the difficulties which exporters must expect to meet, and to possible methods for overcoming them. The Consul says that the general ignorance, among Americans, of the Russian language will prevent the States from taking advantage of the immense business opportunities that will open after the close of the war. Though during the past year facilities have been placed at the disposal of British engineers and commercial men who are inclined to learn Russian, the following comments furnish useful reading for us as well as for Americans:—

The Russian Language.

"Until the war started, German was to a great extent the commercial language of Russia; the representatives in Russia of German firms usually took pains to make themselves proficient in speaking and writing Russian. Now, however, the German language is prohibited in Russia, so that Russian, hereafter, must of necessity be used in all but the few instances where Russian business men have a knowledge of English. There is considerable difficulty at present in Russia in securing competent interpreters for English-Russian conversations. A prominent American business man in Petrograd experienced great difficulty in carrying on negotiations of a rather delicate and complicated character through an interpreter whose knowledge of Russian was apparently perfect, but who did not know sufficient English properly to translate all the Russian. For about five minutes he would talk quite volubly with the Russian business man, and then would explain in two or three sentences in English all that had been said in Russian. This, of course, was unsatisfactory to the American, who wished to know everything the Russian had said. French is not so well known in Russia as is popularly supposed in the United States. While this language is used in diplomatic circles and in the highest society, it is not a commercial language, and is of little or no use for most business purposes. It is not understood at all by the masses of the people. While I was in the United States recently a manufacturer, who is contemplating a campaign for export trade in Russia, stated that he had had a large number of catalogues printed in French for circulation in Russia. French catalogues in Russia would be even less serviceable in securing business than poorly translated Russian catalogues."

Firms that contemplate sending representatives to Russia, when the war is over, or sooner, should ask such prospective representatives to start immediately to learn Russian. We hope that a goodly number of British electrical men are already equipping themselves. By hard study it may be possible to gather a fair working knowledge of the language for conversational purposes within six months. It is one of the most difficult languages in the world to learn, and it is only by constant painstaking study and practice that much progress can be made. But certainly it would be better for these representatives to learn the language themselves than to be obliged to depend altogether upon interpreters. Outside of Petrograd, Moscow, and Odessa it would be difficult to find persons who know English.

"It would seem as if the time had come when American colleges and universities, and especially all business schools, should introduce the study of Russian into their curriculums as a practical help to American business interests in cultivating closer relations with Russia. It would also seem to be a wise policy for American export houses to offer bonuses to such of their employés as would voluntarily take up the study of Russian. If a large number of Americans would during the next few months engage in the active study of Russian, the United States would undoubtedly be in a much better position to take advantage of the magnificent opportunities that the Russian market will offer. Nothing seems to please Russians better than to be addressed in their own language, even if it has to be done imperfectly. It is said that Russians like to hear their language spoken with an English accent, and even consider it fashionable to speak it themselves with an English accent. English governesses are largely employed, and there is discussion at present of the advisability of introducing the study of English in the schools. It would not be advisable, however, for Americans expecting to do business in Russia to wait for Russians to learn English."

British firms hardly need to be reminded that the geographical location of Germany, and her commercial peripatetic activities, have produced armies of Russian-knowing travellers who can run into Russia as easily as an American can get into Canada. Germany will not be robbed of the geographical advantage, nor will the travelling habit cease, after the war. If competent commercial men of this type have been killed at the front in any number—and we very much doubt whether that has happened—the deficiency will soon be made up.

Packing for the Archangel Route.

The report continues: "Until the reopening of the Baltic ports American exporters should give special attention to packing and crating goods billed to Russia, on account of the numerous transhipments before reaching interior points. These precautions should include special measures against exposure to weather. Goods arriving both at Archangel and at Tornea must be carried across a river by boat or sledge before being loaded on the railroad. Owing to the congestion of traffic at these points of entry, as well as at all interior points, goods frequently lie a long time under the open sky. Both routes now open were very little used before the war and are without proper warehouses, and the junction points on the Archangel route are inadequately supplied with such facilities. There is also a shortage of rolling stock on all railroads in this consular district. Goods moving inland from Archangel must at present be transhipped at Vologda from narrow-gauged cars. Goods for Russia from Finland are also transhipped at Petrograd."

Not Made in Germany.

Many articles of American manufacture, bought and shipped through Germany before the war, and believed to be German goods, are now known to be of American origin, and Russian importers are active in efforts to make permanent connections with such American exporters. In this connection it would be well if American manufacturers and dealers would mark all goods in some distinctive manner, as these goods are frequently confused with German goods even now, which may cause delays in the Custom houses. The Russian importer of American goods into this consular district is at present handicapped by shipping difficulties, uncertainty and high rate of exchange, and irregularities and delays in mail and cable service."

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The A.E.G. Meeting.

I can quite understand that your correspondent, "Anti-Humbug," has excellent reasons for not disclosing his identity. He, however, is continuing to sling mud, and has now directed his fire more particularly in the direction of the electrical contractor. I therefore challenge him to come out into the open, and let us see if his name is as British as his sentiments, and if he is not better acquainted with the gas than the electrical industry.

His knowledge of the electrical contracting trade is certainly scanty. There are not 3,000 to 5,000 electrical contractors in the Kingdom. The E.C.A. represents the bulk of the important firms, and certainly two-thirds of the total capital invested in the business.

"Anti-Humbug" has purposely misread my letter. I did not say that the E.C.A. had had to deal drastically with its members for trading with alien enemy firms; it is the question at issue which has received drastic treatment. I would suggest that your correspondent informs himself of the attitude of the Association in this matter by a study of the pages of the *Electrical Contractor* for the past sixteen months.

In my official position in the E.C.A., and during 25 years' contracting experience, I have naturally acquired a very wide and, I might add, valued acquaintance amongst electrical contractors, and I can say that I do not know of a single instance of any electrical contractor supporting alien enemy firms such as the Electrical Co. I do not know how these companies are being kept warm, but think it more than probable that the trade they do is with the fringe of the electrical industry, firms who do not quite know with whom they are dealing, such a one as I believe "Anti-Humbug" himself controls.

Your correspondent seems to suggest that any person engaged in this business who does not publicly disclaim trading with the enemy, is lacking in decency. I regret that I cannot follow this logic. Would it not be equally logical to expect honest men generally to publicly announce that they were not thieves?

H. Marryat.

London, E.C., *November 24th*, 1915.

The attention of my committee has been called to the correspondence under the above heading which has appeared during the past three or four weeks in your journal, especially to the letters appearing in the last issue signed by E. P. Allam & Co. and "Anti-Humbug."

With regard to the former, Messrs. E. P. Allam & Co. can hardly expect the E.C.A. to give full particulars in a public journal as to the action taken by the executive to deter members dealing with firms controlled by alien capital such as they mention, but I may corroborate the statement made by Mr. H. Marryat, that the executive of the Association have been very active in that respect.

I think I may safely say that the whole of the members of my Association are extremely averse to dealing with such companies, and I am instructed by the executive to accept "Anti-Humbug's" suggestion as to circularising the members in this issue.

If your correspondent "Anti-Humbug" will communicate with me directly, I will give him the assurance that I will not divulge his name to my executive, except with his permission, and I shall be prepared to act with him in preparing the circular letter to be sent to my members, and to inform him personally of the steps that we have already taken with regard to the matter of which he is complaining.

Leonard G. Tate, *Secretary,*
Electrical Contractors' Association (Inc.).

London, E.C., *November 24th*, 1915.

"Anti-Humbug" writes a very forceful letter, but, judging as a contractor of long experience, I am afraid he has not good experience. From his letters, I would say that his experience has been gained amongst the "cheap and nasty" type of electrical agents and contractors, who have in the past undoubtedly only been able to carry on business by buying and selling the very cheapest materials obtainable—usually foreign.

To class electrical contractors as a body, or even to suggest that the above class forms a majority of electrical contractors, is absurd. I do not speak for municipal engineers who have placed public orders for German plant, etc., as probably they will reply for themselves.

My firm is the oldest firm of electrical engineers and contractors in Great Britain, and I am glad to be able to say that they have never knowingly bought from German or Austrian manufacturers or their agents at any time. I believe that in buying the earlier forms of metallic-filament lamps and opal shades, say from any good British firm, such as Ediswan, Verity, G.E.C., etc., they have been indirectly helping German enterprise, but only because these articles were not obtainable elsewhere. I honestly believe that this is the position of nearly all of the electrical contracting firms of any importance.

There is no quarrel worse than a family quarrel, and for some years past, owing to the misdeeds of a few firms (usually firms of the here to-day and gone to-morrow type), our brethren in different branches of electrical engineering have been mud-slinging at electrical contractors as a body, and as represented by the E.C.A., both of England and Scotland. This usually has been done for a selfish purpose, but is it not time that this should stop? We are all, as classes, equally honourable business men, and it only keeps back the welfare of electrical enterprise to continue quarrelling amongst ourselves.

I am afraid, Mr. Editor, that this letter is a very general one, but I have been very sorry for a long time back to read and hear similar kinds of "authoritative" statements to that by "Anti-Humbug," and to know of the quarrels amongst the various classes of electrical workers. I always comfort myself by remembering what is nearly always correct, and that is that the real workers work on in unison, and it is the drones who make the noise.

Let us all do our work faithfully and honestly, leaving foreign goods alone, and it will be for the good of our country as well as ourselves.

Thos. B. Wright, A.M.I.E.E.
(Anderson & Munro, Ltd.)

Glasgow, *November 24th*, 1915.

Swiss or German?

The purport of your leaderette under the above heading in your last issue *re* the "Bank für Elektrische Unternehmungen," of Zurich (generally called "Electrobank") is not clear to anyone conversant with the actual facts. The Electrobank is a subsidiary of the Swiss Bankverein, of Zurich, and an international undertaking belonging to one of the great Continental rings for the development and financing of electrical undertakings all over the world, and well known to all engineers connected with pioneer work or the financing of large undertakings.

You may be sure that the Electrobank has no need or intention to "change its coat," as apparently your article seems to suggest, and any change made in its directorate has no bearing on the present war, but it is only natural that the Bank should wish to absorb in their directorate the best technical talent available, and that the seat which became vacant through the death of Emil Rathenau should be filled by Dr. Deutsch, who is one of the heads of the A.E.G. and—no matter what we may think of Germany as a nation—a capable man in electrical work.

I hold no brief for either the Electrobank or Dr. Deutsch, but I deplore any articles which may very well debar English manufacturers in the future from participation in international undertakings, which, as you are well aware, all large electrical undertakings must continue to remain.

A. M. H.

Brighton, *November 27th*, 1915.

[The object of the writer of the above letter is not as clear as it might be. The "actual fact" remains that whereas a year ago there were 19 German and seven Swiss directors, there are now 18 German and 14 Swiss. Does the writer suggest that a large number of additional Swiss directors, together with Dr. Deutsch, were required in order to repair the loss of technical talent suffered by the death of Emil Rathenau? "A.M.H." says that the changes have no bearing upon the present war. The directors in their report say: "Concessions had to be made to the *nationalistic* currents in the sense of occasioning the retirement of deserving administrators and officials from their positions". (Elec. Rev., October 29th, p. 576). The solicitude of our correspondent for the interests of English manufacturers as shown in his closing paragraph is quite pathetic. It would be interesting to know to what extent British electrical manufacturers have benefited in the past from the operations of such Continental banking organisations.—Eds. Elec. Rev.]

The Institution and Alien Enemy Members.

The correspondence under the above heading is indicative of the opinions of a considerable number of members of the I.E.E., and it is apparent that steps should be taken to remove from the list of membership those individuals tainted with the blood of our viperous enemies. A naturalisation paper will not change an individual's nature any more than a coat of wool will turn a lion into a lamb. It is merely a subterfuge.

If the members are united in their desires, why not petition the Council of the I.E.E. to take action? I strongly disagree with "Another Station Engineer" and his definition *irresponsible demigods*, as it is evident that the members combined can enforce their demands, providing they are united.

My own view is that the members of the I.E.E. should prepare their protest outside the Institution, and if they feel justified present it to the Council. I should be pleased to hear from any member sharing my views, with the object of taking speedy action.

W. Ellerd-Styles.

London, W., *November 29th*, 1915.

Decimal Coinage and the Metric System.

Mr. H. M. Sayers writes to point out that his letter in our last issue should read "2,000 salary and wages payments," not "£2,000" as printed. We regret the error.—Eds. Elec. Rev.

Birmingham Tramway Accident.—With reference to the accident which recently occurred on the Birmingham Corporation tramways, and was referred to on page 655 of a previous issue, the Electro-Mechanical Brake Co., Ltd., of West Bromwich, ask us to state that the car was not fitted with the "Maley" electro-mechanical rail brake, with which a large number of the Birmingham cars are equipped.

ELECTRICAL ACCIDENTS IN 1914.

The following is the Report to the Chief Inspector of Factories and Workshops, submitted by Mr. G. Scott Ram, H.M. Electrical Inspector of Factories:—

During the past year I have had considerable assistance from three of the Divisional Inspectors—Messrs. Topham, Evans and Lowe, in the North-Western, North-Eastern and Midland Divisions respectively—and various members of the district staff have also done much work, especially in the investigation of accidents. Mr. Evans reports that he has taken every opportunity of getting into touch with consulting engineers and contractors, so that all new work for which they are responsible may be put up, in the first instance, in accordance with the requirements of the Regulations. He points out, as does also Mr. Topham, that many contractors put in inferior apparatus and material, on account of cheapness, well knowing that it does not comply with the Regulations, being afraid that if they tender for work which will comply with the requirements, other contractors will not do so, and will get the orders on the question of price alone. The factory occupier eventually has to suffer, and is put to a greater expense in putting the matters in order than if he had paid for the proper material in the first instance. The obvious course for consulting engineers and for factory occupiers is to specify that the installation shall comply with the Regulations. If then it is found not to be in accordance with the requirements, the contractor can be called upon to put it in order at his own expense. The extra cost involved is becoming less important, as more manufacturers are making apparatus (*e.g.*, fuseboards, &c.) to comply, which is little, if any, more costly than the inferior and dangerous types which do not comply. Mr. Lowe finds that by repeated visits to different districts the local contractors are beginning to realise that bad work is liable to be found out and condemned, and are improving their standard accordingly. Both Mr. Evans and Mr. Lowe draw attention to the inefficiency of earth connections on most installations, and they enumerate many other dangerous conditions which they have found. Mr. Topham found some high-tension switchboards having passage-ways only 18 in. wide, and unprotected conductors all along one side. Mr. Shinner reports that in the case of an accident in a factory sub-station, where a workman of a Corporation electric supply department got on to some high-tension conductors, and was rescued by one of the factory employés, the Corporation showed their appreciation by presenting the rescuer with £10. Reports from other districts show that various defects in installations have been found and dealt with. Many inspectors refer to the continued increase in the use of electrical energy for power purposes. It is impossible to make an estimate of this increase for the past year, as I have generally done, as the usual returns from sources outside the department are not available.

Four prosecutions for breach of Regulations were taken during the year, and penalties of £5, £10 and £50 were imposed. One case was dismissed on technical (legal) grounds.

TABLE I.—Accidents at Electrical Generating Stations and Sub-Stations in 1914.

(The small figures relate to fatal accidents, and are included in the principal figures)

Description.	Public supply stations and electric railways and tramways.	Other stations.
Non-electrical:—		
At engines, pumps and generators	36	11^{3}
At boilers and steam plant	76	1
At coal-handling plant	18^{1}	1
Falls	97^{2}	5
Struck by falling bodies	35^{3}	1
Miscellaneous	88^{1}	12
Total	350^{7}	31^{3}
Electrical:—		
At switchboards when engaged in ordinary routine work	19	7
Cleaning, repairing, &c., at "live" switchboards or other "live" conductors ...	29^{1}	20^{1}
Cleaning, repairing, or other handling of switchboards supposed to have been made "dead"	2^{1}	—
Adjusting brushes and cleaning commutators and flashing at commutators	2	4
Miscellaneous	13^{1}	3
Total	65^{3}	34^{1}

The mechanical accidents are fewer by 58 than in the previous year, a reduction of 13 per cent. They are such as are liable to occur in engineering works. A number were due to working on moving machinery. One, causing two deaths, was due to the bursting of a steel bottle of compressed air for starting a gas engine.

The number of electrical accidents is slightly larger—99 as against 94 in the previous year, with four fatalities as against three. Under the first heading of the table some of the accidents were due to mistakes on the part of the switchman; others were due to matters beyond his control, either to faulty switch gear or to faults on the circuit at some distant point. In all cases the injuries were burns. In one the tank of an oil switch burst, and the attendant was injured by the burning oil. Six of the accidents occurred in the renewing of fuses.

One half of the total accidents in electrical stations occurred to men when working on live conductors—mostly on switchboards. Eight occurred on extra-high-tension systems, and three on high-tension systems. Two cases were fatal. One of these occurred in a consumer's sub-station to a man dusting a switch (5 000 volts) in a compartment with a door normally kept locked, but which he had himself opened. He was probably under the impression that the switch was dead, but the controlling switch in another compartment had been left "on." The other case occurred to a man working in an underground sub-station making contact with an inadequately protected temporary cable (2,400 volts). In most of the high-tension accidents the injured persons were doing work which was unauthorised and were themselves to blame. In one case an engineer attempted to do some work in a switch cubicle (10,000 volts). The switch was not in use, although live on one side, and it could have been made dead by means of the isolating switches provided for the purpose. This, however, involved the taking down of a heavy iron screen, and rather than take the trouble to do this he took the risk. This accident emphasises the desirability that such doors should be hinged or made to slide on runners so that they may be readily opened. One accident was caused through a short circuit to the framework of the switchboard by the metal end of the insulating pole provided for operating the isolating switches. One accident was due to the misunderstanding of a telephone message. Of the accidents on medium-pressure and low-pressure systems, 16 were caused by making short circuits with ordinary spanners, screw drivers or pliers. One accident was due to short circuit in attempting to remove the tank on a live oil switch. Two other fatal accidents under this heading were reported, but they are not included in the table as they did not occur on premises under the Act. One was in a switch-house on a 10,000-volt system, and the other at a transformer box in the street at 2,400 volts.

Under the next heading, the fatality occurred to an engineer-in-charge taking hold of live conductors of a high-tension arc lighting switchboard presumably thinking they were dead. A switch controlling the switchboard had apparently, contrary to the usual custom, been left on inadvertently from a previous shift. The victim was, no doubt, to some extent blameworthy in not ascertaining for himself whether the board was dead.

Under the miscellaneous accidents, the fatal case occurred to a man who touched with his head a neutral conductor of a high-tension alternator. Several alternators were running in parallel, the neutral point of one being definitely connected to earth. It had previously been assumed that the neutral points of the other machines would have been very nearly at earth potential. In this case it proved that there was 500 volts pressure to earth. The machines were of different types, and the one in question was of lower voltage than the others and connected through a step-up auto-transformer.

TABLE II.—Electrical Accidents In Factories other than Electrical Stations in 1914.

(The small figures relate to fatal accidents and are included in the principal figures.)

Arcing of switches		38
Arcing of fuses		9
Shock or burns when replacing fuse wires		22
Portable apparatus, connectors and flexible wires		65^{2}
Unprotected conductors, switches, terminals, fuses, &c. ...		39^{7}
Working on live electrical apparatus or conductors	skilled persons ...	42^{1}
	unskilled persons..	46^{2}
Miscellaneous accidents in electrical manufacturing and repair works—mostly in testing operations		55^{1}
Adjusting brushes and cleaning commutators and flashing at commutators		6
Miscellaneous		31^{3}*
Total		350^{16}

* One fatality, fall following shock.

The electrical accidents in factories are fewer by 68, or 16 per cent., than in the previous year, the number of fatalities (16) being one less. The accidents in renewing fuses afford examples of the dangers of different types of fuses to which I have drawn attention in former reports. Most of the injuries are burns from short circuit, but some from shock. In some cases short circuits were made by getting the fuse wire or pliers or other tool across the terminals of both poles or between one pole and the metal case. In some instances the fuses had been protected by a switch, but being at a distance it was not used. In other cases where there was a switch at the fuses it was connected on the wrong side so that the fuse terminals were live whether the switch was "on" or "off." Several occurred with fuses in porcelain carriers having the fuse wire in a groove in the front of the porcelain. In these cases, the fuse having blown, the attendant replaced it without having investigated and rectified the fault which caused it to blow in the first instance, with the result that immediately the fuse-holder with the new fuse wire was put into contact, the fuse blew again, burning his hand. Others, causing shock, occurred with the "bobbin" or "grip" type carrier having live metal at each end of the porcelain. None of the above arrangements of fuses complies with the Regulations. Fuses not protected on the live side by switches should be of the switch-fuse type so constructed that the hand when grasping the handle cannot touch live metal, and is shielded from the arc should a fuse blow when being plugged in.

Of the accidents in the use of portable apparatus, 26 occurred in handling the flexible conductors. One case, having fatal results, occurred to a man when working on the wet floor of a dry dock. He was engaged in scraping a ship's bottom and is supposed to have trodden on the flexible cable of a portable lamp cluster a nail in his boot piercing the insulation of the cable. In many works there is no proper examination of the flexible conductors which remain in use after being badly damaged and worn out. In some cases the metallic armouring of the flexible wires had broken and pierced the insulation. Metallic armouring, especially in the form of a wire helix, is not a desirable form of protection. The earth connection is liable to become disconnected, and through rough usage and constant bending the wire is apt to break and pierce the insulation, and becoming live is very dangerous. Other forms of protection, such as rubber or hard cord braiding, are generally preferable. Twenty of the accidents occurred in connecting the flexible wires to the circuit. In six cases "adapters" were being put into lampholders and short circuits occurred. In other cases pin plugs of the old type were used, the wires short-circuiting at the point where they enter the plug. In most of these cases the use of safety type hand shield plugs would have prevented the accidents. The short circuits which occur in this way are often very heavy, leading to very severe burns, by reason of the circuit being too heavily fused. In one case it was found that the circuit for a hand-lamp was fused for 60 amperes. Three cases of shock occurred from unearthed portable drills. Some cases of shock from hand-lamps also occurred. One fatal case—also in a dry dock—occurred in the use of a portable "cargo lamp," a cluster of several lamps being mounted in a metal reflector. The whole fitting became live by reason of a terminal screw in one of the lamp-holders being in contact with the barrel of the holder. The man took hold of the reflector of the fitting and was killed. The fitting was not earthed, and was not in accordance with the requirements of the Regulations. It is noteworthy that safety type cargo fittings have been devised and are now on the market.

Under the next heading, "unprotected conductors," there were seven fatalities, of which six were due to contact with overhead wires. The wires, although out of reach from the ground, were so placed that workmen in the course of their duties might have at some time to get into close proximity to them. In one case, wires covered only with braiding were run out of doors close to a steam valve. A man had to get to the valve and came into contact with the wires (440-volt, three-phase) and was killed. The braiding of wires without any insulating covering is quite useless, and may lead persons erroneously to suppose that they are insulated and safe to touch. The next case was similar; the bare wires, although out of reach from the ground, were within reach from a pipe bridge on which the man got in the course of his duties. He made contact with the wires and fell to the ground, a distance of 11 ft., and although he died from the results of the fall, he was able to state that he received a shock. The next case occurred at a wharf where pit props were unloaded and stacked. The wires were 22 ft. from the ground, but the props were stacked in some places to within 3 ft. of the wires. The supply was 440 volts, three-phase. A man on one of the stacks touched the wires and was killed. The next case was also on a 440-volt, three-phase system. Bare wires were run under the roof of a large engineering shop. Men were at work painting the roof, and one of them took hold of the wires and was killed. His mate managed to hold him until assistance came and he was lowered to the ground. Another case was similar in all respects except that the system was 400 volts, three-phase. Two men tried to get the victim off the wires, but themselves received shocks, and he fell to the ground. In the other similar fatality, a man was sent to clean out a gutter, close to which were live wires at 500 volts, three-phase. The seventh fatal case occurred in an engineering works to a man touching the live parts of a 240-volt, three-phase switch which had no cover, and which he had to use. It was a throw-over type of switch, having double blades at right angles on each pole, so arranged that in grasping the handle the hand would be liable to touch the projecting blades of the outcoming side. Of the non-fatal accidents nine were in connection with electric cranes. Five were by men touching the bare trolley-wires when getting in or out of the cage. Four were due to unprotected conductors in the cage.

Under the next heading, "skilled persons working on live conductors," the fatality occurred on a 440-volt, three-phase system. Alterations had to be made to a motor circuit, and the electrician cut into a live wire with a pair of pliers. It was found that the fuses protecting the circuit had been removed from two of the wires, but not from the third. The accidents under this heading might for the most part have been avoided if the work had been done at night when the works were shut down. Several occurred at switchboards when tightening nuts with ordinary uninsulated spanners.

(To be continued.)

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Half-Watt Lamp Fittings.

Messrs. Engineering and Arc Lamps, Ltd., of Sphere Works, St. Albans, Herts., have recently issued a list of half-watt lamp fittings covering practically all requirements for works office, street and shop lighting, indoors and out of doors. These fittings are substantially constructed, the cast-iron globe ring being hinged and held up by a fly nut; they are sent out with rigid internal connections and the minimum of wiring is required on erection. The fittings are thoroughly ventilated and designed to endure handling and all weather conditions. Internal cut-outs and substitutional resistances can be supplied if required.

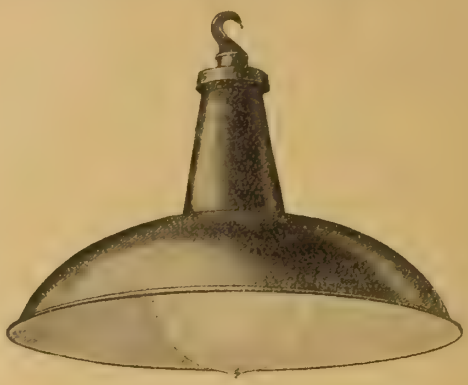


Fig. 1.—Britannia Fitting.

In several patterns hexagon lanterns are supplied as alternatives to globes, thus reducing replacement costs in case of breakages; a variety of glass also is available—opalescent, frosted, clear muranese or other pattern. We illustrate in figs. 1 to 3 the Britannia fitting for works and yard lighting, the Bristol fitting which is specially designed for street, railway, dock or harbour lighting, and a shop window reflector fitting; the firm also supplies indirect lighting fittings for interior lighting by means of half-watt lamps, the chain-suspended reflectors being either polished aluminium or opalescent glass.

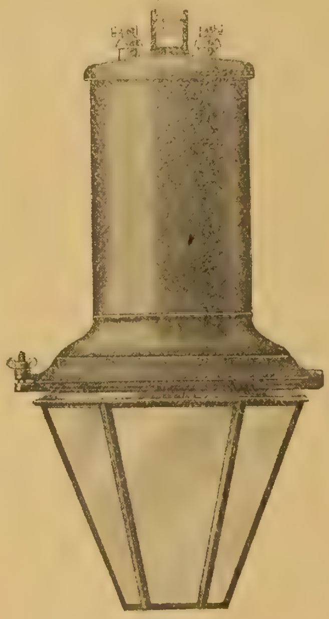


Fig. 2.—Bristol Fitting.

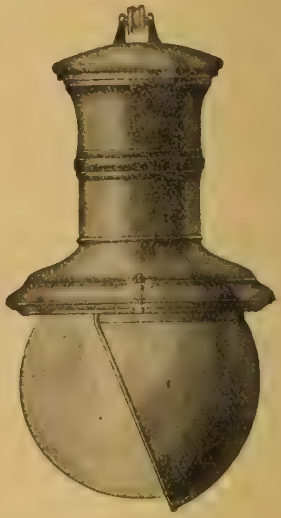


Fig. 3.—Outside Shop Window Fitting.

Inspection Lamp for Shell Work.

The inspection lamp illustrated in fig. 4 is made by Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham. Apart from its robust constructions, which makes it particularly suitable for the strenuous usage of a shell factory, it is provided with an earth wire. The lampholder is insulated from the body, and both holder and lamp cap are protected and cannot be touched by the operator so long as the guard is in position. The lamp shown, if used with an earthing plug, has the approval of the Home Office.

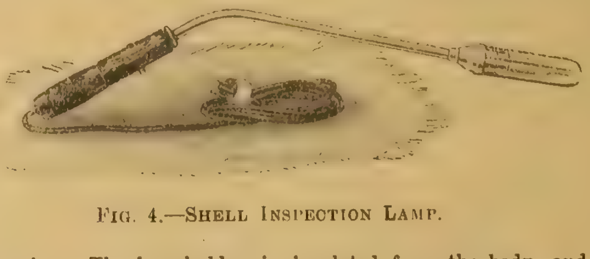


Fig. 4.—Shell Inspection Lamp.

Combined Heater and Fan.

The General Electric Co, Ltd., of 67, Queen Victoria Street, E.C., have introduced a combined steam heater and electric fan for factory heating, which should prove useful for installation in the munitions workshops of which so many have been hastily erected and equipped. The device consists, for low-pressure steam, of a battery of cast-iron gilled radiators enclosed in a strong sheet-steel casing, at the top of which is mounted an electric propeller fan; the latter blows air downwards through the heater and distributes it near the floor level. The heater is carried on a substantial cast-iron base and is fitted with steam connection and valve and drain pipe. A similar device is made for high-pressure steam, consisting of a battery of weldless steel tubes bent to **U** shape and expanded into the cast-iron header, with a sheet-steel casing and electric fan as before. The system appears to be very simple, efficient and easy to install.

Simple Battery Switching Scheme.

The switching scheme shown in the accompanying diagram is used in a power station where a 110-volt direct-current control circuit is needed for operating oil circuit-breakers. For this purpose a 275-cell power storage battery was available, the proper voltage being obtained by tapping off the required number of cells.

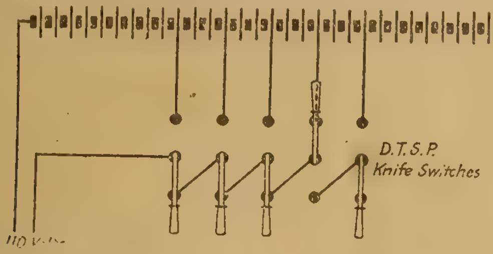


FIG. 5.—KNIFE SWITCHES WIRED FOR ADDING END CELLS.

To take care of the changes in the voltage of the battery at different times of the day, taps were taken from five cells. The connections for changing from tap to tap are shown in the diagram, five single-pole, double-throw switches being used. The arrangement is practically foolproof, as it is impossible to short-circuit any of the cells in changing from one tap to another.—*Electrical World.*

Rust on Legs of Transmission Line Towers.

Each tower in a new transmission line between Prairie du Sac and Madison, Wis., is provided with renewable legs. Those portions of the legs most likely to be attacked by rust—the sections at the ground line—have been made renewable, so that any weak member may be replaced. Under normal conditions any square-base tower will stand on three legs, so that to substitute new pieces in place of rusted ones the maintenance crew has only to unbolt the old ones, remove them, and put in duplicate members.—*Electrical World.*

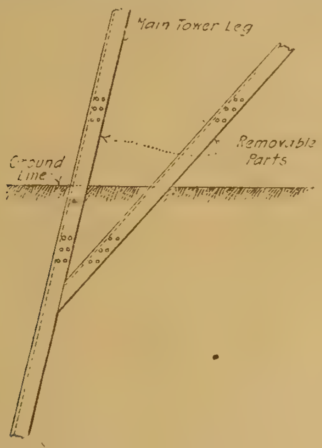


FIG. 6.—RENEWABLE PARTS FOR TOWER LEGS AT GROUND LINE.

A Novel Lamp Shade.

MESSRS. ELECTRA, LTD., of New Barnet, N., have recently introduced a novel electric light shade which has been specially designed to enable the police regulations regarding reduced lighting to be easily and effectively complied with.

The shade can be opened on one side to throw light in a desired direction, giving a subdued light elsewhere, or it can be opened at the bottom for downward lighting. The material used is blue or green coloured, mounted on a wire frame to prevent the fabric from touching the lamp.

LEGAL.

OSRAM LAMP WORKS, LTD., *v.* POPE'S ELECTRIC LAMP CO., LTD.

MR. WALTER, in replying on behalf of the appellants, contended that upon the evidence there had been clearly infringement by the respondents (defendants) of the plaintiffs' patent. He contended that Mr. Ballantyne's (a witness for the defence) evidence under cross-examination in the Court below really amounted to an admission of infringement by the defendants. He contended that the plaintiffs were clearly entitled to judgment on the issue of infringement.

The MASTER OF THE ROLLS stated that the Court would take time to consider its judgment on the issue of infringement, and should it be thought desirable to hear further arguments on the other issues in the case, an intimation to that effect would be sent to the parties or their legal advisers.

MUNITIONS ACT CASE.

AT a sitting of the Oldham Munitions Tribunal last week, the interesting point was raised as to whether a junior cost clerk, aged 15, who was seeking his discharge certificate from a local firm of electrical engineers, was engaged on munitions. The youth had the chance of going into the cotton industry, and his father said his prospects would be much improved, but the firm he was now with refused to let him go. For the firm, it was stated that they were entirely engaged on munitions work, and that the youth had been employed about a year, and had taken the place of a man who had enlisted. After hearing both sides, Mr. Sellers (chairman) announced that he and his colleagues had come to the conclusion that a junior clerk of 15 years, even in the office of a controlled establishment, was not a person employed on munitions within the meaning of Sec. 7 of the Act, and therefore his application for a leaving certificate would be granted.

INLAND REVENUE CASE: APPEAL BY THE UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON, LTD.

IN the Court of Appeal, before Lords Justices Swinfen Eady, Bankes and Warrington, on Monday, an appeal was heard by the Underground Electric Railways Co. of London, Ltd., and Glyn, Mills, Currie & Co., from a decision of Mr. Justice Scrutton, affirming a decision of the Commissioners of Inland Revenue.

The question in the case was what was the proper stamp duty to be assessed upon a deed dated December 13th, 1912, made between the appellant company and Glyn, Mills, Currie & Co., as the trustees, by which the company agreed, provided a sufficient number of the holders of ordinary stock of the Central London Railways Co. would take guaranteed stock in exchange for their ordinary stock, to guarantee interest at 4 per cent. on such guaranteed stock, payable half-yearly, if and to the extent that the profits of the Central London Railway Co. were not sufficient to pay that amount of interest. Mr. Justice Scrutton having affirmed the assessment of the Commissioners, the Railway Co. and the trustees of the deed now appealed to the Court of Appeal. Their Lordships dismissed the appeal with costs.

RESTRAINT OF TRADE.—MESSRS. HERBERT MORRIS'S APPEAL.

IN the House of Lords before Lords Atkinson, Shaw, Parker and Sumner, after arguments, lasting five days, judgment was reserved in an appeal by Herbert Morris, Ltd., from an order of the Court of Appeal affirming by a majority—Lord Justice Phillimore dissenting—a judgment of Mr. Justice Sargant in favour of the present respondent, Mr. Fred. Albert Saxelby.

Sir Robert Finlay, K.C., Mr. A. J. Walter, K.C., and Mr. D. M. Kerly, K.C., appeared for the appellant company; Mr. Mark Romer, K.C., and Mr. W. R. Sheldon for the respondent.

SIR ROBERT FINLAY, in opening, said that the only point their Lordships were asked by this appeal to decide was whether or not an agreement under seal executed on March 17th, 1911, by the parties to these proceedings was a covenant unenforceable in law as being unreasonably in restraint of trade—that is, as being in wider terms than was reasonably necessary for the protection of the appellants in their business. The facts have already been fully reported in the ELECTRICAL REVIEW.

The learned counsel went on to contend that the covenant was not wider than reasonably necessary for the protection of the appellants' business. He traversed the judgments of Mr. Justice Sargant and those of the two members of the Court of Appeal (the Master of the Rolls and Mr. Justice Joyce) who agreed with him. He asked the House to hold that the dissenting judgment of Lord Justice Phillimore was right, and that this appeal should be allowed. The case of employer and employé was not different in principle from that of vendor and purchaser, for the protection of property in each case was the foundation of the principle.

MR. MARK ROMER, K.C., for the respondent, submitted that the order appealed from was right. An employer was entitled to take a covenant from his servant which would prevent him disclosing trade secrets. But there was no secret trade here. An employer was not entitled to say: "I will teach you the business, but I will prevent you competing with me afterwards." It was not a case of prohibiting a servant soliciting orders from his former master's customers.

In the result, the House reserved its decision.

WILKINS *v.* ENGINEERING WORKS, LTD.

IN the Lord Mayor's Court, on Friday, before the Recorder (Sir Forrest Fulton, K.C.), and a jury, a claim was made by John Wilkins & Co., general metal workers, of Clerkenwell, against the Engineering Works, Ltd., London, E.C., for £32 12s. 6d. damages for refusal by the defendants to accept the balance of an order for electric light enamelled iron reflectors. Mr. Kyffin was counsel for the plaintiffs, and Mr. Werninck for the defendants.

According to the plaintiffs' case the defendants appeared to have had a contract to fit up the electric light at the new buildings erected for the Pearl Insurance Co., in Holborn. The defendants required a cheap article made in the cheapest material. Such reflectors were usually made of copper, and a very good article could be turned out. The defendants wanted them made of iron, to a special design, for which special tools and a special process were required. The reflectors were 2 ft. across, and the price of them was to be 5s. each. On July 30th, an order was given by the defendants for 1,000 enamelled pressed steel reflectors, the price with fittings to be 11s. each. Although the defendant pressed for the delivery to be made within a specified time the plaintiffs would not consent to such a term being made part of the contract, but undertook to do their best to make delivery within the time. From time to time complaints were made of certain of the reflectors as they were delivered, defendants complaining that they were not up to sample, and that the enamel was chipped. The plaintiffs, however, said that the articles delivered were commercially up to the sample, but any that were not they were agreeable to replace, and the enamel was not chipped when the reflectors were delivered. The defendants had in all taken 600 of the reflectors, which had been paid for, and it was in connection with the balance of 400, which the defendants refused to take, that the plaintiffs' were now seeking to charge simply the stampers' charges, which they had had to pay. In the negotiations which had taken place a Mr. Bauer, who had changed his name since August 4th last year to Mr. Bower, seemed to be the owner of the defendant business.

Mr. Werninck, for the defendants, said that Mr. Bower was the managing director of the defendant company; he was British born, and the shareholders were British subjects.

Mr. John Wilkins, senior partner in the plaintiff firm, was called, and gave evidence in support of the claim. He said that if the reflector which the defendants required had been plain, iron would have been a suitable material to have employed, and a more satisfactory job could have been turned out. The reflector required, however, was fluted, and for a fluted reflector copper was undoubtedly the better material. There was no doubt that an entirely different reflector to that which they had supplied was going to be substituted.

Counsel for the plaintiffs subsequently said that the parties had come to terms.

The Recorder thought it quite a satisfactory arrangement, and a juror was withdrawn.

Locker-Lampson v. Isaacs.

This matter was mentioned before Mr. Justice Sargant on November 26th, and the hearing of the motion was fixed for the first day in next sittings.

Alleged Infringement of Switch-Box Designs.

In the Chancery Division, Mr. Justice Younger had opened before him on Monday, November 29th, the action of Vandervell v. A. P. Lundberg & Sons, by which the plaintiff claimed relief in respect of an alleged infringement by the defendants of his registered designs for switch boxes used in connection with electrical installations.

Mr. Walter, K.C., and Mr. Hunter Gray were counsel for the plaintiff, and Mr. Colefax, K.C., and Mr. Eric Bousfield represented the defendants.

In opening the case, Mr. Walter said the action was for infringement of two registered designs, the first No. 562,949, registered in Class 3 on May 19th, 1910; the other was No. 568,527, registered in Class 3 on August 19th, 1909. The registration was under the Patent Act of 1907, Sec. 49 of which dealt with registered designs. This particular design applied to switch boxes for electrical installations, but the circumstances were different to those in a patent action. The whole question was whether a new and original design had been infringed, and that was really a question for the eye—the instructed eye. To the instructed eye two paramount things were in evidence, two tumblers and six switches in line mounted behind the plate. At the bottom there were two terminals which took off the current. He thought that the Court would have very little difficulty, having regard to the form in which these articles had been put upon the market, in coming to the conclusion that the defendants' switch-box was practically identical with the plaintiff's registered design. It was not until the end of 1913 that it came to the knowledge of the plaintiff that certain articles to which his design was applied were in the market. On those articles there was no name, and he could not for a long time find out who was putting them on the market. Finally a circular issued by the defendants came to his notice, and he discovered what they were doing. The defendants' articles had the switches arranged on the plate in the same way as the plaintiff's, two circles at the top in the same way, and the two terminals in the same place as the plaintiff's. A closer copy, he submitted, his Lordship could not conceive. Looking at a switch-box made in accordance with the plaintiff's design and one of the defendants, his Lordship would find them identical. The writ was issued on June 3rd, 1914, the plaintiff claiming an injunction, damages, and a delivery up of the infringing articles. The defence put in alleged that the plaintiff's design was not novel; that the defendants had not infringed it; and, further, that the plaintiff had used the number of his registered design upon articles that were not made in accordance with the design. With regard to the last part of the defence, in 1912 the plaintiff introduced two new forms of switch boxes. In one the registered number was on the plate, but in the other, no number appeared on the switch plate. That state of things remained until 1913 when, at the time of the Motor Show, the plaintiff introduced a new switch plate. It was got out in a hurry, and the new plate should have had on it no number; six plates, and six plates only, were produced, but by some mistake the registered number got upon one plate, and that plate was used in connection with a switch box not of the registered design. That one, and that one only, had the plaintiff been able to find, and immediately it was called to his attention he took the precaution of putting the registered number upon the wood of the switch box instead of on the plate. He submitted that the defendants had taken the substantial part of the plaintiff's design, and there was nothing whatever to deprive him of his legal rights under the Act.

Mr. Colefax said that one of his submissions would be that what was put in as an illustration of the plaintiff's switch box was not in fact the registered design.

Mr. Walter said the switch box produced was made from the design.

Mr. Colefax pointed out that it had no beading round it.

Mr. Walter agreed, but said he would produce another which had the beading. It made no difference. The defendants' was substantially produced from the plaintiff's design.

Albert Midgley, chief electrical engineer to the plaintiff, said they did a large business in supplying electric lighting installations for motor cars. It was in 1913 that it first came to his knowledge that switch boxes similar to their switch boxes were on the market. At the time they introduced the switch boxes of registered design there was not, to his knowledge, any switch box like them on the market. In 1911 the plaintiff introduced what might be called their No. 1 switch box, and on that the registered numbers appeared. Later, Nos. 2 and 3 were put on the market, but on neither of these appeared the registered numbers. The same switch plate was used in the latter as in the former. He never knew that the registered numbers had appeared on a No. 2 switch box until his attention was called to it after these proceedings were commenced. In January, 1914, he received a stock of new switch plates, all of which had on the registered number, but they were intended for the No. 1 switchboard. He could not explain how one got to be used for a No. 2.

Mr. Midgley described the process adopted by the plaintiff firm in constructing an article, and said that as soon as his attention was called to one of the switch boxes of unregistered design having gone out with the registered number on the plate he checked every one of the plates in stock. He had not now got any switch plates with the registered number upon them. The registered number was now stamped on the woodwork to avoid any possible error. There was no reason whatever for applying the registered design to switch box No. 2, and until his attention was called to the one instance adduced by the defendants he did not know that it had ever been done.

Mr. Geo. Croydon Marks said that he had had a lengthy experience of motors and motor accessories, and he knew of no switch box similar to the plaintiff's registered design.

For the defence, Mr. Colefax said that the protection afforded by a design was very meagre, and the Court would not assist the plaintiff to extend the protection he was entitled to. What was claimed here was a box with a sloping top and a plate in combination with a number of switches disposed in a line. He submitted that that was not the registered design at all. It was not right to pick out one or two features of the drawing and say they constituted the registered design. Everything shown in the drawing went to constitute the design as registered. Looked at in that way, the defendants' article did not infringe, and it was impossible to say that the metal plate was not an essential part of this design. In each of three respects the alleged infringement differed from the registered design. His second point was invalidity of the design.

Expert evidence was given as to the defendants' interpretation of the design, and

Mr. Walter, in reply, commented on the fact that the defendants had not given evidence as to how they came to get out their design.

At the conclusion of the arguments, his Lordship reserved judgment.

WAR ITEMS.

Necessary Trade Service.—The General Purposes Committee of the Manchester Chamber of Commerce has had under consideration the recent circular from the Board of Trade respecting the preparation by an Inter-Departmental Advisory Committee of lists of occupations from which enlistments ought to be restricted, in view of the necessity for maintaining the trade of the country as far as possible, and the following resolutions have been forwarded to the Reserved Occupations Committee:—

> That, in the opinion of this committee, it is essential for the well-being of the country that the trade of the district should be kept in being as far as possible, in order (1) to provide the sinews of war; (2) to maintain exports and so counteract the serious decline in exchange which is the natural consequence of the increasing value of imports and decreasing value of exports.
>
> That for these reasons it is essential that in certain occupations—subdivisions of the industrial and commercial community—a small percentage of men should be reserved from military service until the latest possible group, always taking into account the percentage of eligible men from that section who have already offered themselves for enlistment.

It is suggested that the undernoted classes of employés should be reserved to the latest possible group, on due representations to the Advisory Committee, viz., heads of departments, principal clerks, expert assistants, makers-up, packers, and case-makers.—"Manchester Courier."

Electricity Works Staffs and Recruiting.—Prior to the war the employés of the Carlisle electricity works numbered 50. Eighteen of these are already with the Forces, but the remainder, though starred men, are not content only to wear a war badge, and last week, leaving just sufficient of their number behind to keep the station running, they marched in a body (27), headed by Mr. Purse, the borough electrical engineer (who is himself of military age), to the recruiting office and presented themselves for attestation.

Up to the present 35 per cent. of the staff and employés of the Hull Corporation Electricity Department have enlisted. Mr. J. F. Magoris (deputy electrical engineer) has informed the Electricity Committee that, in view of the importance of the undertaking in regard to war purposes, he has not yet felt justified in sanctioning further enlistments under the old system. He now proposes that the Committee give their sanction to the remainder of the eligible members of the department offering themselves for enlistment under Lord Derby's scheme. The Committee in approving this course resolved that, in the event of any of those so enlisting being eventually called up to serve, they shall be recognised by the Committee on the same basis as those who have already enlisted.

Engineers and Munitions.—The Executive Committee of the Amalgamated Society of Engineers, in replying to the charges which Mr. Lloyd George made at the Trade Union Conference against certain trade unions, states:—"The best answer that can be given in reply to the general impression created in the public mind that the engineers have not loyally abided by the terms of the Treasury agreement is to state what the A.S.E. has done:—(1) The society has removed all overtime restrictions in regard to the production of war material, and did so in the early days of the war. (2) The society has adopted the Treasury agreement by a large vote of the members, and has loyally observed the terms of the agreement in regard to the non-stoppage of work and the settlement of disputes. (3) The society has agreed to the introduction of semi-skilled workmen doing skilled men's work, and unskilled and female labour doing semi-skilled men's work in the manufacture of shells and fuses."

German Shortage.—The "Morning Post" Paris correspondent says that in a statement issued to German troops on August 28th last, Colonel Oldershausen, Chief of Staff of the 8th Reserves, complains that some of the troops are careless in their collection of telephone wires, and he writes:—"All men must have it properly brought to their notice that, owing to the growing dearth of india-rubber, it is absolutely essential to take the utmost care of all insulated wires. All authorities possessing telephonic equipment, when it is a question of setting up a line or replacing one in use, should carefully determine their actual requirements and should remember that waste and faulty manipulation will one day make it impossible to furnish supplies. All troops should aim at making a reserve stock of wires by carefully collecting the old wires that are to be seen in every direction. The central administration is not in a position to supply all the requests for wire that are addressed to it."

The Only Real Safeguard.—The "Melbourne Age," for October 18th, says:—"Whilst the importation of enemy goods into the Commonwealth is prohibited by law, the Minister of Customs admits that very little check can be exercised regarding the introduction of enemy goods made in neutral countries. With a view to minimising trade of this class, the department is requiring that any goods which might be suspected of being of enemy origin must be accompanied by a certificate from the British Consul that they were manufactured in the neutral country from which they were exported. But the only real safeguard against helping the trade of the enemy, Mr. Tudor says, is for people to purchase the goods of their own country and those of undoubted British origin."

The Mark of Cain.—The "Morning Post" correspondent says that the three leading German Associations of Commercial Employés have just petitioned the German Chambers of Commerce, urging them to do everything possible to prevail on all employers of labour in Germany to guarantee that employés at the Front, whose positions are now filled by women, shall be guaranteed reinstatement after the war, and that the women concerned shall then be dismissed. The petitioners fear that a long time may elapse after the war before German men will be able to find employment abroad.

County Men with the Forces.—We have received from the County of London Electric Supply Co., Ltd., a copy of No. 2 of their "Staff War Bulletin." The Roll of Honour is re-published and is brought up to date, casualties, including those of four men killed in action, being indicated. A list of the wounded or invalided is given, and there are a number of general notes and seven pages of extracts from letters received from the Front.

Electrical Treatment for Wounded Soldiers.—Seven hundred wounded soldiers have arrived in Manchester for special electric massage, heat and light treatment, for which purpose the Corporation has set apart the art gallery and organ room at Heaton Park.—"Times."

BUSINESS NOTES.

Enemy Debts Notice.—By an order of the Chancery Division, an inquiry is to be made as to what debts of the enemy, Dr. Heinrich Traun & Söhne, to persons within the United Kingdom, not being enemies within the meaning of the Trading with the Enemy Amendment Act, 1914, remain unpaid. Any person claiming to be a creditor, and not being an enemy, is required to send particulars to the Public Trustee, the custodian under the Act, 3 and 4, Clement's Inn, Strand, W.C., or he will be peremptorily excluded from the benefit of the said order.

Bankruptcy Proceedings.—SAVILLE & WALTON, electrical engineers and contractors, 39, Victoria Street, Westminster, S.W.—The first meeting of creditors was held last week, at the London Bankruptcy Court, under a receiving order made in this case. Mr. Egerton S. Grey, Official Receiver, reported that Capt. L. A. Thomson had attended under the proceedings, and had stated that in May, 1911, he commenced business in partnership with another as electrical engineers and contractors, at the above address. They contracted for complete installations of electric light and power in works and private houses, also for sundry wiring work. They secured some fairly large contracts, and did very well. The partnership was dissolved in October, 1913, under terms that the debtor paid his partner £86, and continued the business alone. He was successful during the next few months, but the business then fell away, and when war was declared he lost several promised contracts, owing to the firms with whom they would have been made retrenching during the war. On September 18th, 1914, the debtor received a commission, and thereupon delegated the management of his business to another, and had only attended at the office on two occasions since he joined the Army. The business gradually declined, and in June last the debtor decided to close it until he would again be able to give it his personal supervision. He attributed his failure to competition, loss on contracts, outbreak of hostilities, and lack of capital. The liabilities were, roughly, estimated at between £2,000 and £3,000, and the assets were valued at £134. In the absence of any offer, the case was left in the hands of the Official Receiver to be wound up in bankruptcy.

ALBERT WHITELEY, electrical and mechanical engineer, 7, Margaret's Road, Llandudno Junction.—Trustee (L. Hugh-Jones, Chester) released October 14th.

G. E. HIPKINS, electrical engineer, Dudley.—Trustee (A. M. Fairbairn) released October 14th.

Catalogues and Lists.—MESSRS. A. P. LUNDBERG and SONS, 477 and 489, Liverpool Road, London, N.—The firm has issued a bound catalogue (No. 1) of nearly 90 pages, in which there are exhaustively particularised only four of their many types of tumbler and other small switches, namely, single-way, "Twinob," double-pole and triple-pole. Prices of two-way switches are also indicated. Many of their plug connections, ceiling roses, &c., will be dealt with in future lists, but until the issue of these the old pamphlets are still available. The list contains about 200 illustrations, and in the main it deals with 30 different kinds and forms of single-way switch and modifications thereof. The contents are very neatly arranged, prices are clearly shown, and dimensions are given in both inches and millimetres. Copies of the catalogue are to be sent to the firm's regular customers, and other applicants will be supplied if a business card is forwarded.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—8-page leaflet giving full and illustrated description of the "Migas" detector for detecting the presence of gas in mines; also a four-page leaflet describing their combined steam heater and electric propeller fan system for factory heating.

MESSRS. POPE'S ELECTRIC LAMP CO., LTD., Hythe Road, Willesden, N.W.—New leaflet giving prices of Pope's carbon-filament lamps. Trade customers can have quantities of the list over-printed.

MESSRS. BROOK, HIRST & CO., LTD., Northgate Electrical Works, Chester.—Catalogue No. 3 is an excellent and convenient production of 136 pages in which the firm set forth very fully in tabular form prices, dimensions, code-words, and other particulars of their "Brookhirst" direct-current motor-starting and control gear. A number of further catalogues dealing with motor starters, control panels, and other lines, are in course of preparation. The publication now before us covers Midget starters and panels, overload trips for "B" and "C" type starters and panels, constant and variable speed standard "B" and "C" type panels, shunt regulators, multiple lever-type starters and panels, &c.

A New Zealand Exhibition.—The Commercial Intelligence Branch of the Board of Trade is notified by his Majesty's Trade Commissioner for New Zealand (Mr. W. G. Wickham) that the Wellington Chamber of Commerce are organising an exhibition of goods of British manufacture, to be held during one week in February next. Mr. Wickham suggests that British firms who are unable to supply the New Zealand market at the present time, either at all or on the same terms as previously, should endeavour to keep their names before the public, not only by participating in the exhibition, but also by carrying out a campaign in the local Press, telling the public, who are inclined to be sympathetic, exactly why their goods are not obtainable, or why they are higher in price. His Majesty's Trade Commissioner states that there is a marked tendency on the part of local agents to look to foreign countries as a source of supply.

British Trade in China.—In the course of an address to the Far Eastern Section of the London Chamber of Commerce and the China Association, Mr. Thomas M. Ainscough, the Special Commissioner of the Board of Trade, said there had been a growing conviction among British engineers for some time that unless the present system of representation in China was revised they would find themselves completely excluded from the electrical and industrial machinery market, which was being secured by the Germans. This conviction had been reflected in the formation of groups of British manufacturers, who had continued either to carry out their own pioneering work in China, in conjunction with the merchants, or to sell their products direct to Chinese. Such groups were working in the right direction, and their energy and enterprise deserved all success. The past 10 years had seen a wonderful increase in the number of European firms who were distributing their goods direct to the Chinese consumer in all the large towns of the interior through the medium of guaranteed Chinese agents, working under the constant supervision of European inspectors. In order to carry out a system of this kind we required powerful syndicates with large capital, and the ability to count the success of the system by carrying it out for at least a full trade cycle of five years or so. He emphasised the necessity for closer co-operation between the manufacturers and merchants in this country, the need for the provision of greater facilities from our banks and financial institutions for the purpose of financing deferred payments on large Chinese Government and private contracts for plant, machinery, and other supplies, and the importance in the future, as China opened up, for our mercantile assistants and travellers to secure a wider knowledge of the country and its people, their language, traits of character, business methods, and mode of life. British merchant houses in China, he said, ought to take advantage in the temporary lull in German competition in China during the war to revise their methods and put their house in order. The openings for an extension of the foreign trade of the country were greater than ever before.—*Daily Telegraph.*

U.S. Electrical Exports in August.—The *American Electrical Review* quotes the following facts regarding the electrical exports during August. Although the electrical total is below that of July, it exceeds that of August, 1914, by nearly 80 per cent. The latter month, however, was the first month of the European war when all international commerce was very seriously curtailed. For the four classes for which the number of articles exported is given in the Government report, there were shipped last August the following:—Electric fans, 1,112; arc lamps, 75; carbon-filament lamps, 140,282; metal-filament lamps, 461,580.

The detailed figures for the electrical classes reported are:—

	August, 1915.	August, 1914.
Batteries	$114,516	$38,722
Dynamos or generators ...	216,906	114,570
Fans	15,453	5,528
Insulated wire and cables...	251,083	51,236
Interior wiring supplies, &c. (including fixtures) ...	49,202	43,511
Lamps—		
Arc	1,633	1,620
Carbon-filament	17,221	4,338
Metal-filament	74,119	9,592
Meters and other measuring instruments	57,244	23,747
Motors	277,940	118,490
Telegraph instruments (including wireless apparatus)	17,030	3,101
Telephones	50,841	78 403
Transformers	29,146	33,609
All other	633,958	497,543
Total... ...	$1,806 292	$1,024,010

The total value of all electrical exports for the first eight months of 1915 was $14,977,440, compared with $13,654,569 during the corresponding months of 1914, and $18,949,235 for 1913.

Dissolutions and Liquidations.—Brighten, Malcolm and King, Ltd.—A meeting is called for December 29th, at 16, Philpot Lane, E.C., to bear an account of the winding up from the liquidator.

P. L. Dwyer & Co., electrical manufacturers and suppliers, 66, Victoria Street, London, S.W.—Messrs. P. L. Dwyer & P. R. Winterson have dissolved partnership. Mr. Dwyer attends to debts, &c., and continues the business under the same style.

Stolz Electrophone Co. (1913), Ltd.—December 15th is the last day for the receipt of proofs for dividend, by the liquidator, Mr. H E. Burgess, 33, Carey Street, W.C.

Holborn Electric Fires, Ltd.—This company is winding up voluntarily, with Mr. W. G. Parratt, 163, Harringay Road. West Green, as liquidator.

Trade Announcements.—Messrs. William Sanders and Co., of Falcon Electrical Works, Ridding Lane, Wednesbury, writing to us with reference to a recent registration of a company named "Wm. Sanders & Co., 1915, Ltd.," desire it to be known that this has no connection with themselves, as their firm is, and always has been, a private one.

For family reasons, the business of Messrs. McKechnie Bros., copper smelters, &c., of Birmingham, has been converted into a private limited company as McKechnie Brothers, Ltd. The general management will remain as heretofore.

Book Notices.—"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIV, No. 11. November, 1915. New York: The Institute.

"Examples in Alternating Currents." Vol. I. By Prof. F. E. Austin. Hanover, N.H., U.S.A.: F. E. Austin. Price $2.40.

"Science Abstracts," A and B. Vol. XVIII. Part 2. November 25th, 1915. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"*Journal* of the Institution of Electrical Engineers." Vol. LIV, No. 251. London: E. & F. N. Spon, Ltd. Price 3s. 6d. The issue for December contains the following papers:—"A New High-Efficiency Incandescent Lamp," by E. A. Gimingham and S. R. Mullard; "The Higher Harmonics in Oscillograms," by Prof. G. W. O. Howe; "A Mode of Studying Damped Oscillations," by Prof. D. Robertson; "The Magnetic Testing of Bars of Straight or Curved Form," by A. Campbell and D. W. Dye; "Armature Copper Losses in Rotary Converters and Double-Current Generators," by L. H. A. Carr; "The Production and Properties of Electrolytic Copper," by B. Welbourn; and the Inaugural Addresses of the President, Mr. C. P. Sparks, and Messrs. D. A. Starr, D. E. Roberts, and W. L. Carter.

Fire.—A fire occurred on Saturday at the premises of Messrs. Howell & Co., electrical engineers, of Lichfield Street, Hanley. Part of the premises was gutted, and the damage done is estimated at between £2,000 and £3,000.

For Sale.—The Leeds Corporation Tramways Committee has for disposal six Lancashire boilers, with mechanical stokers, superheaters, &c. The Manchester Ship Canal Co. has for disposal two Lancashire boilers, one set of triple-expansion vertical condensing engines, four pneumatic pumps, and 440 ft. of pipe. Particulars are given in our advertisement pages to-day.

A German Trust.—The Central News says that "An Electrical Works Trust has been established in Berlin, to which the greater number of the big companies belong." Absence of fuller information leaves us in doubt as to whether this indicates any alteration in a state of affairs that has long existed.

Board of Trade Inquiries.—South Africa.—A Johannesburg agent wishes to obtain agencies of United Kingdom manufacturers of electrical fittings, wire, and sundries. Manufacturers can obtain his name and address by applying to the Board of Trade Commercial Intelligence Branch, 73, Basinghall Street, E.C.

Electric Lamp Renewals.—The method employed by the Allies Electric Lamp Co., Ltd., of Montgomery St., Hammersmith, W., for repairing electric lamps, is to cut the bulb just below the shoulder, renewing the hooks and filament, and welding the glass together again.

New Lamp Factory in Spain.—It is reported that a new factory for the manufacture of metal-filament incandescent lamps is about to be established in Madrid.

LIGHTING AND POWER NOTES.

Atherton.—Price Increase.—The charges for electrical energy for power, heating and cooking purposes are to be increased from January 1st as follows:—To consumers purchasing energy at a price not exceeding ·625d. per unit, 20 per cent.; to consumers purchasing energy at a price above ·625d. per unit, 10 per cent.

Australia.—The Williamstown T.C. (Vic.) is borrowing £20,000 for the installation of electric light and for drainage purposes.

The Blue Mountains (N.S.W.) Council proposes borrowing £25,000 to install electric light in the towns of Lawson, Blackheath, Springwood, Mount Victoria, and Medlow.

The Queensland Government has appointed Mr. W. Corrin, chief electrical engineer of the New South Wales public works department, to prepare a scheme for the establishment of an electric power station at Ipswich, to supply power and light for Ipswich and Brisbane and the neighbouring localities. It is expected that the Government and the railway department will co-operate in the carrying out of the scheme.

The Wangarratta (Vic.) Council has applied for an order in Council for the supply of electric lighting; the Kyneton (Vic.) Council has also applied for an order to install electric light at Trentham.—*Tenders.*

The Melbourne City Council has had under consideration a resolution, the object of which is to encourage the installation of electric lighting and heating and power in city buildings, thereby increasing the business of the Council's electric supply department, and is to the effect that the initial cost of installing electric current in any premises within the city should be advanced by the Council, if and when desired by any owner, such owner to guarantee repayment in 30 monthly instalments, bearing interest, and that steps be taken to give effect to this. It is stated that only 25 per cent. of the buildings in the city are equipped with the electric light, the main reason being that the owners or lessees are not prepared to scrap their gas fittings and incur an immediate expense ranging from £30 or £40 upwards. The matter was referred to the E.L. Committee for report.—*Melbourne Age.*

Belfast.—Owing to the Treasury having refused to sanction the raising of loans by the Corporation for the purpose of providing electric service mains and meters to consumers, no further applications for electricity, involving this class of expenditure, can be acceded to.

Bispham.—Street Lighting.—The U.D.C. has agreed upon a modified scheme of electric lighting for the district, the electrical engineer having received the necessary instructions.

Bungay.—E.L. Scheme.—The U.D.C. has appointed a Committee to meet Mr. Best, of Bradford, with respect to an E.L. scheme for the district submitted by him. The clerk has obtained information from places where Mr. Best has carried out schemes.

Carmarthen.—The T.C. has considered an application from the Carmarthen Electric Supply Co., Ltd., for consent to increase the price of current to all customers by 10 per cent., owing to the increased cost of labour, &c. The company entered, five years ago, into a 14 years' contract for public lighting, and a clause stipulated that the charge to private consumers should not exceed 5d. per unit. The application was refused.

Dublin.—Sub-Station Explosion.—A violent explosion occurred on Saturday morning at the Corporation electricity sub-station at the corner of Forbes Street and Sir John Rogerson's Quay, which resulted in blowing out all four side walls, although these were 2½ ft. thick. The oil tanks and switches were enveloped in flames, which were extinguished by the fire brigade. Although the cause of the explosion is unknown, it is conjectured that it may have arisen from accumulated gas or benzole, the gasworks being close by.

Edinburgh.—The Electric Lighting Committee of the T.C. reports that the total applications for supply for the year, from May 15th, number 53,251 equivalent 8-c.p. lamps.

The Committee has had under consideration the question of enlistment of men, in connection with the steps to be taken before the Recruiting Tribunal to get men exempted who are considered indispensable to carry on the undertaking. It was pointed out that men required to get themselves attested as a preliminary to their application for exemption, and the engineer was instructed to lay the matter before the men of enlistable age.

Gravesend.—Year's Working.—The report of Mr. McInnes, the borough electrical engineer, on the last completed year of working of the Corporation electricity undertaking, shows that 2,114,056 units were generated, and 1,570,895 sold (as against 1,441,482 in the previous year); of this amount 345,327 units were supplied to Northfleet and 342,775 units to the Gravesend and Northfleet Tramways Co. In view of the demands of large factories in the district, the power station equipment has been increased by the addition of a 1,000-kw., 6,600-volt, 50-cycle turbo-alternator, motor converters, and the necessary switchgear, &c., and H.T. feeders have been laid to the Rosherville sub-station, where a motor converter has also been installed. Before long a supply will probably be given in Swanscombe and Denton. Despite the effect of the restricted lighting orders, the engineer remarks that the output in September, 1915, was very considerably in excess of pre-war figures. The result of the year's working at Gravesend was a surplus of £827, which was transferred to capital account, while the Northfleet undertaking also realised a small surplus on the year.

Liverpool.—Price Increase.—The Electricity Committee proposes, owing to the increased cost of fuel, to increase the charges for electricity for lighting, power and other purposes by 12½ per cent., except in certain special cases.

London. — Hackney. — Linking-up Scheme. — The Electricity Committee recommends that, subject to the Poplar B.C. agreeing to the terms, and to the approval of the B. of T. being obtained, steps be at once taken to proceed with the linking-up of the Council's electricity undertaking with that of the Poplar Council, and that the necessary mains and switchgear be provided, at an estimated cost of £3,000; also that an additional E.H.T. switch panel should be erected with the three now in hand, at a cost of £417. This will enable the old engine room to receive the proposed supply when required, and the undertaking will be provided with a complete spare panel, which could be used for any other purpose in emergency.

Manchester.—Condensing Water Project. — The Corporation Rivers Committee has forwarded to the Finance Committee a recommendation for the expenditure of a sum of about £50,000 on the provision of tanks at the Davyhulme sewage works, in connection with the scheme for providing cooling water for the purposes of the electricity department.

Mutford and Lothingland.—Overhead Mains.—The Oulton Broad Electricity Co., Ltd., has asked the R.D.C. to sanction the erection of overhead mains, and also to sanction any further extensions that it might be found desirable to execute within the Council's area from time to time. The Council has agreed to the mains, but has declined to sanction any further undefined extension.

New Zealand.—In November last year, the Lake Coleridge hydro-electric scheme was formally opened, but it was not until March of this year that the service came into full continuous operation; since then the plant has worked smoothly and efficiently without serious interruption, and it is stated that the undertaking shows every promise of becoming a financial as well as an engineering success. The three units of generating plant now installed equal 6,000 H.P.; and the present demand, added to that in prospect, for which contracts have already been arranged, calls for the immediate installation of a fourth unit of 2,000 H.P., and there are indications that two further units of generating plant will have to be provided in the not distant future. The tunnel and headworks are sufficient to provide for probable expansion during the next six or seven years, when it is expected that the output will adequately supply the district which can be economically served from the Lake Coleridge scheme. The existing pipe-lines are of sufficient capacity to drive the fourth unit of machinery now on order, and the power house can accommodate this unit without additions. The total expenditure on this scheme from its inception to March 31st last was £262,034, and the installation of the fourth unit is expected to place the business on a footing where interest on capital, maintenance, depreciation, and working expenses will all be defrayed out of revenue. —*Otago Witness.*

E.L. Purchase.—The Timaru Council has decided to purchase from Messrs. Scott Bros. the electric lighting and power plant which supplies the town, and is obtaining a loan of £50,000 to complete the purchase and make necessary additions.

Portaferry (Co. Down).—Messrs. T. Somerville and Co., who supply electric light to the town, are charging only 6d. per week per light to tenants of small houses and labourers' cottages, the installations being made free of charge.

Rotherham.—The R.D.C. has consented to the erection of an overhead transmission line by the Curton Wood Colliery Co. from Brampton Bierlow to Wontworth.

Scottish Power Proposal.—It is proposed to utilise the water power of Loch Awe in the Scottish Highlands to secure electric power for steel works to be established in that district. Immediate steps are being taken to obtain a provisional order with this object in view. Loch Awe extends to 14½ square miles, with a catchment area of 300 square miles. The works will embrace a dam across the River Awe; an open canal, and steel pipes will lead the necessary water to the power house. The energy generated is to be transmitted by overhead lines to the site of the proposed works at North Connel. The cables cross Loch Etive, near Island Ferry, and follow a course along the hillside. The level of Loch Awe will be very considerably raised. At the new steel works at Loch Connel, where the process will be entirely electrical, there is both sea and rail communication. The chairman of the new company is Mr. J. Campbell Robertson.

Shipley.—Financial Result.—For the year ended March 31st last there was a loss of £404 on the electricity undertaking. This has been met out of reserve, leaving a balance of £719 to carry forward.

Stalybridge. — Price Increase.—The Generating Station Committee of the Joint Board has passed a resolution to the effect that all power consumers paying less than 1d. per unit be charged an additional 0·1d. per unit to cover the extra cost of coal, instead of the additional 10 per cent. charged at present. The alteration will take effect at the beginning of the New Year. The Committee has also decided that it cannot take on any additional large power consumers.

Stoke-on-Trent.—The Finance Committee of the T.C. has expressed the opinion that in the event of the additions at the Burslem Works being essential, the cost should be charged to the revenue account, and not to the capital account, as suggested by the Electricity Supply Committee.

TRAMWAY and RAILWAY NOTES.

Blackpool.—War Bonus.—The Corporation employés have accepted the terms offered by the Sub-Committee, *i.e.*, a war bonus of 2s. to those earning up to 30s., and 1s. for from 30s. to 35s. weekly, overtime not being taken into account.

The Tramways Committee has decided to curtail the night service. The total receipts from the beginning of the financial year (April 1st) to November 18th, on the Blackpool system, were £64,925, or £1,449 more than at the corresponding date last year. Considering there has been a decrease of nearly 29,000 miles in the aggregate car-mileage, the receipts are regarded as satisfactory.

From a report of Mr. Chas. Furness, the tramway manager, on the question of contracts, it appears there are only two other places in the country where tramway contracts are obtainable—Aberdeen and Lancaster. At Lancaster there are 232 contractors, and there is an annual loss to the tramways of nearly £2,000 a year. At Aberdeen there are about 1,000 contractors, paying an average of £3 4s. per annum each, against 1,466 contract-holders at Blackpool paying an average of £2 17s. each. In the Scotch town the sectional contracts are £2 10s. for the first 700 yards, and 2s. per annum for every additional 100 yards. Thus for £3 (the old contract rate for Blackpool) Aberdeen people could only travel on a 1,200 yards' section, while £6 1s. a year is charged for a length equivalent to Blackpool's Promenade.

Bradford.—Female Labour.—A special meeting of the Tramways Committee has considered a report of Mr. C. J. Spencer, the general manager, with regard to the effect of recruiting and the shortage of labour on the tramway system. Mr. Spencer reported that the present staff of 1,281 employés was absolutely necessary to maintain the present services; of that total 818 were of military age, and 151 were unmarried. He also referred to the difficulties experienced in replacing labour by men of non-military age. He considered that the peculiar conditions of Bradford were against the employment of female conductors, and that females as drivers were out of the question. The only alternative he could suggest was the one of very greatly curtailing the services. After discussing the report, the Committee decided that it was not desirable to employ women as conductors owing to the conditions existing in Bradford, and instructed the manager to draw up a report on the question of employing men who were unfit for military service, and also to consider a system of issuing tickets for the public to avoid the collection of fares on the cars.—*Leeds Mercury.*

Colne.—War Bonus.—The Council has considered a request from the Association of Tramway Workers for an advance in wages of 15 per cent., and has decided to offer an advance of 5 per cent. as a war bonus, to commence on January 1st and to cease 13 weeks from the declaration of peace.

Continental.—Spain.—Plans are being prepared in respect of a projected electric tramway in the town of Tortosa.

Dundee.—In asking for licences for a number of car conductors, the tramway manager stated that within a few days 41 men had left; he also pointed out that new men were resigning because they would not stand the criticisms of the townspeople, who apparently make no allowance for the lack of training of the new men, although the latter are temporarily filling the places of men required at the Front.

Edinburgh.—The Tramways Committee has decided to call the attention of the directors of the Tramway Co. to the frequency of the breakdowns on the system.

It is reported that the Tramway Co. has agreed to state a price at which it would be willing to sell the rolling stock, &c., to the Corporation, in view of the latter taking over the system on the expiration of the lease in June, 1919. Whatever the decision in regard to conversion to electrical working, the Corporation will require to work the present cable system for a time, and at June, 1919, there will still be a debt on the latter of over £300,000.

London.—The electric train service of the L.B. & S.C.R. was very much disorganised on Monday, owing to the derailment of an electric train at London Bridge Station.

Manchester.—The war bonus of 2s. paid to men guards is to be paid to women guards after three months' satisfactory service. Up to November 23rd, 2,107 men from the tramway department had joined the Colours, and payments made to them or their dependents are at the rate of £72,000 per annum. It is estimated that if all the available single and married men of military age employed by the tramway department join the Colours the cost to the department will be well over £100,000 per annum. The Tramways Committee has decided that men in the service of the department desiring to enlist must do so under the "group" system. The Treasury has sanctioned expenditure by the Tramways Committee on street improvement and the doubling of short lengths of tramways.

Northenden.—The Parish Council was informed last week that the Manchester Corporation had applied to the B. of T. for an extension of time to August, 1917, for the completion of the tramways and the compulsory purchase of land for street widening.

Normanton.—Tramway Track Maintenance.—At a joint meeting of representatives of the Councils of Normanton, Whitwood, Glass Houghton and Pontefract, it was decided to make representations to the B. of T. with regard to the condition of the tramway track between Normanton and Pontefract.

Reading. — Female Labour. — Women are now employed as conductors and inspectors on the Corporation tramways.

Salford.—The Tramways Committee has decided as an experiment, to allow a limited number of the wounded soldiers to travel free on the cars, for one month. This period, if the privilege is appreciated, will probably be extended. Other tramway Committees in South-East Lancashire have under consideration the granting of similar privileges.

South-Western Railway Electrification.—The proposed electric service on the Kingston "roundabout" line has been again postponed owing to an application to the Court by the Postmaster-General on Saturday, in connection with alleged interference with the telephone circuits in the neighbourhood of one of the sections which has recently been electrified. It is hoped that the service will be running before the end of the year.

Sunderland.—Female Labour.—The employment of female ticket inspectors on the Corporation tramways has been commenced.

Swansea. — Tramway Extensions.—The T.C. has applied to the B. of T. for an extension of time to February 28th, 1917, for the compulsory purchase of land required for tramway extensions.

TELEGRAPH and TELEPHONE NOTES.

A Swedish Telautograph.—A new telautograph, or telewriter, an instrument for the telegraphic transmission of ordinary handwriting, has just been invented by two Swedish engineers. The apparatus differs entirely from the fundamental principles of other telautographs. The most characteristic feature of the apparatus seems to be that it can be used independently of the electrical resistance of the line. It can be connected alternately to a long or short line without any adjustment of the resistance, and used in connection with public telephone systems.—*T. and T. Age.*

Australia.—The Federal Public Works Committee has considered the expenditure of £114,000 on an automatic telephone exchange for Sydney.

Automatic Telephony in Chicago.—Mr. K. B. Miller, the well-known telephone authority, who was authorised by the Chicago City Council to investigate the automatic telephone situation in that city, states that the problem resolves itself into a choice between two courses:

(*a*) To take the property for forfeiture and dispose of it for cash;

(*b*) To permit the sale of the property to the American Telephone and Telegraph Co.

Mr. Miller concludes that any attempt to continue the operation of the automatic system as a competing enterprise, either under city or private control, and either with or without interconnection with the system of the Chicago Telephone Co., will not be conducive to better or cheaper telephone service in Chicago. It will tend to lower the possible standard of service, raise the cost of service, and will, in all probability, cause the loss of large sums of money, failing for lack of public support.—*T. and T. Age.*

The Council decided to sequestrate the property some months ago because the company had not 20,000 *bonâ fide* subscribers, as required by its franchise.

Brighton.—Former users of the municipal telephone system have hitherto been allowed to retain their unlimited service at the old price (£5 10s.), whereas others had to pay £10 a year. Under the War Budget increases, the Post Office proposes to charge all unlimited-service subscribers £12, and the Brighton and Hove Telephone Advisory Committee is sending a deputation, in conjunction with Glasgow and Portsmouth, which are similarly affected, to wait upon the Postmaster-General with a view to securing better terms. Users of private telephones, over which no business is transacted, can retain them at £8 a year, and the measured-rate service is also available.

Code Telegrams.—The existence of another secret code in "plain language" was brought to light in the Glasgow Sheriff Court on Monday, when the proprietors and editor of the Glasgow *Daily Record and Mail* were charged with the possession of a cipher code not intended and used solely for commercial or other legitimate purposes. The code was to be used to place the *Record* in possession of information earlier than the news could be transmitted at Press rates.

Hull.—The Corporation telephone employés have sent in a petition for a weekly war bonus on the same terms as those granted to Post Office employés. They demand that the increased bonus shall be paid within seven days, and that it shall date from last March. The Corporation, in granting a 2s. bonus to all departments, included the telephone employés, but this bonus is 1s. less than that granted by the Government. A large proportion of the Corporation telephone staff was taken over from the Post Office, and they declare that they mean to enforce the demand for the extra shilling.—*Standard.*

The World's Wireless Stations.—The International Telegraph Bureau of Berne recently published statistics in relation to the situation of wireless telegraphy throughout the world on April 1st, 1915. According to the figures, the first position in the case of coast stations is occupied by the United States with 140 stations; the second place is held by Great Britain with 61; Canada ranks third with 47; Italy fourth with 37, and Russia fifth with 32; Alaska has 29; Brazil, 28; Spain, 21; Australia, 20; France and Germany, 18 each; Japan, 11; Austria-Hungary, 4; and China, 3 coast stations. As, however, the principal importance of wireless telegraphy relates to intercommunication between ships and between vessels and coast stations, the position of affairs assumes a different aspect as regards the ship installations of individual countries. On this point, the statistics give the following figures for the countries mentioned:—

Number of Ship Installations.

Great Britain	1,568	Austria-Hungary ...	101
United States	967	Japan	96
Germany	537	Brazil	65
France	357	Spain	79
Italy	125	Australia	64
Holland (6 coast stations)	122	Norway (6 coast stations)	85
Russia	119	Argentina (12 " ")	88

The statistics show a total of 706 coast stations and 4,846 ship stations. The Marconi system is credited with being used at 225 land stations and 1,894 ship stations, and the Telefunken system at 150 land and 807 ship stations.

CONTRACTS OPEN and CLOSED.

OPEN.

Athy.—December 6th. U.D.C. Tenders are invited for lighting the town with electricity. Particulars from Mr. J. A. Lawler, Town Clerk.

Australia.—ADELAIDE.—January 19th. P.M.G. Common-battery switchboard. See "Official Notices" November 19th.*

January 26th. Deputy P.M.G. Twenty tons of galvanised-iron wire, 400 lb. to the mile.*

BRISBANE.—P.M.G. January 26th.—Galvanised-iron wire. December 1st.—Measuring instruments. January 5th.—Jointing sleeves and copper-clad steel wire. See "Official Notices" November 19th.

January 26th. Deputy P.M.G. Telephone instruments, parts and accessories.*

SYDNEY.—December 20th. Metropolitan Board of Water Supply and Sewerage. Three centrifugal pumps and electric motors, with switchboards, starters, &c., for the pumping station at Marrickville, N.S.W. Deposit £10. Tenders to the Board, at 341, Pitt Street, Sydney, N.S.W.*

January 31st, 1916. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

February 28th, 1916. Municipal Council. Tenders for induction regulators. Specifications (11s. 6d.) from the Electric Light Department, Town Hall, Sydney.

MELBOURNE.—January 4th. P.M.G. Electric measuring instruments, telephone parts, and automatic common-battery telephones.*

Beckenham.—December 12th. U.D.C. 2,000 tons of Midland slack coal (100 tons per week from January 1st, 1916), for the Electricity Department. See "Official Notices" to-day.

Durham.—December 10th. Twelve months' supply of electrical fittings, for the Trimdon Grange Colliery Co. Storekeeper, Trimdon Grange Colliery Co. (Co. Durham).

London.—December 9th. H.M. Commissioners of Works. Twelve months' supply of electric cable and wire. See "Official Notices" to-day.

WEST HAM.—December 16th. Three months' supply of electrical fittings, for the B. of G. Forms of tender from Mr. T. Smith, Clerk, Union Road, Leytonstone, N.E.

Manchester.—December 6th. Steelwork and foundations for new boiler house; also foundations for cooling towers at Stuart Street station. Messrs. C. S. Allott & Son, Civil Engineers, Brown Street, Manchester.

New Zealand.—WELLINGTON.—December 8th. Public Service Stores Tender Board. 6,700 telephone cords, 120 miles win-twisted rubber-insulated wire.*

South Africa.—DURBAN.—January 5th. Corporation Telephone Department. (1) Telephone apparatus and materials; 2) underground cables; (3) 540 c.i. pipes, 9 ft. long, for cables. Messrs. Webster Steel & Co., 5, East India Avenue, E.C., are the Corporation's London agents.*

Spain.—December 8th. Municipal authorities of Piedrahita. Concession for the electric lighting of the town during a period of ten years.

Tenders have just been invited by the municipal authorities of Santa Coloma de Farnes (Province of Gerona) for the concession or the electric lighting of the town during a period of ten years.

Walthamstow.—December 15th. U.D.C. Supply of ow-tension cable, for the Electricity Department. See "Official Notices" to-day.

Specifications for the items marked * can be seen at the Board f Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—TASMANIA.—The tender of the British eneral Electric Co. has been accepted by the Public Works epartment for power plant at the Mental Diseases Hospital, New orfolk, at £2,347; and that of Messrs. A. J. Todd & Co. for electric lighting installation and overhead equipment, at £435.

The following contracts have been placed by the Victorian Railays Department:—

Electric lighting material for the Jolimont car-repair shop.—Siemens Bros. Dynamo Works, Ltd.; B.I. & Helsby Cables, Ltd.; Aust. General Electric Co.

One 5-ton electric crane, £1,187.—Babcock & Wilcox, Ltd.

Motor-generator, switchboard and accessories, for battery-charging at Jolimont repair shop, £266.—Lascelles Parrington. —*Tenders.*

Manchester.—The Tramways Committee has accepted e tender of Messrs. F. Smith & Co. for copper trolley wire, and at of Messrs. Edgar Allen & Co., Ltd., for special trackwork, int tongues and crossings. The Electricity Committee has cepted the following tenders:—

Cable.—Western Electric Co., Ltd.

Asphalt troughing.—Howard Asphalt Troughing Co., Ltd.

One 5,000/6,000-KW. turbo-alternator.—B.W. Electric & Mfg. Co., Ltd.

One 5,000-KW. high-pressure turbine.—James Howden & Co., Ltd.

Salford.—The Electricity Committee has accepted the tender of Newall's Insulation Co., Ltd., for covering with composition various lengths of steam piping at the generating station, for £33 10s. Mr. J. Heaton, of Ramsbottom, is to supply during the next six weeks 300 tons of Garswood slack, at 15s. 3d. per ton, and 300 tons of Brodsworth slack, at 15s. 9d. per ton, with an extra charge not exceeding 1s. 3d. per ton for cartage to the generating station.

FORTHCOMING EVENTS.

University College, London.—Fridays, December 3rd and 10th. At 5 p.m. Fifth and sixth lectures on "Electric Heating and Electric Furnaces," by Prof. J. A. Fleming, F.R.S.

Salford Technical and Engineering Association.—Saturday, December 4th. Visit to the Salford Corporation Cleansing and Flag-Making Department, Langley Road Depôt, and Annual Meeting.

Royal Society of Arts.—Monday, December 6th. At 4.30 p.m. At John Street, Adelphi. Cantor Lecture, on "Optical Glass" (Lecture II), by Dr. W. Rosenhain, F.R.S.

Wednesday, December 8th. At 4.30 p.m. Paper on "The Art of Finding Your Way at Night Without a Compass," by Lieut.-Col. W. A. Tilney, late 17th Lancers.

Rontgen Society.—Tuesday, December 7th. At 8.15. At the I.E.E., Victoria Embankment, W.C. Papers on "Some Remarks on Fluorescent and Intensifying Screens," by Mr. L. A. Levy; and "Further Notes on Localisation," by Mr. G. G. Blake.

Institution of Electrical Engineers (Yorkshire Local Section).—Wednesday, December 8th. At 7 p.m. At the Philosophical Hall, Leeds. Paper on "Some Difficulties of Design of High-Speed Generators," by Prof. A. B. Field.

(Students' Section).—Thursday, December 9th. At 7.45 p.m. Address on "The Institution," by Mr. J. E. Kingsbury, Hon. Treasurer.

Association of Engineers-in-Charge.—Wednesday, December 8th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Ammunition Manufacture," by Mr. A. E. Penn.

Faraday Society.—On Wednesday, December 8th. At 8 p.m. At the Institution of Electrical Engineers, Victoria Embankment, W.C. General Discussion on "The Corrosion of Metals."

Greenock Electrical Society.—Friday, December 10th. At 7.45 p.m. At Temperance Institute, 19, West Stewart Street. Paper on "Electric Tramways," by Mr. J. Punch.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 11th. At 2 p.m. At Neville Hall, Newcastle. General Meeting.

NOTES.

Electrical Vehicle Committee.—A letter, of which the following is an abstract, has recently been widely circulated amongst the heads of municipal departments by the E.V. Committee, through its honorary secretary, Mr. Frank Ayton:—"The Manchester Corporation have recently served notices upon a large number of owners and tenants in the city to abate an alleged nuisance by discontinuing to keep horses on their premises. It is likely that this commendable action by the Sanitary Committee of the Manchester Corporation will be followed by other progressive cities and towns, since it is admitted by all who are qualified to give an opinion that the presence of stables in urban areas is harmful to the public health.

"If horses are to be displaced in this way, motor traction in some form will have to be adopted.

"From the standpoint of public health, the petrol vehicle is also most objectionable, owing to the noxious gases emitted by the exhaust and also to the nerve-racking noises caused by the engine and gears, especially at central garages. On the other hand, the electric battery vehicle is in every way an ideal vehicle for town use.

"My Committee, therefore, suggest that municipalities should make special efforts to encourage the use of the electric battery vehicle in the areas under their control. The most convincing way of doing this is to set the example by using such vehicles for municipal work, such as watering roadways, scavenging, house refuse removal, cartage of road and other materials, ambulance work, fire brigade work, cartage of coal and ashes, as well as for passenger transportation by means of electric battery omnibuses. Smaller electric vehicles can also be used to advantage for the transportation of officials in the performance of their duties.

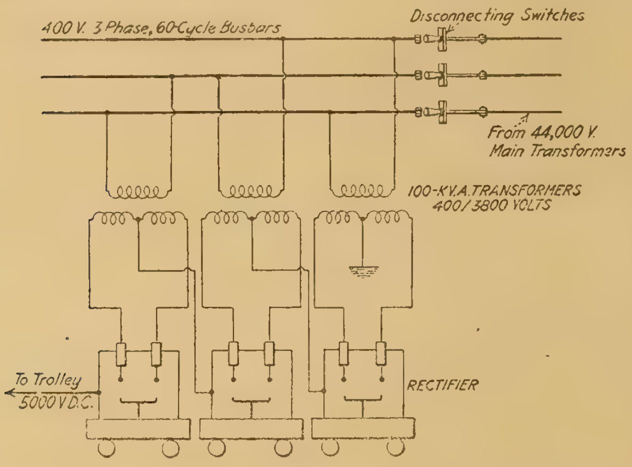
"Not only will the adoption and use of electric vehicles in these directions gradually have the effect of doing away with stables, but it will, in addition, bring a handsome revenue to the electric supply undertaking which nearly every municipality nowadays owns.

"My Committee wish particularly to emphasise the point that there is nothing experimental about the modern electric vehicle."

Dublin Electrical Dispute.—The Right Hon. T. L. O'Shaughnessy, Recorder of Dublin, sat in his Chambers at Green Street Courthouse, as arbitrator in the dispute between Dublin master electricians and their men. The latter, who had been on strike on the question of wages for some time past, had returned to work pending his Lordship's decision. After lengthened and careful consideration, the Recorder decided that the men should be granted ½d. per hour, their wages being raised from 9¼d. to 9¾d per hour. He also decided that those engaged on War Office work should be granted a bonus of 6d. per day. The men's demand was for 11d. per hour, apart from war bonus.

Direct-Current 5,000-volt Railway Operation.—In the use of direct current for electric railways the trolley voltage of 600, so long considered the limit, has, during the past few years, increased to 1,200, then to 1,500 volts for interurban service, and 2,400 volts for heavy electric traction. A further step in increasing the voltage was the electrification of the Chicago, Milwaukee and St. Paul Railway at a trolley voltage of 3,000. Now, however, we have 5,000-volt direct current for interurban work, which has been in use since June 1st on an experimental line of the Michigan Traction Co.; this important advance has been rendered possible through the co-operation of the company's engineers with those of the Westinghouse Co., who worked out the details of the equipment.

Direct current at 5,000 volts is obtained from steel-tank mercury-vapour converters having their alternating-current terminals connected one set to each phase of the 400-volt three-phase 60-cycle bus-bars and the direct-current terminals connected in series, as shown in the diagram. This installation is the first in which mercury-vapour converters have been connected in this way to a three-phase circuit, or have been used to produce so high a direct-current voltage. It is also the first case in which converters of the steel-tank type have been operated on 60 cycles.


400 V. 3 Phase, 60-Cycle Busbars
Disconnecting Switches
From 44,000 V. Main Transformers
100-KV.A. TRANSFORMERS 400/3800 VOLTS
To Trolley 5000 V D.C.
RECTIFIER

The car equipment consists of four motors, each rated at 100 H.P., 2,400 volts, connected two in series for operating on 5,000 volts. The use of such a high voltage as 2,500 at the terminals of each motor is made possible by the fact that they are of the double-armature type, in which each field frame contains two separate armatures with independent pinions meshing with a common gear. While the voltage at the terminals of the motor is 2,500, that at any commutator is limited to 1,250.

It has been found in practice that the flashing at the switches on this car, with 5,000 volts on the trolley, is notably less than when a 600-volt car is handled in the same way. This is due to the extremely small current required.—*Power.*

Value of Clean Bottles for Sampling Transformer Oil.—The insulation strength of the oil in all transformers used on circuits operated above 6,600 volts in the system of the Georgia Railway and Power Co., Atlanta, Ga., is tested once each month. When the oil shows an insulation strength lower than 40,000 volts it is filtered and tested until this strength is secured. It is well known that a small amount of moisture in oil greatly reduces the dielectric strength, and inasmuch as a small sample must be taken for test, it has been found that extreme care must be exercised to secure the sample and deliver it to the test room in the same state as that in which it is found in the transformer case. To make this possible a specially prepared 4-oz. sample bottle is furnished to station operators for delivering the monthly samples for test. These bottles are prepared by washing and rinsing in gasoline; they are then dried and the corks inserted. The cork and mouth of the bottle are then dipped in heated paraffin, which seals the bottle air-tight.

The value of this precaution was recently shown when a new attendant who did not believe in the value of the prepared bottle sampled the oil from a transformer and delivered it in a used bottle to the test room. The oil punctured at 32,000 volts, and was ordered to be filtered. The attendant secured a new sample of the oil and delivered it in a specially prepared sample bottle, when it tested at 42,000 volts. This attendant now finds it easier to use the bottle than filter the oil.

About 0·04 per cent. of water will reduce the dielectric strength of oil to about 10,000 volts, the curve of decrease being very steep up to about 0·80 per cent., when the dielectric strength decreases more slowly as water is added. The need in sampling oil of care such as that exercised in this case is therefore apparent, and the method used is a very simple one to eliminate errors in tests. —*Electrical World.*

Armature Repairs and Rewinding.—A "Reader of many years' standing" of this journal would be glad if any of our readers would give him information as regards the most suitable plant and instruments to be used in conjunction with the rewinding of A.C. and D.C. machines, also the approximate floor space required. The maximum size of armature would be 100 KW.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—Orders for Week commencing December 6th, 1915.—By Lieut.-Col. C. B. Clay, V.D., Commanding.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

Saturday, December 4th.—Parade in uniform at East Putney Station, at 2.45 p.m. See below.

Monday, December 6th.—Sections 1 and 2, Technical; Sections 3 and 4, Squad, Signalling Section and Recruits.

Tuesday, December 7th.—School of Arms with Architects' Corps, 6 to 8 p.m.

Thursday, December 9th.—Sections 1 and 2, Shooting.

Friday, December 10th.—Sections 3 and 4, Technical; Sections 1 and 2, Squad, Signalling Section and Recruits.

Saturday, December 11th.—Instruction Class at 2.30 p.m.

Sections for Technical Parade at Headquarters, London Electrical Engineers, 46, Regency Street, S.W.

Sections for Shooting Parade at Miniature Ranges.

Unless otherwise ordered, all Parades at Chester House.

Train on Saturday for East Putney on District Railway, leaves Mansion House Station at 2.22 p.m.

E. G. FLEMING,
Company Commander and Acting Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, December 2nd, 1915:—

Week-end Parades.—Saturday.—Field Operations. Parade at Baker Street Station at 2.30 p.m. Detailed instructions will be sent later to officers concerned. The Commandant's Class will parade in the ante-room of the Officers' Mess at 3.15 p.m.

Sunday.—7 a.m., Reveille; 10 a.m., Church Parade; 10.20 a.m., Parade under Company Commanders. The Battalion will parade at 2 p.m. and march to the Hendon Aerodrome, where a demonstration of flying will be witnessed, and it is hoped that a lecture will be given to the Corps.

Winter Quarters.—A voluntary fatigue party is required for work on the winter quarters on both Saturday and Sunday next, the 4th and 5th inst. Members offering their services for this duty will report to the Camp Quartermaster at Wembley Park, at 2.30 p.m. on Saturday and 10 a.m. on Sunday.

Musketry.—There will be no shooting at Acton on Saturday, the 4th inst.

Bisley.—The range will be open all day for members of the Corps. Names to be sent in to Headquarters, as usual. Members going down in the morning should report to Sergeant Cotter at the barrier of No. 9 Platform, Waterloo Station, at 9.15 a.m. Those unable to travel at that time should apply for travelling vouchers at Headquarters not later than 4 p.m. on Friday, the 3rd inst.

A. G. JOINER, *Major and Adjutant*, O.B.C.

What a Big Concern Can Do.—In the course of a recent address on "Modern Tendencies," Mr. T. N. Vail, president of the American Telephone and Telegraph Co., referred to the recent development of the telephone, culminating in trans-Continental telephony, and pointed out that this achievement would not have been possible except in the hands of a single concern with ample resources. In the same way wireless telephony has been developed by the Bell company until conversation has been made possible over a distance of 4,000 miles; this also could never have been accomplished by any number of small unassociated companies. Incidentally, Mr. Vail said: "Talking over the wireless is like talking in a boiler shop; earth currents and electrical disturbances which sweep through space are picked up by the wireless antennæ and translated into noise by the delicate receiving instruments. These storms are the *bête noire* of the wireless, whether telegraph or telephone, and for months at a time they will be so continuous and so serious as to make wireless communication over great distances impossible and over short distances extremely difficult There were the same difficulties in the early development of the telephone. The grounded telephone wires, acting as do the antennæ of the wireless station, picked up these same currents and translated them into noise. Some may remember that these noises in early telephone times made conversation always difficult and sometimes impossible. The noises caused by earth currents were gotten rid of by making the telephone circuit of two wires entirely insulated from the earth. The atmospheric disturbances still remained, but were neutralised by transposing the two wires or virtually twisting them, and in this way the regular telephone conversational current was given a noiseless path. What device will be possible to neutralise the effect of these electrical storm disturbances on the antennæ of the wireless is yet the problem of the future."—*Telegraph and Telephone Age.*

Lighting National Colours on Neutral Ships.—The proper lighting of the names and national colours of neutral ships is a matter of importance now that nights are long and dark, and occasional U-boats still seek anything which floats as prey. A satisfactory solution to the problem is easy where ships have electric lighting plant installed, and in other cases acetylene projectors are used successfully to illuminate those parts of the ships' sides on which name and flag are painted. According to *Schiffbau* a Scandinavian electric sign company is supplying luminous letters for mounting along the centre line of a vessel over its deck structures, so as to be visible on either bow. The bodywork of the letters is of strong zinc sheet, and the glass panels are reinforced by wire netting. Each letter stands about 1 metre high, and contains a 50-C.P. electric lamp or gas burner. The cost of each letter erected ready for use, is given at £3 6s. for electric light, and £4 8s. for gas. Tungsten lamps can be used in the electric lanterns

Maturing Wine by Electricity.—Some years ago we described an electrical process which had been tried in France for giving raw wine and spirits the properties they acquire by being kept for a number of years. According to the *Daily Mail*, it is claimed that a successful process has been devised by Prof. Charles Henry, who is able in a few minutes to convert whisky three years old into a mature whisky pronounced by experts to be at least 12 years old. Burgundy is already being ripened and matured by this process in France, and successful experiments have recently been made with beer and essential oils.

Electric Cooking in American Apartment Houses.—The *Electrical World* recently contained some interesting data on the subject of electric cooking in situations where it is used exclusively.

In a Buffalo apartment house 95 electric ranges are in daily use; data is given for four months during which time the number of families reporting increased from 23 to 44, and the average cost for lighting and cooking ranged from $2·31 to $2·51 per month. A single meter tariff was in use, the charge for the first 15 units being 7 cents per unit, next 30 units, 5 cents, and all over, 1½ cents per unit.

Figures for a tenant in an apartment house at Great Falls, Mont., show a monthly cost per person (seven in family) varying from $·26 to $·42, with electricity at 3 cents per unit; similar figures for a Great Falls residence (seven persons) show a monthly cost per person of from $·30 to $·49.

For families of three to six persons in Salt Lake City, the average cost per day per person varies from 1·3 to 3·3 cents, with energy at 3 cents per unit.

An instructive table giving data relating to four apartment house installations using 83 Simplex Heating Co.'s ranges, is as follows:—

Location.	KW.-hr. per person per day.	No. of ranges.	Rated load KW.	Maximum demand, KW.	Maximum load, rated load in per cent.
Worcester, Mass. ...	0·93	16	77	13·5	17·50
Great Falls, Mont	1·12	21	110·25	13·5	12·35
Salt Lake City, Utah	0·85	24	77	11·5	15·00
Anaconda, Mont. ...	0·97	22	92	—	—
Average... ...	0·96	—	—	12·8	15

The data given are sufficient to enable conclusions to be drawn as to average results in American practice.

British Association, 1916.—At a meeting held on November 24th, the Newcastle-on-Tyne City Council formally resolved to invite the B.A. to meet there next year on lines similar to those adopted at Manchester this year.

Russia's Proposed Electricity Tax.—A Congress has been held on the proposed taxation of electricity in Russia. Mr. A. J. Nikolaienko, Temporary Director of the Ministry of Finance, who presided, spoke briefly on the history of the proposition. The meeting had before it the *projet de loi*, prepared by the Chief Department of Indirect Taxes, with an explanatory report. On the question of the desirability of taxing electric current, the representatives of electrotechnical science and industry observed that in view of the necessity to obtain money they were prepared to recognise the taxation of current required for lighting. Some of them agreed also to taxation of power for tramway systems, but in the case of current for industrial purposes, it was considered that such a tax might be a burden, both for the existing electrical industry and for the industries themselves that used the current as a motive power. The Director of the Chief Department of Indirect Taxes, S. S. Chripunoff, said that the *projet de loi* empowers the Ministry of Finance to reduce the rate, or even to grant complete exemption in suitable cases where the imposition of a tax would be burdensome. Prof. P. P. Migulin said that to tax electrical energy was necessary from a financial point of view, the more so that this tax did not so much affect the industry itself as the consumers. Prof. M. I. Bogoliepoff said that at present this question should be decided from another point of view. The country was on the eve of the introduction of new taxes, and there was no free choice. The whole question resolved itself into this—could they stand a new tax or could they not? The meeting had not discovered anything contrary to the latter. Referring to the effort in England, where similar taxes were always considered in the light of the necessities of industry, Prof. M. I. Bogoliepoff further observed that in the new taxes recently introduced into England for a colossal sum, the Chancellor of the Exchequer had said that at a certain point it was impossible not to ignore the fact that a certain amount of injury accompanied the operation of taxes on industry. In England they did not hesitate to tax motor spirit; that was to say, in a certain case they taxed motor power, and in the motives and measures of the English fiscal policy they might find pointers for Russia, whose financial needs were considerably greater than those of England. In further discussion, the question of the technical effects or otherwise of a tax were comprehensively considered, and a further consideration was given to the proposed statutes regulating the new tax, and several changes were made in the text of the *projet de loi*.

Nearly a "Dead" Short-Circuit.—A street-railway inspector was testing some trolley insulators suspected of being defective in their insulating qualities. The test was made in a car barn with a wooden floor by placing each insulator in series with a voltmeter, and from the reading and known resistance of the voltmeter the calculation was made. A file was used to clean the metal work so that a good contact could be made. The inspector held the trolley connecting wire and touched it against the insulators as the case required, while his helper held the ground wire, and being well insulated on the wooden floor, there was little danger. The tests were going along beautifully until the inspector failing to reach the file, the helper picked it up and handed it to him. The next second, both were flat on their backs wondering what had hit them. In passing the file (which had no handle) they had connected themselves across the 500-volt direct-current circuit. The rest of the tests were conducted on the "safety-first" principle.—A. P. Connor, in *Power*.

Estimating Distance at Sea.—In *Nature*, last week, an ingenious method of estimating distance at sea in fog or thick weather, devised by Prof. J. Joly, was described in the course of a report of the proceedings of the Royal Society. The method is based upon the different velocities of disturbances in different media. If aerial and submarine signals are simultaneously emitted at a lighthouse station or lightship, the lag of the aerial compared with the submarine sound is about 4·3 seconds to the nautical mile. An approaching ship picking up the signals and measuring the lag to an error even of one second, becomes aware of her distance to less than one-quarter of a mile. Similarly, wireless signals and submarine signals, or wireless and aerial signals, may be used. If the faster-moving signals be sent out in groups, the individual signals being spaced at regular intervals—say, of one second—and the slower moving signal be always emitted simultaneously with the first signal of a group, the navigator has only to count the faster signals until the slower signal reaches him, in order to estimate his distance from the signal station. In this case the signals themselves tell him his distance, and no actual time measurements are required on board ship. If vessels possess the means of emitting a loud and crisp sound signal which can be sent out simultaneously with a wireless or a submarine signal, the determination of distance rendered possible thereby, along with wireless information as to course and speed, will enable the navigator on each ship to determine with certainty (1) whether there is risk of collision, or whether there is no risk, and (2) the point upon his own course, and the moment at which collision is threatened. The solution of the problem is based upon the fact that at each instant the rate of mutual approach is the maximum if the ships are advancing so as to collide. A simple geometrical construction, which by its character is unlikely to involve error, enables the mariner to solve the problem immediately the signals are received.

Aeronautical Production.—The Aeronautical Production Committee of the Aeronautical Institute of Great Britain, after closely investigating the causes at present retarding production, has evolved adequate methods whereby it can help to speed up the production of aircraft to the highest point, and is ready to commence its work. It states that a greater increase in rate of production than now obtains can be achieved only by adequate organisation in directions beyond the sphere of the great aeronautical work which is being actually carried on by the Government. To run the whole work of organisation with full effect the Committee requires £5,000, and in order to obtain this the Executive Committee of the Aeronautical Institute invites 5,000 suitable persons to become members of the Institute, at a subscription of one guinea each, or a smaller number to make donations. Its address is temporarily at 39, Victoria Street, Westminster, S.W., where all inquiries will be answered.

Walford Bodie Prosecuted.—At the Birmingham County Court on November 29th, Abraham Weisenberg, a tailor's presser, sought to recover damages from Walford Bodie, music hall performer, for having administered to plaintiff a more powerful electric shock than he undertook to give, with the result that he was knocked down, his right arm and hand were injured, his bodily health was impaired, and he lost seven weeks' earnings. The claim was made on the ground of the defendant's negligence. The case was adjourned until April next.

Corrections for the Hefner Lamp.—Recent researches carried out at the Laboratory of the Schlieren Works of the Zurich Gas Undertaking by Dr. E. Ott, member of the International Photometric Commission, show that the illuminating power of the Hefner lamp is given by the formula—

$$y = 1{\cdot}049 - 0{\cdot}0055\,x + 0{\cdot}00011\,(b - 760)$$

where y = the illuminating power in Hefner units = 1 when the atmospheric humidity = 8·8 l. and the carbon dioxide present amounts to 0·75 l. per m.^{3} of pure dry air, and the atmospheric pressure is 760 mm.;

x = volume of aqueous vapour in litres per m.^{3} of pure dry air;
and b = the atmospheric pressure.

It will be noticed that no term appears for carbon dioxide; it is assumed that observations will be made in well-ventilated rooms, in which the proportion of CO_2 present averages 0·75 l. per m.^{3} of pure dry air.

Electric Heating and Electric Furnaces.—In his fourth lecture, on Friday last, Dr. Fleming dealt with arc furnaces, of which the first of commercial importance was that of Stassano, which was used for the production of special alloy steels. As this furnace was heated by radiation from the arc, in order to avoid contamination of the steel with carbon, the efficiency was very low, the energy consumed in the reduction of 2½ tons of steel amounting to 1,360 units per ton. This has been reduced in later designs to about 900. The Héroult arc furnace, charged with liquid pig and pure scrap iron, had carbon electrodes, which were lowered upon the charge to start the arc, and then raised; the furnace consumed 800 to 900 units per ton of steel. The Keller furnace was an attempt to imitate the operation of the blast furnace in smelting iron ore, and was fed with iron ore, coke, and lime; 16 tons of pig iron could be produced for 2,292 units per ton. As the ordinary blast furnace consumes 16 cwt. of coke per ton of pig iron produced, of which 6½ cwt. is required to deoxidise the ore, the greatest saving that can be effected by the electric furnace in smelting iron is 9½ cwt. of coke per ton of pig, costing 8s. a ton, so that in order to compete with the blast furnace, electrical energy would have to be supplied at $\frac{1}{20}$d. per unit, or £1 per H.P.-year, about half the lowest price now obtainable. The only chance for electrical smelting, therefore, is where water-power and ore are together and cheap, and coke is dear. The problem is being studied in Norway and Swéden.

In the Girod furnace only one carbon electrode was used, iron electrodes being embedded in the floor of the furnace. A three-phase furnace had three electrodes, which formed a three-phase arc on the top of the charge, and additional electrodes were provided outside the magnesite lining, which became conductive when hot. Messrs. Verdon Cutts and Hoult designed an electro-Bessemer furnace, in which air was blown through the charge to oxidise the impurities.

Pointing out the importance of employing electrodes of the most efficient dimensions, because they conduct heat outwards from the furnace, the lecturer described the original investigations of Mr. Carl Hering, who was the first to discuss the subject analytically, and showed how to arrive at the cross-section which gave the minimum loss of heat.

Fatality.—At an inquest held at Skinningrove (Cleveland), on Monday, the question arose as to whether the deceased, a Loftus mines electrician named Charles Markham, had died from electric shock. It was stated that deceased had been engaged in cleaning out the electric controller and a haulage engine, and started the machinery to test it. He placed his left hand on the outer casing of the motor, but almost immediately fell and groaned. When a doctor arrived Markham was dead. A witness, in response to questions, said he did not consider the outer cover of the motor dangerous. Markham was not wearing gloves. Dr. Donaldson said he found a mark as of a burn on the right wrist. The condition of the body was consistent with deceased having received a shock. The mine manager, Mr. Wm. Moore, said he thought the flesh would have been injured or burnt if deceased had had a shock. "Death, probably from electric shock," was the verdict.

Situations Vacant.—Assistant in engineering department (37s.), for the Wolverhampton Union; shift engineer (£2), for the Oldham Corporation electricity department; engineers, 45s. 6d. (7 days), for H.M. Dockyard, Pembroke Dock. Particulars are given in our advertisement pages to-day.

Converted Repair Shops.—Messrs. Rawlings Bros., Ltd., of Kensington, recently re-arranged the motor-car repair shops at the private mansion of a well-known public man for munitions making, and a very acceptable monthly output of shells will result. The owner of the mansion has two sons at the Front, but he is anxious to do more, hence, by the aid of the electrical installation, three screw-cutting lathes, drilling machines, &c., are rendering a good account of themselves. Messrs. Rawlings ask all who have lathes or other machines lying idle to get into touch with them, so that they may give them the benefit of their experience in converting the above repair shops.

Professional Classes War Relief.—On Wednesday, Thursday and Friday next week a "Christmas in War Time" Sale will take place at the Albert Hall, on behalf of the Professional Classes War Relief Council; it will be open from 1.30 to 10 p.m. on December 8th, admission 5s. The entrance fee, which is reduced to 2s. 6d. on Thursday evening and Friday morning, and 1s. on Friday evening, entitles the visitor to an article of the same value. Entertainment will be provided by well-known artistes, and many of the articles sold will be novel to this country, being made by Belgians who are occupying the I.C.S. premises at Hendon. Gifts for the sale should be addressed to the Gifts Secretary, Albert Hall, S.W. The articles will be useful Christmas gifts, at ordinary market prices.

The object for which the Council works, as we have previously explained, is most deserving of support, as many members of the professional classes have been very hard hit by the war, and are in great distress.

Patents and Alien Enemies.—The Board of Trade has granted licences to Messrs. G. H. Forrester and G. Marsh in respect of patents Nos. 12,868-69-70, 1905, granted to Goldschmidt and Weber for detinning plates.

Institution and Lecture Notes. — The Faraday Society.—On Tuesday, December 8th, the Society will hold a general discussion on "The Corrosion of Metals, Ferrous and Non-Ferrous," at the Institution of Electrical Engineers. The discussion will be preceded by the reading of papers by Mr. Leslie Aitchison, Dr. C. H. Desch, Dr. J. Newton Friend, Mr. W. E. Gibbs, Mr. Bertham Lambert, Mr. Arnold Philip and Mr. S. Whyte, after which the subject will be open to general discussion. Those desirous of attending can obtain tickets on application to the Secretary, 82, Victoria Street, S.W.

The Rontgen Society.—The Report of the Council for the year ended June 30th last shows that the membership has increased, and the financial position of the Society is satisfactory. The principal officers for the session 1915-16 are:—President, Mr. J. H. Gardiner, F.C.S.; hon. treasurer, Mr. G. Pearce; hon. secretary, Dr. R. Knox.

Diesel Engine Users' Association.—At the November meeting the subjects of income-tax assessment and allowance for depreciation, and the rise in the price of fuel oil, were considered, and the discussion on the subject of cracked and seized pistons was resumed. The next meeting will be held on December 20th.

Institution of Electrical Engineers.—(Students' Section). The following arrangements are announced:—

Thursday, December 9th, at 7.45 p.m., address on "The Institution," J. E. Kingsbury,
Wednesdays at 7.45 p.m.—
December 15th: "The Aluminium Electrolytic Arrester, with an Introduction on Electrical Disturbances," A. G. Ramsey, B.Sc.
February 2nd, 1916, "The Methods employed for the Wireless Communication of Speech," P. R. Coursey, B.Sc.
February 16th: "The X-Ray Tube and Modern Practice," W. J. Jones.
March 1st: Discussion on "Suggested Applications of Science to Warfare."
March 15th: "Long-distance Transmission Lines," E. T. Driver, B.Sc.
March 29th: Annual General Meeting.

A meeting of the Manchester Local Section was held on Tuesday, when Prof. A. B. Field read his paper on "Some Difficulties in the Design of High-speed Generators," and a discussion followed.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Mr. N. W. PRANGNELL, distributing engineer with the Metropolitan Electric Supply Co., Ltd., has obtained a temporary lieutenant's commission in the R.N.V.R., and is taking up duties in the electrical department of H.M.S. *Vernon.*

Derby Corporation Electricity Committee has appointed Messrs. G. J. SCALE and W. L. LETCHFORD, switchboard attendants, as junior charge engineers, at £120 a year, and Mr. C. PEARCE as switchboard attendant.

Mr. G. D. VICKERS has resigned his position as managing engineer of the Banbury & District Electric Supply Co., Ltd., in order to take up a position as resident engineer under the Shropshire & Worcestershire Electric Power Co. at their Dudley station. He was presented by the staff of the Banbury Co. with a case of pipes.

Tramway Officials.—Mr. T. HANLON, of the staff of the Isle of Thanet Tramway and Lighting Co., Ltd., who is leaving to take up a position on the Oxford Tramways, has been presented by the staff with an inscribed brass hall gong and a pipe and tobacco pouch.

General.—The Foreign Office, in its report on the attack on H.M. Consul and the British Colony at Shiraz, Persia, states that on November 10th the Persian gendarmerie suddenly seized, without any warning, H.M. Consul, the superintendent of the Indo-European Telegraph Department, and others. The wife of the telegraph superintendent subsequently arrived at Bushire under escort of gendarmes. The gendarmerie, who hold Kum (70 miles south of Teheran) in the interests of the Germans, have cut the line of the Indo-European Telegraph Department to the South.

At a smoking concert held at the South Lancashire Tramways Company's Social Club, Howe Bridge, last week, presentations were made to Sergt. E. HERBERT, Pte. E. MCGUINNESS, Pte. HARRY SMITH, and Pte. GEORGE SMITH, four former employés of the company who have returned from the Front wounded. Mr. E. H. Edwardes, general manager, handed over the gifts, which took the form of cigarette cases and pipes.

Alderman WM. THOMPSON has been appointed chairman of the Blackburn Electricity and Tramways Committee, and Councillor O. HIGHAM vice-chairman.

Mr. F. H. BRUCE-DUNDAS, at present erector-in-charge with the General Electric Co., Ltd., at Witton, has been appointed power-house superintendent for the Orgreave Colliery, of the Rother Vale Collieries, Ltd., Treeton, near Rotherham.

Alderman DUNCAN WATSON has been re-elected chairman of the St. Marylebone B.C. Electric Supply Committee.

Mr. G. S. HELME, A.M.I.E.E., chief assistant to Messrs. Kelsall & Parsons, engineers, Glasgow, has been gazetted second-lieutenant to the 3/3rd Highland Howitzer Brigade, R.F.A., at present stationed at Greenock.

It is announced that the Board of Trade has appointed Mr. R. W. Dalton, of the Commercial Intelligence Branch, to be H.M. Trade Commissioner in New Zealand, in succession to Mr. W. G. Wickham, who is appointed H.M. Trade Commissioner in South Africa, Sir R. Sothern Holland, who has hitherto held that appointment, being now engaged under the Ministry of Munitions.

Mr. W. T. Taylor, to whom we referred a fortnight ago, has lately returned from Bolivia, South America, and has been gazetted a captain of the 1/12th Loyal North Lancs. (Pioneer) Regiment. Captain Taylor saw active service in the Bechuanaland Expedition and the South African war, and he holds medals with eight clasps aggregate.

Councillor Richard Mayne has been appointed chairman of the Newcastle-on-Tyne Tramways Committee, and Councillor A. M. Sutherland vice-chairman.

According to the *Melbourne Age*, the Victorian Railway Commissioners have engaged the following officials in connection with the installation of automatic signalling on the suburban railways, men holding the requisite qualifications not being obtainable in the Commonwealth :—

Mr. G. H. Wion, who was formerly employed by the Pennsylvania Railroad Co., at New York, as an engineer in connection with its power and automatic signalling systems, was engaged in July, 1914, as assistant signal engineer for a term of five years.

Mr. C. W. Prescott, who was dispatched by Mr. Merz to Melbourne in connection with the installation of automatic signalling, has had experience on the London underground railways, and was in February last transferred to the service of the Commissioners for a term of three years.

Mr. T. Kittredge was recently engaged in the United States for a term of three years as a track circuit designer draughtsman, and is now on his way to Melbourne.

Mr. W. J. Huggins was formerly assistant inspector of signals and telegraphs on the Metropolitan Railway, London, and was engaged in December, 1914, for a term of five years as a signal foreman in connection with the installation of power and automatic signalling. Mr. Huggins was also required by the Commissioners for the instruction of the fitters who will be utilised on this class of work.

Messrs. E. R. Fox and F. R. Wilson were also engaged in England in September, 1914, as electrical fitters in connection with the installation of automatic signalling.

Mr. J. Rist, formerly of the Central London Railway, who has had experience as an instructor of motormen, was engaged in October, 1914, to train the motormen, guards, and other employés who will be required to operate the electric trains.

The employés of the Electric Construction Co., Ltd., of Wolverhampton, have presented a purse of Treasury Notes to Mr. S. Antwis, who is leaving the staff after 32 years' service.

Mr. F. Greere Howard, A.M.I.C.E., electrical engineer, of Berners Street, W., was on Monday elected chairman of the Electric Lighting Committee of the Hampstead Borough Council.

Roll of Honour.—Lance-Corporal George H. Badham, 1st North Midland Division, Royal Engineers, late chief assistant to Messrs. S. Thomas Pemberton & Co., of Birmingham, was killed in action on October 12th.

Sergeant J. H. Hodges, of the 8th Battalion Lancashire Fusiliers, formerly employed at the British Westinghouse Works, Trafford Park, has been wounded at the Dardanelles.

Sapper Harry Thorpe Lees, of the Royal Engineers, has been killed by a sniper in France. Deceased, who was 23 years of age, was prior to the war in the employ of the Stalybridge Joint Tramways and Electricity Board.

Mr. Albert Schloesser, who was with the British Westinghouse Co., Trafford Park, is officially reported missing. He was wounded in France some months ago, and nothing has since been heard of him. Prior to the war he was in Canada, and he joined the Canadian Scottish.

Sapper John Frederick Beney, of the Royal Engineers, who has fallen in action in France, was a railway electrician.

Lance-Corporal W. A. Smith, of the 2nd Queen's Regiment, who has been killed in action at Loos, France, was prior to the war on the staff of Messrs. R. W. Blackwell & Son, Ltd.

Lance-Corporal H. Wise, of the 7th South Staffordshire Regiment, who was prior to the war engaged at Rugby with the British Thomson-Houston Co., Ltd., has been killed in action at the Dardanelles.

Company-Sergeant-Major Lindsay, of the 1/4th Loyal North Lancs. Regiment, who was prior to the war on the staff of the United Electric Car Co., Ltd., of Preston, has been awarded the Distinguished Conduct Medal for conspicuous bravery in France.

Gunner W. Billingham, of the Royal Field Artillery, who was prior to the war engaged in the winding department of the British Thomson-Houston Co., Ltd., of Rugby, has died from wounds received in action at the Dardanelles.

Mr. William Oakley Garrett, who was killed in the battle at Ctesiphon, was employed, prior to the war, in electrical engineering work in India.

Municipal electrical men will have learned with regret that Sir John and Lady Courtis, of Llandaff, Glam., have suffered the loss of their eldest son, Captain J. H. Courtis, he having been killed in Mesopotamia, November 22nd-24th, at the age of 27 years.

Bombardier A. E. Ellis (46,446), 106th Brigade, R.F.A., who has been awarded the Distinguished Conduct Medal, was before the war a clerk in the gutta-percha department at the works of the India-Rubber Co., at Silvertown. The official report reads: "For conspicuous gallantry on September 25th, 1915, near Vermelles. He displayed great courage and resource in repairing telephone wires in 17 different places, thus enabling communication to be kept up. This work he did in the open, and under a very heavy shell fire."

Obituary.—M. Adolphe Greiner.—We deeply regret to learn of the death of M. Adolphe Greiner, director-general of the famous John Cockerill Co., and president of the Iron and Steel Institute, which occurred at Seraing, Belgium, on November 20th. M. Greiner, who was 72 years of age, joined the Cockerill Co. as engineer-chemist when he was 21 years of age. Since 1887 he has been director-general of the company. Readers of the Electrical Review have been made familiar through our own articles, and through papers read by M. Greiner before the Iron and Steel Institute, and published in our pages, with the important pioneering work for which he was responsible in connection with the utilisation of blast furnace and coke oven gases, and in the employment of electrical transmission in steel works. The *Times* states that he was among the first to adopt Parsons turbines on the Continent. *Engineering*, in a brief reference to his death, recalls that the Seraing works were invested by the German armies in August last year. At the time of the last meeting of the Iron and Steel Institute, at which he was to have presided, it was announced that he was practically a prisoner in his own house, having fallen ill through strain and worry.

Mr. G. Clarkson.—The death is announced of Mr. George Clarkson, who had been in charge of the electricity plant at Thurland Castle, Tunstall (Lancs.).

Mr. H. C. Donovan.—We regret to record that the death occurred on November 23rd, at Blackheath, at the age of 73 years, of Mr. Henry Cornelius Donovan, M.I.E.E., late of the Telegraph Construction & Maintenance Co., Ltd.

We tender to Mr. A. M. Sillar, M.Inst.C.E., our sincere sympathy on the death of his wife, which occurred at Waddon, Surrey, on November 29th.

Wills.—The late Major H. R. Chapman, a director of Clarke, Chapman & Co., Ltd., left £17,389.

The late Mr. Edwin Danks, of E. Danks & Co., boilermakers, Oldbury, left £33,192 gross.

NEW COMPANIES REGISTERED.

Quasi-Arc Co. (France), Ltd. (142,217).—This company was registered on November 23rd, with a capital of £5,000 in £1 shares, to carry on in France or elsewhere the business of consulting, civil, chemical, electrical, mechanical, and marine engineers, draughtsmen, manufacturers of, agents for, and dealers in machinery, tools, implements, appliances, and commodities of all kinds, etc. The subscribers (with one share each) are: A Tiano, 64, Warnford Court, E.C., commission agent; A. Cars, 59, Mark Lane, E.C., merchant. Private company. The number of directors is not to be less than two or more than four; the subscribers are to appoint the first. Qualification, 250 shares. Registered office: Caxton House, Westminster, S.W.

Tredelect Engineering Co., Ltd. (142,245).—This company was registered on November 25th, with a capital of £3,000 in £1 shares (1,000 six per cent. pref.), to take over from H. C. H. Smyth, of 11, Linden Arcade, High Road, Chiswick, the benefit of a certain existing invention relating to improvements in or relating to electric generators for lighting mechanically propelled vehicles, to carry on the business of electrical and general engineers, suppliers of electricity, etc. The subscribers (with one share each) are: H. C. H. Smyth, 14, Foster Road, Duke's Avenue, Chiswick, W., electrical engineer; H. A. Bartlett, 31, Albert Road, Regent's Park, N.W., contractor. Private company. The number of directors is not to be less than three or more than five; the first are H. C. H. Smyth, H. A. Bartlett, and G F. A. Norman. Registered office: 11, Linden Arcade, High Road, Chiswick.

CITY NOTES.

Allgemeine Elektricitats Gesellschaft.

As a result of the war the directors of the A.E.G. state that they refrain from giving details of the manufactures during the year ended with June 30th, 1915, and the annual report is, therefore, much shorter than has been customary in former periods. It states that the workshops were well employed on articles of peace and war, and were available to a wide extent for the defence of the country. It was not always possible to obtain appropriate compensation in the fixing of sale prices for the considerable rise in wages and in raw materials, especially as the prices agreed to were confronted with greater wear and tear of the machinery and machine tools. The quick and extensive provision of workshops and equipment rendered it possible to effect the transformation in working. The company was, consequently, able to undertake orders for airships and munitions, particularly shells, fuses, cartridges, and grenades, and extensive light and power installations for the Army authorities and for chemical and powder factories had to be carried out. Large guarantees in the form of allocations to the reserve funds had been made for the undertakings in and debts due from hostile countries and across the sea. The A.E.G.—Union Electrique, of Brussels, had been able to pay 6 per cent., which was, approximately, the same as in 1913-14; the Italian A.E.G.—Thomson-Houston Co., had again paid 6 per cent.; and the A.E.G.—Union Elektrizitats Gesellschaft, of Vienna, 4 per cent., as against 8 per cent in 1913, and the company was well occupied at present. The branches in Scandinavia, Switzerland, Spain, and Holland had carried on business satisfactorily.

The central station department received a considerable share in the contracts for the nitrate and nitrogen installations required by the Government, the Elektro-Nitrum Gesellschaft having given to the company an order for the entire equipment of two nitric acid factories. In addition, the Elektro Werke had ordered a complete great power station of an initial capacity of 185,000 KW., which would be the largest station ever built in Germany at one time. The Bavarian Nitrogen Works Co. had contracted for the transmission line between the power station of the A.E.G.—the Elektro Werke—and the first-mentioned company's chemical works, whilst the A.E.G. had also undertaken to furnish a great switch installation in Upper Silesia and a transmission line between the chemical factories there and the power station of the Silesian Electricity Works. Among the orders received from abroad is mentioned one for the delivery of two turbo-dynamos of 12,000 KW. for an overland station to be erected at a colliery. In the case of the railway department, the report states that the shops were engaged on the comprehensive works for the A.E.G. High-speed Railway, of Berlin, and the completion of the State railway sections between Lauban and Konigszelt and Halle and Merseburg, and the delivery had taken place of three locomotives out of the 27 on order for the Halle line. The Hamburg Elevated Railway would be completed in the current year; but owing to the war it had not yet been possible to put in hand the extensions which were subsequently contracted for. The business in tramways had been essentially limited to the delivery of renewal parts. The accounts show the following figures in comparison with those for the preceding year:—

	1913-14.	1914-15.
Share capital	£7,750,000	£7,750,000
Brought forward	36,000	36,000
Gross profits	1,132,000	1,544,000
General expenses	73,000	77,000
Taxes	106,000	146,000
Interest on loans	—	—
War allowances	—	230,000
Depreciation	44,000	44,000
Net profits	908,000	1,020,000
Bonuses to staff and employés ...	60,000	75,000
Pension fund	50,000	75,000
Dividend	775,000	852,500
Dividend per cent.	10	11
Carried forward	36,000	35,000

Before the balance of profit and loss was struck the sum of £103,000 was written off for depreciation of investments, the total of which stood at £2,843,000 on June 30th, as compared with £2,828,000 in the previous year. Among these are sums of £300,000 representing subscriptions to German war loan, and 1,000,000 crowns (£41,666) to Austrian war loans, which have been considerably increased in the new financial year. The depreciation stated in the table refers to the customary 2 per cent. set aside for buildings, whilst the additional machinery and machine tools have been fully written off, as in previous years, in some undisclosed form, so that the machinery and machine tool accounts appear in the balance sheet at the nominal figure of one shilling for each works. The bank credit on June 30th, 1915, is claimed to have amounted to £4,531,000, as contrasted with £3,848,000 on the corresponding date in 1914, but the payment of claims which has been effected by the Berlin Electricity Works Co. in the meantime has raised the balance at the banks to £5,165,000, as was recently reported. The stocks of raw and semi-finished materials and of manufactures, together with the installations, etc., in hand, represent £4,670,000, as compared with £4,621,000; the reserve fund remains unchanged at £3,678,000, and the contingency reserve at £982,000, whilst the pension fund is set forth at £758,000.

International Light & Power Co., Ltd.

Mr. F. Holt presided, on Monday, at a meeting of the shareholders, held at 9, Cloak Lane, E.C., for the purpose of considering the report and accounts which will be submitted at the annual meeting to be held in Toronto on December 20th.

The Chairman reminded the shareholders that the three properties operated by the company were the Venezuela Electric Light, the Merida Electricity, and the Parana Light and Power Companies. The period covered by the accounts, which were to June 30th last, had been one of unprecedented upheaval in the economic and commercial life of the world, and their interests had, he said, been affected even more perhaps than those of similar undertakings, due to the fact that their Merida property was not only subjected to the effects of the European war, but suffered also from the demoralisation of business and finance during the Mexican revolutions. The cost of coal at Merida had been high, due to the great scarcity of shipping. A portion of the fuel used was wood, and this also had been extremely difficult to obtain on account of labour troubles and the reduction of railway facilities. It had required almost superhuman efforts at times to keep the plant supplied with sufficient fuel to maintain operations, and they were deeply indebted to Mr. Julius, who agreed to go to Merida at a most critical period, and the local manager, for obtaining some profit from the undertaking, and for safeguarding their interests throughout a year of very grave public disorder and difficulty. The depreciation of the Mexican currency continued. The par value of the Mexican dollar was 24d., but at the beginning of the fiscal year this value had fallen to 15d., and it had since still further depreciated to, approximately, 3d. The results of this depreciation were far-reaching; wages and salaries, and the cost of all imported supplies increased, and the value of currency earnings from the sale of electric lighting and power was greatly affected when converted into sterling for the purpose of remittance. The highly efficient Swiss generating machinery urgently required for proper development at Merida, and purchased for that purpose before the outbreak of war, was still, unfortunately, in the hold of a German tramp steamer that had taken refuge in a neutral part. He believed they were now past the most critical period in Mexico, and with the present more peaceful conditions the town of Merida, and with it their property, should quickly recover prosperity. Conditions in Caracas, the field of the Venezuela Electric Light Co., had been as normal as could be expected, considering the effect of the war on general trade conditions, and the currency being on a gold basis there had been no depreciation in the value of remittances. Another advantage in Caracas was that the electricity they distributed was principally generated by means of water power, and, consequently, the high prices ruling for fuel in all parts of the world had not affected the financial results. That was an example of the advantage that a holding company like the International enjoyed in abnormal times by having widely separated geographically the businesses which it controlled. The Parana Light and Power Co. was affected to some extent by the general feeling of uncertainty that followed the outbreak of war. A reduction of earnings resulted for the last four months of 1914, but this was more than compensated for by increased business during the first six months of 1915. The company supplied both gas and electricity, and as the cost of generation was largely that of fuel, the production costs had been affected by the increased price of coal. Economies, however, had been effected in other branches of expenditure, and the result of the year's work had been slightly better than for the previous year. The total revenue received from the subsidiary companies amounted to £28,554, of which debenture interest absorbed £15,000, administration expenses £1,869, interest £1,412, leaving £10,273 to be carried to the balance sheet. The 6 per cent. preference share dividend required £12,328, and reduced the balance brought forward from last year by £2,055. Considering that so many companies had had to suspend payment of dividends since the war, the directors believed that the payment of the preference dividend in full would be particularly welcome to the shareholders at this time; therefore, in view of the substantial reserves and carry-forward of the subsidiary companies, amounting to approximately £29,600, they decided to approve the last quarterly dividend for the year at the full rate, although the earnings for the year were not up to the mark they would have liked. As the Mexican exchange, upon which so much of the profit of the Merida undertaking depended, might not recover as quickly as they could wish, they had decided, pending developments, to defer the payment of further quarterly dividends during the current financial year. The position would be considered as soon as possible after the end of June next, when they hoped that they would be able to declare a final dividend for the year. He concluded by proposing a resolution authorising the directors to support the adoption of the annual report by proxies at the Toronto meeting.

Mr. Francis M. Voules seconded the motion, which was carried.

German Electrical Companies.

The *Elektrische Licht und Kraft Anlagen, of Berlin*, records net profits of £93,200 for 1914-15, as compared with £93,100 in the previous year. It is intended to distribute 5 per cent., being the same rate as in 1913-14.

The *Baugesellschaft fur Elektrische Anlagen, of Aix-la-Chapelle*, which is associated with the Garbe-Lahmeyer Co., of the same town, reports net profits of £5,000 for 1914-15, as compared with £5,900 in the previous year. A dividend of 6 per cent. has been declared on the share capital of £50,000, being the same rate as in 1913-14.

The *Telefonfabrik A.G. vorm. Berliner, of Hanover*, after placing £25,000 to depreciation in 1914-15, as against £10,000 in 1913-14, reports net profits amounting to £101,000, as compared with £41,000. It is proposed to set aside £25,000 as a war reserve fund, and to pay a dividend of 18 per cent., as contrasted with 10 per cent. in the preceding year.

The liquidator of the *E H. Geist Elektrizitats Gesellschaft, of Cologne-Zollstock*, which company resolved two or three years ago to wind up voluntarily, owing to losses incurred in endeavouring to meet the ruinous competition of the large manufacturing groups, reports a loss of £440 in the year ended with June, 1915, which has been defrayed out of the reserve fund for liquidation expenses. As a consequence, the deficiency of £24,000 on a share capital of £40,000, which was recorded at the beginning of the proceedings, has been carried forward without any change.

The report of the *Elektrizitats Gesellschaft vorm. H. Poge, of Chemnitz*, states that it was possible to continue full working in 1914-15 within the limits of the reduced number of workers, to dispose of the manufactures at favourable prices on the revival of the demand in the months following the advent of war, and also to work off the stocks and market the output therefrom. After devoting £16,000 to depreciation, as against £18,000 in 1913-14, the accounts show net profits of £21,000, as compared with £20,000, and it is proposed to distribute 7½ per cent., as contrasted with 4 per cent. in the preceding year, on share capital of £225,000.

The directors of the *Wotan Werke A.G., of Leipsic*, report that after the outbreak of the war it was possible to maintain working with the reduced staff, although the company had chiefly to produce for stock. An active demand, however, set in several months later, which was met with the aid of the accumulated stocks, but the scarcity of labour prevented the company from participating in army contracts. The gross profits amounted to £20,000 in 1914-15, as compared with £8,000 in 1913-14, and the net profits to £10,000, as against £8,000. It is proposed to pay a dividend of 20 per cent., as contrasted with 15 per cent. in 1913-14, on an ordinary share capital of £40,000.

The accounts of the *Berliner Elektrizitats Werke* for 1914-15 show gross profits and balance forward amounting to £992,000, as contrasted with £1,164,000 in the previous year, the working results having been prejudiced by the diminution in the consumption through the war, the displacement in the ratio of the lighting to the power consumption, and the increased cost of working. The net profits, after defraying general expenses, interest charges, and depreciation to the amount of £249,000, as compared with £256,000 in 1913-14, are £426,000, as against £567,000, permitting of the payment of a dividend of 9 per cent. on the ordinary share capital of £2,205,000, as compared with 12 per cent. in the preceding year.

The report of the *Elektrische Licht und Kraft Anlagen, A.G., of Berlin*, which is an investment and underwriting company interested in various manufacturing companies in Germany, and in lighting and tramway undertakings both in Germany and in a number of other countries in Europe, has been issued for the year ended with September 30th, 1915. It states that the influence of the war brought about a diminution in the working results. In the case of the native electricity works—with the exception of those in the vicinity of the war zone in Upper Alsace—which at first experienced a large decrease in the consumption, a gradual recovery had taken place, so that the consumption had now essentially reached the level of that prevailing before the war. The manufacturing concerns closely associated with the company, after declines at the beginning and after accommodating themselves to the changed conditions, were at present satisfactorily employed. The connections with the foreign undertakings had been rendered difficult in some instances, whilst those in Russia had been entirely interrupted since the outbreak of the war. It was assumed, however, that the works in operation before the conflict were continuing in regular operation, and the undertakings in course of establishment were brought to a temporary standstill. After giving details of the various interests, the report contains the following figures for the past two years:—

	1913-14.	1914-15.
Share capital paid	£1,500,000	£1,500,000
Loans	1,893,000	1,873,000
Gross profits	219,000	203,000
General expenses	6,500	5,400
Interest on loans	67,000	88,000
Net profits and balance forward ...	93,000	93,000
Reserve fund	8,400	8,400
Dividend	75,000	75,000
Dividend, per cent.	5	5
Carried forward	8,500	8,600

Italian Supply Companies and the War.

The unfavourable results experienced by the Unione Esercizi Elettrici, of Milan, in 1914-15 are attributed in the first place to the earthquake in Abruzzia, which caused serious damage in Aquila, Sulmona and other places in the province where the company supplies electricity, and induced the migration of a large portion of the wealthy population, and, consequently, a corresponding reduction in the receipts. Secondly, the war affected the results, as it terminated the custom of foreigners also on the eastern Riviera, as well as the visits of strangers in Stresa and Bavedo, and at the same time brought about a crisis in industries, such as the marble trade in Pietrasanta and Serravalla, those of asphalt and gypsum in the Abruzzi, and that of cement in Senigallia. In the third place, the entrance of Italy into the war had the direct effect of causing an extraordinary reduction in the consumption of electricity through the migration of the inhabitants from the districts threatened by the war, and the collapse of the visiting season on the sea coast. In addition, the dearth of coal was seriously felt, whilst the Società per l'Utilizzazione dei Combustibili Italiani, in which the Union Co. is largely interested, will presumably soon be compelled, partly as a consequence of the war, to proceed with a scheme of reducing the share capital, and other investments held by the Union Co. are also exposed to a depreciation of more or less extent. The company has, therefore, considered it prudent to set aside £12,000 as reserve for the equalisation of possible losses, to place £8,000 to the depreciation fund, and carry forward the net balance of £280, this result contrasting with a dividend of 4s. 9.6d. per share in 1913-14. A second company which has been adversely affected by the unfavourable situation is the Società Elettrica Milanese, of Milan, which has been compelled to reduce the share capital from £240,000 to £120,000. At the same time, the company is to be amalgamated with the Società Veronese di Elettricita, which has a share capital of £32,000, and is, consequently, to be raised to £152,000.

Norwegian Hydro-Electric Works.

The report for 1914-15 of the Aktieselskabet Hafslund, of Hafslund, Norway, states that the great transformer station at Hafslund was extended during the year, and the double 60,000-volt line Kykkelsrud-Vamma was continued to the new industrial district of the town of Frederikstad, whilst the extension of the Vamma power station was almost completed. The company, which is associated with the Siemens-Schuckert Co., earned net profits of £68,000 after making provision for depreciation to the amount of £8,000, and a dividend at the rate of 8 per cent. is proposed, as contrasted with 7½ per cent. in 1913-14. During the year the share capital was increased from £247,000 to £961,000, one of the objects being to secure an interest of £228,000 in the Glommens Traesliberi Co. The Hafslund company's works are entered at the value of £465,000, of which the hydro-electric works at Sarpsfos represent £168,000.

Mackay Companies.—The directors have declared the usual quarterly dividend of 1¼ per cent. on the common shares.

STOCKS AND SHARES.

Tuesday Evening.

The new French Loan became a matter of consequence to the Stock Exchange markets on this side for days in advance of its actual appearance. It placed an effective stop upon a sharp run up in Consols which lifted the price from 58½ to a couple of points higher, the rise evidently tempting holders to realise; and some of the money, as City men know, was wanted for application to the new French Fives, so temptingly offered. Speaking generally, however, there is a good deal of strength shown by most of the markets round the House; and although the boomlet in rubber shares quieted down with a reaction in the price of the raw material, business in this department is still active.

Up to this evening, nothing fresh has transpired with reference to the truth, or otherwise, of the rumours that led to so smart a rise in the prices of Underground Electric Railways issues. Many people hold that the company could easily modify its fares, on tubes and 'buses alike, without any great hardship to the travelling public; and they explain the demand for the stocks by reference to the probable accuracy of this report. There are, however, other schemes in the air, which may have materialised before the end of the week; so it is scarcely worth while setting them out at length. The Income bonds have gained another couple of points, but even now the yield on them is high enough to be attractive to the speculative investor. Those who regard them as cheap point to the argument that, war or no war, London's demand for transport must inevitably increase, and that the Underground Electric Railways has acquired such a monopoly as to make it practically secure against effective competition, so that the possible scaling down of the interest on the income bonds, say, for a year, must be followed by the full amount being distributed in normal times. The next report is expected to show that the £10 shares have earned a small dividend, although only the optimists look for any payment to be made on these. The price has eased off to 38s. 9d., and the shilling shares reacted nearly 1s. to 5s. 9d. middle.

Following upon the attention drawn to Undergrounds has come a rally in the shares of the London & Suburban Traction Co., the ordinary advancing to 3s. 3d., the preference to half-a-guinea, and the two debenture stocks to 60 and 80 for the 4½ per cents. and the 5 per cents. respectively. The ordinary shares on the outbreak of war stood about 4s., and the preference at 11s. 3d., but for many months the market in both classes has been practically dead. London United Tramways 4 per cent. debenture stock is also finding some support, and stock has changed hands within the past few days at 51. The company continues to pay its interest.

The British Electric Traction Co.'s arrangements for final amalgamation of the various stocks are expected to be completed very soon, and this should be of advantage to the stockholders, inasmuch as it would naturally have the effect of making the new securities much more marketable than the present sextet. The 7 per cent. preference changed hands last Friday up to 41½; the preferred is quoted nominally at 11, and the deferred about 7. Metropolitan Electric Tramways 4½ per cent. debenture stock stands in the neighbourhood of 83, but has not been dealt in for a month; and the 5 per cent. debenture stock was last done at 81 about three weeks ago.

There is little that is fresh in the way of news from Mexico, though the various stocks and shares connected with the Republic are holding their prices with marked firmness. The three bull points in connection with Mexico are: (1) the official recognition of Carranza by the United States; (2) the work of the various committees formed to protect the interests of bondholders; (3) the probability of the currency question being taken seriously in hand. There is not much business doing in any of the stocks, but the undercurrent seems to be a firm one; and it is not easy to pick up the better-class bonds at anything like quoted prices.

The increase in the Shawinigan Water & Power Co.'s dividend from 6 per cent. to 7 per cent. had a stiffening effect upon the price, and, at the same time, has directed more attention to the issues of the Cedar Rapids Co.—more particularly the 5 per cent. first mortgage gold bonds—because the former company has a large interest in the latter, and is said to have been able to raise its distribution largely in consequence of the progress made by the Cedar Rapids concern. The 5 per cent. bonds stand about 92, with a coupon due on January 1st, so that the yield comes to about 5½ per cent. per annum.

The demand for bonds in the United States goes on increasing, and the securities of the best-class railroad undertakings are fetching fancy prices. Industrial bonds are also very firm. General Electric Co. 5 per cent. gold debentures have risen to 102½, and Shawinigan Water 5 per cent. first mortgage bonds stand at 104. Some of the others may be conveniently set out in a short table:—

Bonds.	Price.	Yield. £ s. d.
Consolidated Cities Light, Power & Traction 1st lien	77	6 9 6
Consolidated Gas, Electric Light & Power, of Baltimore, mortgage debenture	92	5 8 6
Mississippi River Power 1st mortgage	86	5 16 0
Pennsylvania Water & Power 1st mortgage ...	97½	5 2 6
Philadelphia Co. convertible gold debentures	95	5 5 0

The above bonds all carry 5 per cent. interest.

In the Canadian group, the Toronto Power Co. and the Winnipeg Electric Railway both have issues of 4½ per cent. consolidated debenture stock, standing at 85, the yield on which comes to 5¼ per cent.

The electric lighting list shows only one alteration, a rise of ¼ in City of London preference raising the price to 11, at which the return is just under 5½ per cent. on the money. There is some demand for County preference, and the preference shares of the other companies are not difficult to place, which is rather more than can be said of the ordinary shares.

Brazilian Tractions have fallen another point to 56½, the Rio exchange dwindling a little day by day. At the same time, Brazilian securities are by no means unpopular, and not much buying would be required in order to put a better appearance upon the Traction market. The preference shares are still difficult to obtain. Anglo-Argentine Tramways debentures are good, and there is scarcely any floating supply of stock. The 5 per cent. debenture stock is hard to get under 81; and evidently the speculative investor is attracted by the company's preference shares, for both issues are easier to sell than they are to buy. No changes have occurred in the British Columbia group. Victoria Falls ordinary shares are a good market at 7s. 9d., and the preference, at 18s. middle, keep steady.

Half-a-dozen rises attest the attention paid to the telephone market by reason of the excellent returns to be obtained from its leading stocks. Globe ordinary and preference are particularly firm. Eastern ordinary has gone up 3 points. Anglo-American deferred is steadily rising, and should touch 25 before long, if the present demand is maintained. New York Telephone 4½ per cents. are a trifle easier; and Marconi shares continue stagnant and neglected. There is very little doing in the shares either of the parent company or of its subsidiaries.

The manufacturing group as a whole is good, and British Westinghouse preference further improved upon their sharp rise of last week. In other cases, prices are decidedly firm, as the buyer finds when he attempts to pick up cheap stock. The rush in the rubber market is over for the time being, because the material went back to 3s. per lb. This has taken the glamour off the gamble; but, at the same time, every day furnishes its crop of good-class companies showing handsome dividends, and it is obvious enough that the results of the current year are not likely to fall behind those of the previous twelvemonth. In spite of the Excess Profits Tax, they ought in most cases to be substantially better. The armaments group is hardly moving, and copper shares are very quiet. The Broken Hill Mining group has received a strong impetus in consequence of the statement that the Australian Government has ordered that all contracts made with alien enemies before the war are to be regarded as null and void. This is considered tantamount to giving the various companies concerned with spelter, zinc, etc., the power to deal with their output independently of any fear of what might happen if, in doing so, they ran counter to the contracts which they had made previously with Germans and Austrians.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend, 1914.	Price Nov. 30, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	7¼	—	£6 18 4
do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	3½	—	7 2 10
do. do. do. 4½ Pref. ..	4½	8¾	—	6 0 0
do. do. City Pref.	4½	3½	—	6 8 7
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4¼	—	5 17 8
do. 4½ Deb.	4½	87	—	5 8 6
City of London	9	12¼	—	7 7 3
do. do. 6 per cent. Pref. ..	6	11	+ ¼	5 9 1
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10	—	7 0 0
do. do. 6 per cent. Pref. ..	6	10½	—	5 17 8
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	83	—	5 8 0
Kensington Ordinary	9	6	—	7 10 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref. ..	6	4¼	—	7 1 2
do. do. 4 Deb.	4	77	—	5 4 0
Metropolitan	3½	2¼	—	7 15 7
do. 4½ per cent. Pref. ..	4½	8¾	—	6 0 0
do. 4½ Deb.	4½	85	—	5 6 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6½	—	7 13 10
do. do. do. 7 per cent. Pref.	7	6	—	5 16 8
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6½	—	6 18 6
do. 4½ Pref.	4½	4⅛	—	5 9 0

Telegraphs and Telephones.

	Dividend, 1914.	Price Nov. 30, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	102½	—	5 18 0
do. Def.	1½	22⅞	+ ⅛	6 11 3
Chile Telephone	8	6½	—	6 9 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	12⅛	+ ⅛	*6 12 0
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord...	7	128	+3	*6 4 0
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	10⅝	+ ½	*6 9 2
do. Pref.	6	10½	+ ⅛	5 14 [illegible]
Gt. Northern Tel.	22	83½	—	6 11 4
Indo-European	13	46 xd	—	6 18 4
Marconi	10	1⅞	—	5 6 8
New York Tel. 4½..	4½	101	— ½	4 9 1
Oriental Telephone Ord.	10	1 13/16	—	5 8 1
do. Pref.	6	⅞	—	6 17 2
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5¾	+ ⅛	*7 19 1
do. Pref.	6	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 [illegible]
Western Telegraph	7	12½ xd	—	*6 8 0
do. 4 Deb.	4	80	—	5 0 0

Home Rails.

	Dividend, 1914.	Price Nov. 30, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented ..	4	71	+ ½	5 13 6
Metropolitan	1¼	25¼	+ ¼	5 0 0
do. District	Nil	16	+1	Nil
Underground Electric Ordinary ..	Nil	88/9	— 1/16	Nil
do. do. "A"	Nil	5 9	−10½d.	Nil
do. do. Income ..	6	80½	+2	*8 10 5

Foreign Trams, &c.

	Dividend, 1914.	Price Nov. 30, 1915.	Rise or fall this week.	Yield p.c.
Adelaide Sup. 6 per cent. Pref. ..	6	5	—	6 0 0
do. 5 Deb.	5	95 xd	—	5 5 0
Anglo-Arg. Trams, First Pref. ..	5½	4	—	6 17 6
do. 2nd Pref.	5½	3½	—	7 17 2
do. 4 Deb.	4	76	—	5 5 8
do. 4½ Deb.	4½	76	+1	5 18 5
do. 5 Deb.	5	80 xd	—	6 5 0
Brazil Tractions	3½	56½	—1	6 4 0
Bombay Electric Pref.	6	10½	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
British Columbia Elec. Rly. Pfce. ..	5	53	—	9 14 4
do. do. Preferred ..	—	37	—	Nil
do. do. Deferred ..	—	33	—	Nil
do. do. Deb. ..	4¼	62	—	6 17 1
Mexico Trams	Nil	42	—	Nil
do. 5 per cent. Bonds ..	—	49	—	Nil
do. 6 per cent. Bonds ..	—	41	—	Nil
Mexican Light Common	Nil	30	—	Nil
do. Pref.	Nil	42	—	Nil
do. 1st Bonds	—	49	—	—

Manufacturing Companies.

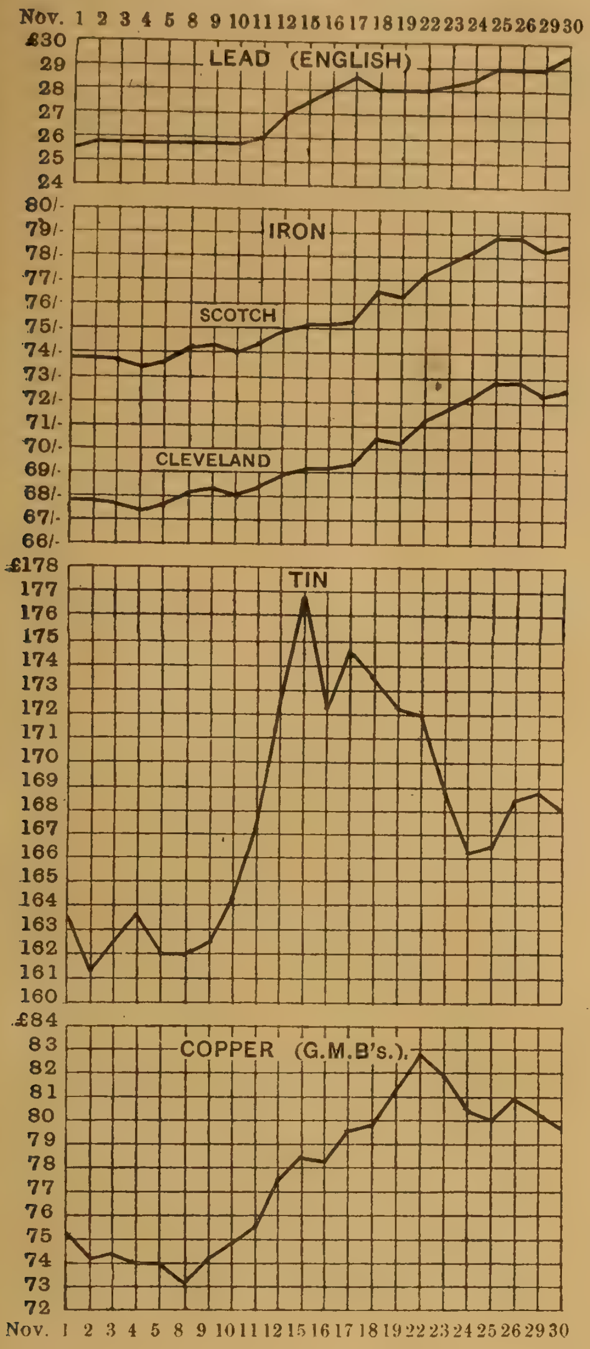
	Dividend, 1914.	Price Nov. 30, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	2 5/16	—	6 1 9
British Aluminium Ord.	5	1 1/16	—	4 14 1
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	10⅛	—	7 8 2
do. Pref.	6	5⅞	—	5 2 2
British Westinghouse Pref.	7½	87/-	+1/-	7 16 9
do. 4 Deb...	4	70	—	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	10½	—	7 2 10
do. 5 Pref...	5	4½	—	5 11 8
do. 4½ Deb.	4½	85	—	5 6 0
Castner-Kellner	20	8¼	—	6 8 0
Edison & Swan, £3 pd.	Nil	9/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	57	—	7 0 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	14/-	—	8 11 6
do. do. Pref.	7	19/9	—	7 1 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	12¾	—	*8 19 4
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	7¾	—	6 5 0
Telegraph Con.	20	31	—	*8 1 6

* Allowance made for dividends being paid free of income-tax.

Patent Restoration.—An order has been made restoring Patent No. 24,539 of 1907, granted to Philip Francis Oddie, for "Improvements in duplex pumping engines."

METAL MARKET.

Fluctuations in November.



Heating Houses by Electricity in Sweden.—In Sweden, where the price of electrical energy is low, Hjalmar Lofquist, of Stockholm, is introducing an electric hot-water heating system for houses of four to 10 rooms. A thermally insulated water tank in which electric heating elements are installed is placed in the attic, and the water in this tank is heated at night, when the rates for electrical energy are low. In the morning the heating elements are disconnected by an automatic switch, which simultaneously starts a motor-driven water-circulating pump. Hot water is then conveyed through the pipes to the radiators mounted in the rooms to be heated, and thence it flows back through a common return pipe leading to a small tank in the cellar, from which it is pumped again to the upper tank. The circulation of the hot water is thus continuous. With a heat-insulated tank of 132 gallons capacity, and 4 KW. in heating units in operation 10 hours per day, it is claimed the water will absorb 74,800 calories, an amount of thermal energy said to be sufficient to heat four or five rooms. The cost of heating a room by this method with electrical energy at 1 cent per KW.-hour is given as about 12 cents for a normal winter day. By changing the number of electric heating units in service the system can be adjusted to weather conditions. The system is designed for use only where the cost of electric energy is low or where low rates can be obtained at night.—*Electrical World.*

ELECTRICITY IN AGRICULTURE: ITS NATIONAL ASPECTS.

For some time past more than the usual amount of attention in official circles has been devoted to the position of British agriculture, the necessity of increasing the production of food in the present crisis having become apparent even to the Board of Agriculture.

Expert discussion has centred on the question of ways and means, which are obviously to a large extent beyond the scope of an electrical journal—not wholly so, however, as we hope to show later on.

The problem to be solved is more involved than might appear at first sight; whatever methods are adopted must satisfactorily meet the conditions, not only during the uncertain period of the war, but after the war, when, no doubt, the competition of foreign produce will again be felt.

This points to the necessity of avoiding artificial stimulants and subsidies as far as possible, and of securing permanent alleviation of the conditions which have enabled wheat or meat produced thousands of miles away to come all that distance, and yet be sold at prices which apparently offer no inducement to the British farming industry to extend its operations. In a word, costs of production must be by hook or by crook come down to a lower level.

We think it will scarcely denied that the British farmer, despite the good work undertaken by agricultural colleges, societies, Chambers of Commerce, shows, and similar aids to advancement, is still in the mass unscientific, sceptical, unorganised, and, in fact, saturated with that John Bull cocksureness as to his own methods, which has in the past enabled British agriculture to survive, though not to progress.

One of the most important factors in production costs, viz., labour, has, judging by the literature on the subject, been gradually getting scarcer and correspondingly dearer, year by year, for some time; the war has at the moment added to the difficulty, for, as compared with January, 1914, between 15 and 20 per cent. of the agricultural employés have enlisted, and the bulk of them have not been replaced—and, in view of the probably increased cost of living for some years ahead, it is more than likely that the majority of these men, when ex-soldiers, will seek better-paid employment. In any case, the attractions of the town have always lured away the agriculturist, and as such attractions are increasing rather than decreasing, the labour difficulty, on that account, is likely to grow more acute.

In recent months farm labour has been deficient practically everywhere, wages have risen and temporary labour has been difficult to obtain; indeed, it is on record that farmers were recently giving up those productions which involved much labour, at a time, too, when an excess of home-grown produce is most desirable.

It is fairly obvious that labour is now, and will continue to be, the stumbling block to commercially and nationally successful farming in England, unless the logical solution to the difficulty, the introduction of scientific methods of labour saving on a large scale, is adopted.

A writer in a recent issue of the *Journal of the Board of Agriculture* points out that in the past, the introduction of farming machinery has always been intimately connected with labour supply, and that any abnormal migration of rural workers from the land has usually been followed by a large increase in the use of machinery. And since the outbreak of war the Board of Agriculture, more especially in view of labour shortage, has, in various ways, endeavoured to urge upon farmers the desirability of employing labour-saving machinery on the farm, attention having been particularly directed to the organisation of local demonstrations of machinery, towards which financial aid has been offered.

The Royal Agricultural Society has for many years been holding competitive trials of a wide range of mechanical appliances at its annual shows, with the specific object of developing the use of machinery and familiarising the farmer with its use; no particular attention appears to have been given either by the Board or the Society to the use of electricity on the farm, and we understand that the latter does not take the initiative in the introduction of new processes, though it does what it can to promote the development of such processes.

It will be seen that both the Board and the Society have the desired end in view, but, excellent as no doubt are their intentions, we take leave to doubt whether their methods are in any way adequate to the present occasion, or, indeed, to the requirements of a national industry such as agriculture, in normal times.

To commence with, any system which encourages the farming community to multiply by tens of thousands, little explosion engines, of necessarily low mechanical efficiency, as sources of power, when there are within easy transmission distance public electricity generating stations able to supply both power and light, is economically unsound.

Why should we propagate inefficient methods of power supply in the case of farming communities around our towns, when in the towns themselves we are striving to eradicate this very same evil of small inefficient independent plants? It is undoubted that these little engines cost more to buy and to run than electric plant, and—considering the question from a national point of view—in the aggregate they represent the addition of millions of pounds annually to costs of production.

The answer is that a broad and comprehensive survey—a national survey—of the matter of the farmer's power, and, moreover, of what is equally important, his light, has not yet been undertaken by those who claim to watch over the agricultural welfare of this country; the potential resources of our electricity supply undertakings, in the matter of cheap power and light are not grasped, nor are the almost world-wide applications of electricity to farming, because of its economic advantages, appreciated in official circles.

The economic side of the question is concisely stated by an American writer in the *General Electric Review* as regards his own country, as follows:—

> If the 25 or possibly 30 million horses and mules now used in farm work were displaced by mechanical power, 100 million acres of cultivated land would be released for human requirements, and it is safe to attribute the high cost of living to a very great extent to the very low efficiency of farm labour as compared to the higher efficiency in other industries whose rapid growth will continue to make even greater demands upon the farm productivity. The use of electricity on our farms is, therefore, sure to be greatly increased, and that this is becoming generally recognised by our central station interests is clearly demonstrated by the extensive network of transmission and distributing circuits which are being built and extended to cover the vast rural districts all over the country.

The same writer in a paper read before the A.I.E.E. quotes the U.S. census figures of electrical motors driving agricultural implements as follows:—1899, 7,643; 1904, 20,713; 1909, 38,905; showing the enormous developments in this direction, although, no doubt, irrigation accounts for a good proportion of motors.

Another American writer mentions that over 125 farm uses have been found for electricity, and touching on the labour difficulty, he points out that electrical applications, even in their simplest form, bring great advantages to the farmer, not only in economy, but because they eliminate to a very large extent, the drudgery of farm life.

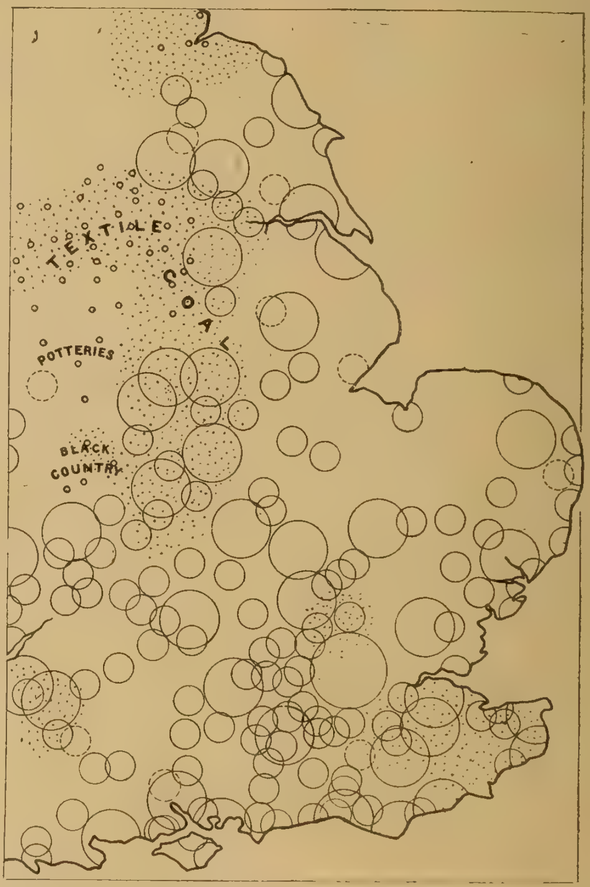
The hard work and long hours have made the farm labour problem a serious one. He considers that electricity, as much as any other one factor, will tend to alleviate or minimise the present drawbacks and check the migration of young men to the city, and that it will shorten farming operations and reduce the cost of them.

A reference to the map on this page will show that the principal agricultural areas of England are in great part within easy tranmission distance of a central station, but unfortunately the central station interests in this country have not recognised the great opportunity which undoubtedly exists for farm supply, nor do they appreciate the financial possibilities which such development holds out.

There are one or two exceptions, as shown in a recent article* in these pages, and in one case—the Hereford area—farming supply has reached a state of such proved utility, although only the initial work has been carried out, that it might well form the starting point for an official inquiry into the subject of agricultural electricity supply generally, having special regard to our own requirements in this connection, and the best means of meeting them.

In our diagram the larger circles of about 20 miles diameter indicate fairly large and generally alternating current power plants, which should find no immediate engineering difficulty in supplying the areas indicated; the smaller circles show the positions of direct-current generating stations, and give an idea of their possible range of supply during the initial stages, while the dotted areas are those in which there are power companies at work. The frequency with which adjoining circles intersect and touch each other indicates (*a*) that the country is well covered by the existing central stations; (*b*) that with our present resources we could economically supply hundreds of thousands of farms and numerous farming villages adjacent to our towns with electric light and power; and (*c*) that such a scheme would inevitably lead to a general interlinking of provincial power stations, with corresponding economic gain to the central stations themselves.

In this connection we may recall the article by Mr. R. A. Chattock, city electrical engineer, Birmingham, on "Co-operative Control of Electric Supply Undertakings."*



Suggested Initial Agricultural Areas of Supply from Existing Generating Stations.

Mr. Chattock urged the vital necessity of dealing with the question of electricity supply to our industries on broad lines—in fact, on national lines, under Government control—when the country could be properly mapped out in areas, the boundaries of which would not be municipal or county, but arranged to suit the industrial requirements of the country as a whole; then overhead distribution could be developed on systematic and proper lines, and full advantage taken of the great economy in the cost of this method.

We quote Mr. Chattock's views on the greater question which he treated, as they necessarily apply to a widespread industry like farming, which can only be treated effectively as a whole, and in such a way as to obviate the present time-wasting official procedure and vexatious local obstructions, due to the necessity for obtaining wayleaves, and the possibility of a local authority vetoing the construction of an overhead line.

On all counts, the authority mostly concerned in facilitating our national interest in the matter of farming is the

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* Electrical Review, June 11th and 18th, 1915.

* Electrical Review, December 19th, 1913.

Board of Agriculture, on whom should devolve the duty of initiating or approving suitable schemes of supply in selected areas, and, if necessary, of giving temporary financial aid in carrying them out in the way of short loans to municipal or other authorities, or to private syndicates in which farmers themselves might take an interest. The Board of Agriculture should exercise the same parental control over such schemes in the interests of agriculture, as, for instance, the Local Government Board does in connection with town planning schemes under the 1909 Act. Experience, both in this country and abroad, leads to the conclusion that the farmer is a profitable consumer of electricity, that he appreciates its labour-saving effect, the hygienic advantages of electric light, the increased safety and security from fire risk due to its use, and that the financial risk would be small. In any case such risk is insignificant compared with national danger of food shortage which the present crisis has brought so uncomfortably near, and the money would be well spent if it ultimately increased the productive capacity of the land.

Most of the great industries are carried on in the mass; the workers and thinkers are in daily and hourly contact, and the seeds of progress quickly germinate under such favourable conditions; moreover there is a collective body of opinion on the spot to help matters forward. Practically the opposite is the case with the agricultural industry, however, which, great and important as it is, as a whole consists entirely of scattered workers, whose individual views can only be co-ordinated by the systematic suggestions and efforts of an outside body, such as the Board of Agriculture, which is, in fact, carrying out good work along these lines.

We suggest that the Board, which is at present actively instigating demonstrations of the use of mechanical farming appliances in various parts of the country, cannot logically overlook the far greater advantages likely to be derived from the exploitation of our electric power resources in the provision of both power and light, nor the immediate necessity of demonstrating them to the farming community, particularly in the neighbourhood of towns where an electricity supply is already available. For it is imperatively necessary that England should not lag behind the other agricultural peoples of Europe and America, whose economic position in the matter of agriculture is already superior to our own.

It is quite possible to slur over the matter with the reflection that "the farmer is satisfied with things as they are." No doubt he is in individual cases. But the real question is are we, as a nation, satisfied with the position of our agricultural industry, as revealed by the war? and should we not adopt every available means of improving it?

THE FARADAY SOCIETY.

The Transformations of Pure Iron.

At its October meeting the Faraday Society held a general discussion on "The Transformations of Pure Iron." The discussion was opened by Dr. A. E. Oxley, of the University of Sheffield, who contributed a most suggestive paper, and the president, Sir Robert Hadfield, F.R.S., occupied the chair. Apart from the considerable number of experts present who dealt with the different aspects of the subject, contributions were received in writing from distinguished metallurgists in all parts of the country. We will endeavour here to summarise briefly the salient features of the discussion. The subject may to some seem academic and remote, especially in times of action like the present, but as the president pointed out, we must understand why certain treatment—alloying or heat treatment—can produce an adamantine form of iron, before we can really successfully manufacture hardened steel. The basis of this knowledge is an understanding of the properties of iron itself.

The experimental foundation for the view that pure iron can exist in different states is the occurrence of discontinuities in physical properties, and of well-defined heat evolutions in cooling and heat absorptions on heating at two if not three definite temperatures or ranges of temperature. Of these the more important are at a little below 800° C., known as the A_2 transformation from what is conveniently called the α to the β form, and the A_8 point at a little above 900° C., at which the supposed β form changes to the supposed γ form of iron. The A_8 change takes place, as far as our present data tell us, at a definite temperature, 915° C. on cooling and 935° C. on heating. The A_2 transformations do not occur at a definite temperature, but throughout a range of some 100° C. Changes in electrical resistance, thermo-electric properties and specific heats also take place at A_2 and A_8, but most striking of all are the magnetic changes which take place at A_2. Magnetisation begins to diminish appreciably far below the A_2 range, but near those temperatures it drops practically to zero. The question discussed at the meeting was: what is the nature of the internal changes taking place in iron that cause these discontinuities in physical properties; in particular, are they allotropic changes in the sense in which the change from oxygen to ozone is an allotropic change? Now this latter transformation is a difference of atomic structure in the molecule, and Dr. Oxley makes a clear distinction between this and the crystalline grouping of molecules. It has been usual to assume that the A_2 transformation, which, be it remembered, is apparently not a sudden but a continuous change, does not involve allotropy, it being merely a molecular redistribution, whereas the A_3 transformation is a true allotropic change. Dr. Oxley thinks the distinction unnecessary, preferring to explain the A_8 change, too, as a case of change in the crystalline grouping of the molecules, or a change in the closeness of the packing of the molecules, and not as in true allotropy, a rearrangement of the atoms in the molecule. In Dr. Oxley's opinion, the change from ferro-magnetic β iron to paramagnetic γ iron is consistent with such a view, because ferro-magnetism demands inter-molecular forces. A modification of these is all that is necessary to bring about the magnetic change at the transformation points. The fact, proved by Honda, that the magnetic changes are continuous through a range of temperatures is a strong confirmation of Oxley's views. Dr. Oxley was on more contentious ground when he looked for support to the small magnitude of the heat changes at the A_8 point, which he claimed were comparable with those of the fusion of elements rather than with ordinary allotropic misomorphic changes, for Dr. Desch showed that the heat evolution accompanying the change from grey to white tin—certainly an allotropic change—approximated to the heat changes in iron, and Mr. F. C. Thompson adduced the change from rhombic to monoclinic sulphur in support of the same contention. Prof. Pierre Weiss, author of the well-known "Magneton" theory, criticised from Paris Dr. Oxley's evidence from magnetic considerations. His recent work showed that β iron was probably Fe_8; that there were two varieties, one with 10 and one with 12 magnetons, and that γ iron was possibly Fe_2 with 40 magnetons. Dr. Oxley however, maintained that these recent results of Weiss, which had been put forward at the Manchester meeting of the British Association, were proof neither of the atomicity of the different kinds of iron nor of the magneton theory, as he assumed the truth of one to prove the other. Very interesting were the considerations brought forward by Prof. Soddy, Mr. McCance, Prof. Carpenter, and Prof. Nicholson on crystalline structure, as it has been revealed to us by the X-ray photographs of the Braggs. This work goes to show that the conception of a molecule has no meaning as applied to a solid, because the atoms of the solid are anchored and do not exist in freely-moving groups (molecules) at all. Whether the groupings of the atoms in iron were monatomic or polyatomic, or whether there was a change at the transformation points could perhaps be tested by an examination of a well-formed iron crystal with the X-ray spectrometer. It was suggested that the President might be able to procure such a crystal and hand it to Prof. Bragg for examination. Dr. Oxley could not agree that the work of the Braggs precluded the conception of a molecule in the solid state. In the case of complex molecules it was possible to isolate a certain group of atoms in a crystal and say they belonged to a particular molecule. This aspect of the subject is obviously by no means clear, and the discussion will have justified itself by drawing attention to it. Other contributors to the discussion dwelt on the question of crystalline changes at the A_3 point, notably Mr. J. E. Stead, and Dr. Carpenter. Whether the transformation under discussion was called allotropic, or merely a difference in phase, there was certainly a profound internal physical breaking down and rebuilding of the crystalline structure, accompanied by an absorption of heat. Dr. Carpenter showed some slides illustrating the remarkable crystallographic changes that occurred within a range of 2°, when pure iron was heated for some time at 915° C. and allowed to cool. The consensus of opinion certainly seemed opposed to the view that these were mere differences in molecular packing, although whether the change is comparable to that from oxygen to ozone is equally open to doubt. At the end of it all the question remains an open one, but the discussion was certainly both suggestive and hopeful.

One remarkable fact of profound practical interest was mentioned incidentally by Dr. Harker. We have very few exact data on the thermal constants of pure iron. Although millions of tons of iron and steel are melted annually, we actually do not know exactly what the latent heat of fusion of iron is. This is work pre-eminently fit to be carried out at the National Physical Laboratory, and Dr. Harker outlined a method by which it should be attempted. Sir Robert Hadfield generously offered to defray the cost of the work if it could be carried out at the Laboratory.

Electric Smelting of Tin.—The Standard Smelting Co., of Pittsburg, has been organised with a capital of $100,000, and is erecting two Wile electric furnaces for smelting Bolivian tin concentrates. The company expects to be in operation very shortly, and the output at present arranged for is about 6 tons of tin per day. The product is expected to run 99·75 per cent. pure.—*Mining Journal.*

SOME DIFFICULTIES OF DESIGN OF HIGH-SPEED GENERATORS.

By PROF. A. B. FIELD, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *November*, 1915.)

In early days the limitations of speed imposed by the generator design acted somewhat as a handicap in the rapid development of the turbine, but recent years have witnessed a concurrent development of both turbine and generator, with the raising of the speeds of the combined sets to the limits corresponding to 2-pole and 4-pole designs. Simultaneously, the output per machine has been greatly raised, until many sets are now running capable of giving continuously up to 6,250 K.V.A. at 3,600 R.P.M., 20,000 K.V.A. at 1,800 R.P.M., and higher ratings at 1,500 R.P.M. (60, 50, and 25 periods).

In attaining these results many difficulties have been overcome in different ways, and the author describes some of the methods adopted by one large manufacturing concern in the United States with which he was connected for some years and whose engineering directors have been broad-minded enough to encourage such a discussion here. Reference will chiefly be made to a 20,000-KW. 3-phase machine having the following characteristics:—

Speed	1,800 R.P.M.
Poles	4
Cycles	60
Kilovolt-amperes	20,000 at P.F. 1.0 to 0.8
Voltage	13,200
Rotor dimensions	51 in. × 75 in.

About a couple of years ago some half-dozen of these machines were put in hand simultaneously, in addition to a number of other 2-pole and 4-pole machines of unusual sizes and proportions.

The design of such a machine represents to a greater degree than is usually the case a compromise between many conflicting mechanical and electrical requirements. Viewed in a general way, there is first the problem of constructing a rotor which must necessarily weigh something of the order of 60,000 lb., and which will be running with a peripheral speed in the neighbourhood of 24,000 ft. per minute. Such a rotor carries much metal which is not self-supporting. The centrifugal force acting upon a 1-lb. mass at the periphery will be about one ton.

Fig. 1 represents a cross-section of the steel of such a rotor when constructed from the point of view of mechanical stresses upon one of the simplest and most symmetrical plans.

Rotor Materials.—It is impracticable to use a through shaft with a hollow body or with disks threaded upon it—a construction which, however, is satisfactory in smaller machines. The rotor body could be made as a solid steel casting or forging in one piece with the shaft ends, and it would be quite possible to obtain such a piece with a fair amount of forging work done upon it; for example, an ingot diameter of about 6½ ft. would allow of a 2 : 1 reduction of area on the main section.

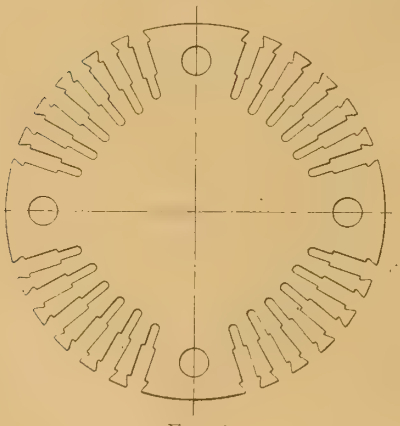

Fig. 1.

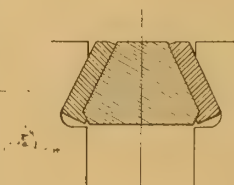

Fig. 2.

For lower speeds or smaller diameters such a construction is very often advantageously used. Such properties of the material as are desirable in the case of the larger machine in question are, however, difficult to obtain commercially. In many applications of forgings, bending and twisting effects have chiefly to be provided against; these involve longitudinal tensile stresses and shearing stresses, which reach their maxima at the periphery; ductility is chiefly of importance near the surface and in the directions indicated. Material near the centre is of no value, and is frequently removed by boring, so as to allow of better annealing conditions, and for other reasons. In our case, on the contrary, considerable *radial* tensile stresses are encountered, and the ductility in this direction is chiefly required far below the surface. Again, the radial tensile stress right into the centre is not inconsiderable, and were the central material removed by boring, the tangential tensile stresses, at normal speed, of the material near the bore would be in the neighbourhood of 20,000 lb. per square inch. To this must be added the local excesses due to such lack of symmetry as occurs.

Several large rotors, weighing up to some 45,000 lb., had been constructed successfully by the Westinghouse Co., of America, using two steel castings united on the rotor centre-line. Many experiments were needed before such castings could be produced with even moderately satisfactory qualities, and then only at considerable cost in discarded material and not infrequently in rejected castings. Ordinary carbon-steel, and also low-percentage nickel-steel had been used for these. At an early date in the use of these castings, the company had made elaborate tests by taking out several test-bars in different directions and at different radial depths in each of many sections, progressing from the top end to the bottom end of the mass as cast. Chemical analyses were made at corresponding points to trace the segregation occurring. In one such series of tests, over 100 test-bars were taken out of the casting, with a corresponding number of analyses. At a later date, tests were similarly made on a large forging, particularly to determine the properties in a radial direction and at different positions in the forging.

The construction initiated by the Westinghouse Co. for the large rotors under consideration was adopted after such investigations upon the regular market productions obtainable in the United States, and in consequence of realising that one must be prepared to build turbo-generators at all times, irrespective of market conditions (*i.e.*, when the steel mills are busy and therefore not anxious to devote extra and special care to the production of material of unusual properties to satisfy the requirements of critical inspectors), and that it is of great manufacturing importance to have designs such that the material may, as far as possible, be obtained from any one of many sources in the country. These are some of the more important reasons which influenced a decision in favour of the material and construction described below.

A difficulty, in some respects similar to that indicated above, had previously arisen in connection with large forgings for high-speed water-wheel-driven generators, and it had been overcome by the use of open-hearth rolled plates consolidated and mounted on a shaft. There is probably no other form in which such large masses of steel can be produced at a low cost having such good physical properties in directions of two dimensions.

In the case of a number of important machines Behrend used the thickest rolled plate that was commercially available; this would limit us generally to plate about 2¼ in. thick in the rough. One batch of about 100 tons of such steel produced under unusually favourable conditions and containing a small percentage of nickel, gave tests averaging approximately as follows:—

Ultimate tensile strength ...	80,000 lb. per sq. in.
Yield point	53,000 lb. per sq. in.
Elongation	26 per cent. in 2 in.
Reduction of area	60 per cent.
Bending test	Strips the full thickness of the plate bent through 180 deg. and closed down without fracture.

In the case of the steam-driven turbo-generators under consideration, this plate material appeared very attractive, combining, as it did, a very low cost per pound with entirely reliable properties from the periphery to the centre and from end to end of the rotor. Its use would result in the production of a rotor in which practically the only internal stresses would be intentional ones; there would be nothing corresponding to the huge initial stresses to which solid forgings and castings are liable. With the plate construction every cubic inch of material would be within an inch or two of a forged surface (or the equivalent). The impossibility of using a central shaft, however, at first discouraged the idea of a build-up plate rotor. It was due to the suggestion of Behrend, again, that the feasibility was demonstrated of constructing such a rotor with the plates slightly rabbeted into one another, and into a flanged shaft at each end. A rabbet about ⅛ in. deep is ample; and by means of a group of four or six chrome-nickel steel bolts, each about 4 in. in diameter, a 50 to 56-in. diameter rotor can be constructed with practically the solidity of a single piece. These bolts can be tightened up until they have a stress of about 40,000 lb. per square inch, and in the actual construction of the rotors special means are adopted to ensure obtaining a tension in the bolts roughly corresponding to the desired amount, by tightening the nuts until a specified elongation of the bolts has been attained, the elongation being a distinctly measurable amount, viz., over 1/10 in. in many cases.

Another method that had been in use for some time in similar operations consists in applying the required force to a 5-ft. or 10-ft. spanner by means of the shop crane. Using a regular suspension weighing machine on the crane hook, this force can be measured, and hence the final tension in the bolt determined, provided it is known what coefficient of friction should be allowed with respect to the rotation of the nut. Comparing the two methods, and from other direct means of check, it was found that a coefficient of friction of about 0.16 suited the conditions of lubrication. The crane-and-weighing-machine method has some advantages in practical operation over the extension method, and it has been generally used.

It is still necessary to have heavy forged shafts with large flanges forged on them, of the full diameter of the rotor; however, the difficulty of securing a satisfactory forging has not only been reduced as the consequence of the much smaller weight of each single-piece forging, but the axial length of the large-diameter part can be kept down to such dimensions that in addition to the usual radially-directed forging process, the material can be worked in an end-wise, *i.e.*, axial, direction. This method of working the material ensures good properties in a radial direction. In other words, to produce the flanged shafts for the severe cases under discussion, a large bloom is forged down to a diameter intermediate between that of the flange and that of the large end of the shaft, and stepped off; the forging is then placed with its axis vertical, in a die, under a forging press, and the increased flange diameter obtained by end-wise forging. Radial test-bars taken out of the flanges of such pieces, even at a depth of 8 or 9 in. from the surface, have shown excellent results; one can practically depend upon getting an elongation of over 20 per cent. in 2 in., with a reduction of area exceeding 35 per cent., in a standard ½-in. test-bar from a carbon-steel forging, giving an ultimate tensile strength of 70,000 lb. per square inch and a yield point of 35,000 lb. In fig. 3 is shown a partially-machined shaft produced in the way described.

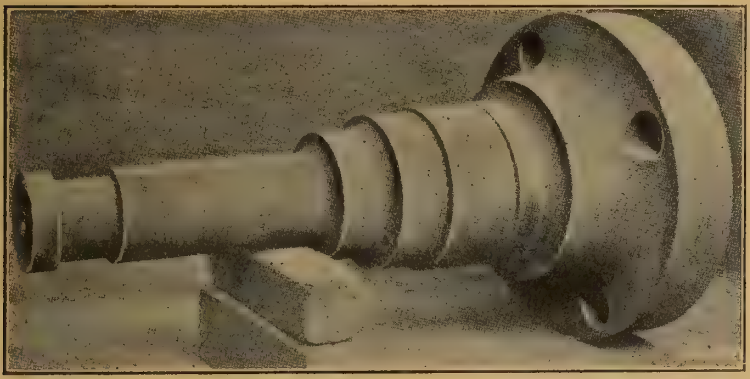

Fig. 3.

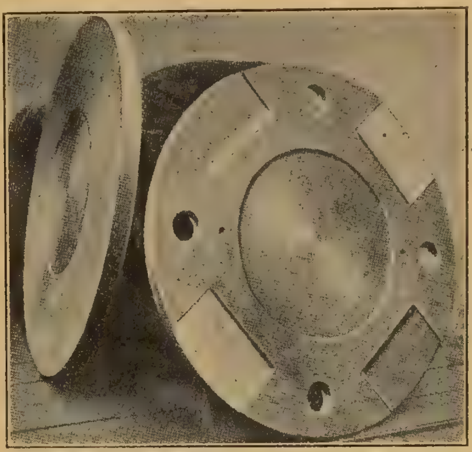

Fig. 4.

When the plates can be obtained locally it is frequently convenient to use ingots of such size that one disk is obtained out of each plate, so that the complete plate can be delivered to the factory, put upon a boring mill, and the required disk parted out of it, the scrap material being returned to the rolling mill. In this way, incidentally, we have an easy check upon the amount of discarded material from the top and bottom ends of the ingot; and we save the shearing labour, and also the machining of a considerable radial margin which must be left when the plates are rough-sheared to circular shape at the mills.

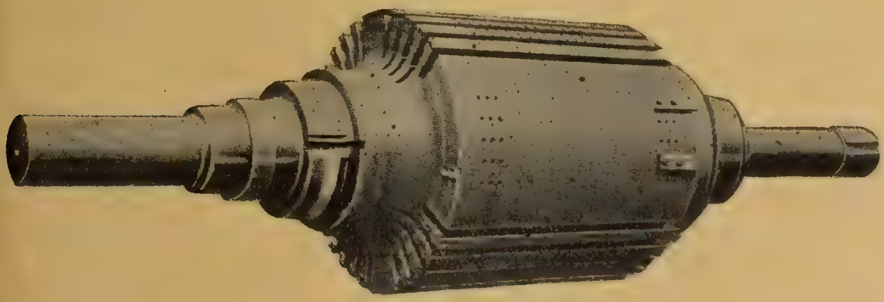

Fig. 5.

The plate can easily be supplied flat enough for a ¼-in. allowance to be sufficient for machining both sides, especially as the diameter of the rabbet projection on one side of the plate is only about half that of the plate itself.

Whether the material is supplied sheared or in the rectangular plate, it is marked by the rolling mill to indicate the part corresponding to the top end of the ingot, and care is always taken to transfer this mark while machining, so that a corresponding indication appears on the finished plate. When drilling and assembling the plates, this marking enables us to rotate each plate, say, 60 deg. with respect to the plate below it in a constant direction, so that in the complete rotor there is practically no remnant of the slightly different properties of the plate in directions along and across the direction of rolling.

The properties which can be expected from this material as an average are somewhat as follows:—

Ultimate strength	67,000 lb. per sq. in.
Yield point	34,000 lb. per sq. in.
Elongation	27 per cent. in 2 in.
Reduction of area	43 per cent.

For a cold bending test, a strip of the full thickness of the plate will generally bend through 180 deg. round a 3-in. diameter pin. For purchasing specification purposes, it is necessary to allow some margin on these figures, particularly in the matter of ductility. As regards the market price, this is in the neighbourhood of 0.8 to 1d. per lb. with ordinary conditions of the steel market.

Critical Speed.—While many large rotors are running satisfactorily at operating speeds above their critical speeds, it is believed that there is a distinct advantage in keeping the critical speed above the running speed, when this is feasible. Experience has shown that in the case of some 4-pole machines of the former class, running perfectly under normal conditions, a short-circuit of even a few turns of rotor winding on one pole may result in serious vibration. On the other hand, one of the machines now under discussion and designed for a high critical speed, was purposely run with two-thirds of the winding of one pole short-circuited, and no considerable difference in the running was noticeable.

If it is decided to run below the critical speed in the case of these large machines, concessions must be made in nearly every feature affecting the critical speed. The rotor body must be as short and light as possible, involving a high air-gap density and a severe working of the stator material in the neighbourhood of the air-gap The shaft diameter must be kept large, and high peripheral speeds must be tolerated for journals and slip-rings. In the case of the present machines, the journal speed approaches 6,000 ft. per minute; and for the slip-rings a speed of about 11,000 ft. per minute becomes necessary, even after adopting special means to keep the slip-ring diameter as small as possible, short of using a hollow shaft and slip-rings outside the bearings. The span between the journal centres especially must be kept small, which imposes some limitations upon the design of the stator end-windings, and necessitates the omission of blowers from the rotor. The lengthening of the rotor span, entailed by the use of blowers on the rotor, is greater than corresponds to the axial length of the blower openings on account of the provision that has to be made in the end-bells, and the necessity of being able quite easily to dismantle the end-bell structures without disturbing other parts of the machine.

In this connection it is of some interest to notice that a rotor constructed along these lines really has no true critical speed.

Rotor Ventilation.—It is extraordinary how large a rotor loss can be dissipated merely from the drum surface with no ventilation, and it is commonplace knowledge how little good some fairly elaborate ventilation systems are found to do.

Nevertheless, it is possible to obtain very efficient ventilation, and our object of obtaining a small, short rotor can only be attained by taking advantage of every means to that end.

It therefore becomes incumbent upon us to use a ventilated rotor and to put up with the disadvantage that this necessitates cleansing the air supply before admission to the generator. In any case, the disadvantage is not so great as at first appears, inasmuch as the stator gains a great deal of benefit at the same time from the absence of dirt.

The system of ventilation which lends itself best to the other features of the machine that we shall have to adopt, is one combining an axial passage underneath the winding slots with a radial discharge distributed over a fairly wide central portion of the rotor. The plate construction here lends itself admirably to our requirements, inasmuch as we can readily obtain the radial ventilating spaces by means of a simple "slab-miller" operation upon the individual plates before assembly. This provides a vent ⅜ in. wide in the region of the slots and teeth, leaving the plate solid in the region of the pole. Were the rotor made of a single piece, the radial vent space could only be obtained reasonably by parting down grooves round the complete circle. The previous arrangement not only gives a very solid rotor by having the plates butt together up to their outside radius, but also the extra metal in the region of the poles is needed for magnetic reasons. The size of these rotors for their output is such that we begin to get some saturation in the poles, a condition rarely occurring in general in the case of 2- or 4-pole turbo-generators, except when artificially obtained.

Fig. 4 shows a pair of disks for a 4-pole rotor; in this particular case the disks have been parted out of the rectangular plates. The one disk is ready for assembly, having been milled on one side for the ventilation in the slot region, but the other disk has only been faced. After assembling the disks and shafts, the bolt-holes are to be reamed out, the bolts fitted, and the winding slots cut. The bolts are to be finally tightened after the slotting, and the heads of the nuts cut off. Fig. 5 gives a general idea of a 2-pole built-up rotor ready to receive its windings.

Rotor Windings.—A separately-formed edge-wound coil, dropped turn by turn into the slots, is used, with solid mica insulation and a light steel cell to protect the insulation against the effect of the ventilating air. For several mechanical reasons, concessions are made in the electrical requirements of the winding, so that a comparatively wide strip (about 1¼ in.) is used, with only three coils per pole, *i.e.*, six slots per group, in the 4-pole rotor. The field windings, even when of this width, will be of substantial thickness, perhaps 0.1 in. for 220-volt excitation, and it is not altogether an easy matter to get such windings down solidly in the slot in such a way that no shifting will occur during running. It must be remembered that the pressure of the coils upon the wedges in such a rotor when running at 20 per cent. over speed exceeds 200 tons for each slot. It is hardly possible to put this pressure upon the winding during construction, but fortunately it seems that by a suitable succession of applications of considerable pressure, with baking processes interspersed, the further yielding of the windings with increased pressure is small, and quite good results can be obtained, even when the pressures put upon the copper during construction do not reach those which will occur during the overspeed test. Even so, special shop equipment is needed to press the windings into the slots in the way indicated above. Finally, it is important that the retaining wedge should be put into position while the coil is still under considerable pressure. This, however, is almost impossible if it is attempted to drive the wedge over the top of the coil in an end-wise direction. The wedge construction shown in fig. 2 is very effective in overcoming this difficulty, inasmuch as the central bronze part of the wedge can be inserted in the slot and pressed down upon the winding under great pressure while the two steel liners, one on each side, are driven into place without any friction on the top surface of the insulated coil. While this mechanical feature of the 3-part wedge is important, there are also electrical advantages. On account of the high air-gap density, the size of air-gap is small for machines of this class, being of the order of 1 in. radially. In conjunction with such an air-gap, the width of rotor slot required to accommodate a 1¾-in. copper strip would introduce a considerable extra stator-tooth loss, due to the pulsation of flux in the tooth as the rotor slots and teeth pass underneath it. By the 3-part rotor wedge construction, the opening of the rotor slot is, from a magnetic point of view, greatly reduced, and a reasonable compromise is thereby effected. Oscillograph tests to investigate this matter have been taken, by using an exploring coil round the top of one tooth of the stator, and such records were obtained both at no load (full voltage) and under load conditions.

(*To be continued.*)

Discussion in London.

Prof. S. P. **Thompson**, in opening the discussion, said the author dealt with the practice of a particular firm. One could not so well realise the actual conditions from a description; it was necessary to see the construction. He asked, was it a fact that the built-up rotor with 2¼-in. core disks was as stiff as the solid rotor? He confessed to some doubt as to the bolts which had to brace together so many joints; but possibly experience confirmed the value of this type of construction. He asked why the bolt heads were cut off, as it would seem better to leave them on. The 3-part wedge was admirable; he presumed the end rings described took the place of the bells formerly used for retaining the end windings. The paper hinted at the supersession of mica by fused silica for stator insulation, which would be a great advantage. He asked what was the merit of the 60-cycle standard largely adopted in America, and how it worked out in practice, and concluded by remarking on the contrast between the machine described and the 50-year-old alternator in the Institution collection.

Mr. F. H. **Clough** remarked that it would be an advantage to have definite ratings and no ambiguity as to overloads; under English rating, the 20,000-kw. machine referred to by the author would be called a 14,000-kw. machine. The use of initially stressed rotor bolts was ingenious, but probably the same result could have been obtained by other constructions. He thought it would be possible to use a through construction, and that much larger holes could be obtained for ventilation and more copper be put on. Judging from the description, he believed the machine would have been cheaper if it had been designed with considerably less flux and higher armature reaction. Close regulation was not aimed at, and there seemed no reason why a high flux should have been used. The machine could also have been built to run satisfactorily through the critical speed, and it would have been possible to retain the rotor fans rather than provide external apparatus. He was not quite in favour of the three-part wedge, and thought a one-part wedge would have been sufficient. It was almost unnecessary to adopt the refinement of inlaying copper on the end rings if the bonding of the rotor was thoroughly carried out.

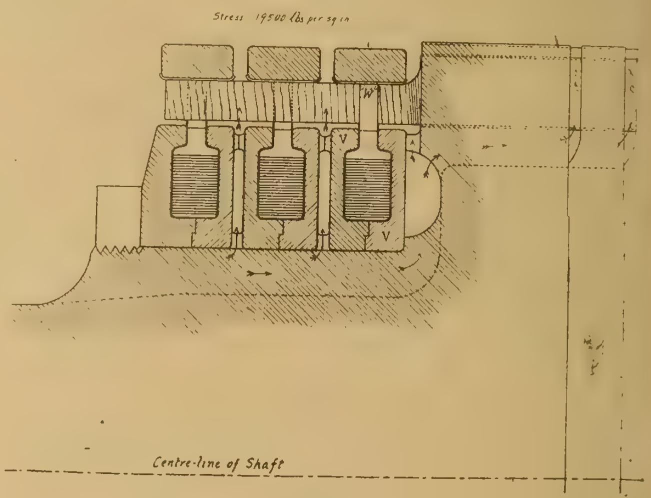

Fig. 6.

Mr. H. **Burge** said the rotor construction appeared to give no positive means, except for the copper in the slots, of preventing the core plates sliding one on the other, and giving rise to torsional movement. The slot wedges shown must be very useful in preventing eddies in the solid pole faces. As regarded eddies in the stator conductors, the usual cure in deep slots was to use a pressed stranded conductor and solid end connections.

Dr. **Smith** pointed out that the same difficulties did not arise here with 50-cycle machines as was the case with the 60 cycles adopted in America. The whole argument as regards the construction adopted seemed to be based on obtaining a rotor to run below the critical speed. If one could build a rotor to run satisfactorily between the first and second critical speeds, then it would obviously increase the limit of output considerably. But if the limiting speed was below the critical speed, it would limit the output, and it seemed that had already happened. If it was required to double the output, he thought it would be impossible to run below the critical speed. The built-up type of rotor construction shown seemed repugnant to him; the suggestion occurred as to whether through bolts could not be used with a solid rotor construction; he thought the conditions would be no worse, and might be better. He asked what was the value of the stator leakage on such a machine. He was glad that the author favoured making the machine itself safe against short circuit and did not rely on reactances. The 2-pole construction seemed rather clumsy; the wedge arrangement was ingenious, but he questioned whether it was necessary to use so much bronze in the wedges, and suggested the possibilities of cast-iron as a material which was cheap and easy to work, and would provide a semi-magnetic closing of the slot. There might be some throttling of the flux in the rotor, owing to the bolts, which would be reduced in section by the initial stress put on them and be a loose fit.

Mr. W. M. **Mordey** supported the author's contention in favour of building machines which could be dead short-circuited at their terminals when running excited and giving full voltage. This requirement should appear in every specification. It was wanted not only for the generator, but also for the turbine, and the test should be made with full load on as it might occur in practice. This test should be a condition of final acceptance.

Mr. R. **Livingstone** said it seemed that the time had not yet come for us to face the problems dealt with by the author. Such large machines could not be employed in our stations under the conditions obtaining here. We were dependent on the metallurgist for progress in output, and there would be no difficulty if the materials were available. He gathered that the type of stator conductor used was a twisted one; the ordinary method was to use a stranded conductor. Many people favoured the use of rotor fans which added to the rotor length, but with big stations, separate air cooling and filtering plants would be necessary. It was very doubtful whether it was necessary to use magnetic steel for rotors, and probably ordinary steels would be quite satisfactory.

Mr. R. F. **Allen** considered that the method of obtaining initial tension on the rotor bolts was rather crude, and suggested that the core plates could be squeezed hydraulically and the bolts then tightened.

Prof. **Miles Walker**, in a written communication, said: the construction of the steel body of the rotor described in the paper is very suitable where rotors of large diameter are required to run at high speeds, say, at a peripheral speed of 24,000 ft. per minute; on a rotor running at 1,500 r.p.m., and not measuring more than 50 in. in diameter, it would appear that satisfactory solid forgings can be obtained. As the present tendency is to build larger and still larger units, it is well that we have this steel-plate construction described in the paper, so that the peripheral speed can be still further increased without introducing an element of uncertainty. In regard to rotor windings for small machines and for machines of medium output, the separately-formed, edgewise-wound coil shown in the paper has been found simple and convenient; but I believe that for the very much larger machines which are to be built in the future a better type of winding should be put forward. Such a winding is already in use in a large number of generators having a rating of 4,000 kw. and over; the heavy end-windings are supported in a thoroughly mechanical manner between stout steel cheeks; while the copper in the rotor slots consists of deep bars, so that there is very little insulation to give way. The diameter of the rotor for a given output can be considerably reduced. To illustrate the advantages of this winding, fig. 6 shows a lay-out of the end-connectors for a 50,000-k.v.a. generator running at 1,500 r.p.m. The diameter of the rotor is only 58 in., so that the steel body can be built up with steel plates, as described by Prof. Field, and the stresses would be less in it than in the 20,000-k.v.a. machine described in the paper. The main weight of the end-connectors is taken by the steel cheeks marked vv; the total stress in these cheeks due to the copper load and their own weight does not amount to more than 11,500 lb. per square inch. There are 88 slots, and 6 bars per slot, each bar being skewed over through a distance of 1½ in. as it comes out of the slot, so as to admit of expansion and contraction. It is found that owing to the extremely good ventilation of the parts of the bars which project from the slots, the copper section can be cut down to about one-half, and this gives plenty of room for the steel hoops which support them. The total stress in these hoops is not more than 19,500 lb., and the factor of safety of the whole construction is a little over 6. The electrical connection between the end-connector and the bar can be carried out by electric welding at the point w. The method of pressing down the coils by means of the wedge shown in the paper is very ingenious, and overcomes what otherwise is a serious difficulty. The paper is a valuable record of some of the steps which have been taken towards that great desideratum after the war—the cheap supply of electrical power.

The **Author**, in replying, said they could get no manufacturers in the States to supply the large forgings which would be required; there would be enormous initial stresses in such structures. He thought the running tests had proved the stiffness of the rotor construction employed; no critical speed had been discovered. The nuts were cut off the rotor bolts because smooth ends were required. A periodicity of 50 cycles seemed to be desirable; 60 cycles was advantageous to the turbine because of the increased steam speed; it was found cheaper to build 500-kw. turbines running at 6,000 r.p.m. geared to 900 r.p.m. generators. The practice followed in the paper and in America was to rate the machine at what it had to do. A large rotor could be built with a through shaft, using chrome-nickel steel disks, if one cared to pay the price. The machine described was by no means a high flux machine, but it was a high density machine, because short—the size was small for the output. The feeling in the States was that the external fan had distinct advantages. An ordinary pressed stranded stator conductor did not get over the trouble of eddy currents; only a thoroughly interwoven stranding would do this. While it was possible to build machines to run below the critical speed they would do so, but if necessary they would go above it. Through bolts would not render a solid rotor construction safer in regard to radial stresses. With the 2-pole built-up rotor, six bolts were used, two at each pole and one each at an intermediate place; the bolt space was waste, and the only available place was between groups of windings. Bolt clearance spaces were of no account when dealing with the large air gaps used in such machines. Nickel steel was used quite largely for rotor bodies in the States. He believed that the large turbine units would be required in this country just as much as in the States.

THE ELECTRICAL INDUSTRY AND THE WAR.

Mr. **David A. Starr**, the new Chairman of the **Scottish Local Section** of the **Institution of Electrical Engineers**, opened the session in Glasgow on November 9th with his inaugural address. He said that it was a source of the greatest gratification to those who had assisted in the adaptation of electricity to many useful purposes, that electricity was playing such an important part in the successful carrying out of the war. The many applications of electricity on war vessels, from the super-dreadnought to the submarine and mine sweeper, were now so important that without this agent our Navy could not maintain its place in defending our shores nor hold supreme command of all the seas. It had been frequently represented by the military and naval authorities that this war could not be carried to a successful issue without the thorough co-operation of those who were engaged in the manufacture of war munitions; electricity, probably more in this branch of war activities than in any other, had played a great part in facilitating the rapid turning-out of work, and it had undoubtedly been to the advantage of the nation that, in practically all the great shipbuilding centres, all extra and urgent power requirements had been expeditiously met from local central stations. There was no doubt in his mind that in the public electric supply of the country the nation had at this critical period an asset of the first importance, and those who were interested in this work felt that they were assisting in safeguarding the freedom of Europe from the yoke of German militarism. A very important matter in which the management of all generating stations was interested to-day, whether municipal or otherwise, was the cost of production. There were two items which entered very largely into such cost, namely, coal and labour. On comparing to-day's prices with those of 1911 and 1912, the increase in the cost of coal was nearly 100 per cent. in the West of Scotland. That increase, due very largely to conditions arising out of the war, was fortunately checked to some extent by the Government passing an Act which limited the price of coal to the consumer, and by recent legislation affecting the exportation of coal. The remedy that power producers had was to insert a coal clause in their contracts with consumers, and that had been almost universal practice during the last few years. The terms of the coal clause varied in different parts of Great Britain, the general practice, however, being to arrange as a basis a fixed price per ton delivered to the power house, and to adjust the price per unit to the consumer in proportion to the increase or decrease of fuel cost per ton. In some cases a fixed price for a standard coal at the pit mouth had been taken, the intention being to guard against an abnormal rise in the price of coal. The second factor which entered so largely into the cost of production was labour. Most power producers had had to concede additional wages, generally in the way of a so-called war bonus to employés on account of the increased cost of living, and this was a factor which must be reckoned with at the end of the financial year. Many electrical undertakings had not been interfered with to any very serious extent by the action of labour agitators, but he was sure that all true patriots would have welcomed, either at the time war was declared or shortly afterwards, a Royal proclamation, putting every man, woman, and child in the country under martial law. He did not wish at present in any way to censure those who had the control of such affairs, but, at the same time, he could not help but think that some of those in authority had still a tendency towards political jobbery rather than the promotion of the highest national interest by the exercise of sound common-sense. It was almost certain that when the war was over there would be a reduction in the supply required for munitions work, a great deal of which must necessarily be of a temporary character, many contracts having been made for the duration of the war only. It would take some time to re-organise industrial works which were temporarily equipped for this class of work, and to restore their plant to normal industrial capacity. On the other hand, it was quite possible that a great many manufacturers would find new markets for their products, both at home and abroad. During the period of the war their shipyards had been almost exclusively engaged on war material. A great many ships had been rendered useless for their original purposes through being stripped of their fittings and converted into armed cruisers, transports, etc. The shortage of merchant ships consequent on German submarine activities must to some extent be made up. It was, therefore, reasonable to expect that shipbuilders and a great many engineering concerns who depended on the subsidiary work in connection with both naval and mercantile shipbuilding and ship repairing would be exceedingly busy. The restrictions placed on the export of coal would be withdrawn, and the output of the collieries should be consequently increased. Opportunities would be afforded to British manufacturers to obtain a firm footing in markets all over the world which had hitherto been entirely in the hands of the Germans, and if these opportunities were grasped an increase in the number of industrial factories might be looked for. Naturally, money to finance new projects would be both scarce and dear, but, making allowance for this, they should be in a better position than their enemies or allies. This was a subject which should engage the most thorough consideration and careful attention of the personnel of the electrical industry in common with all other British manufacturers. They must face the future in a spirit of calm optimism, and with Britain fully awakened the recapture of their former world trade by the Germans should be a "negative possibility."

INDIAN NOTES.

[From our Special Correspondent.]

Electrical business in India keeps fairly brisk, in spite of the serious and unavoidable delays over delivery of supplies from home. Prices have, of course, gone up in proportion to the home manufacturers' increases, plus the freight and insurance extras. The Government since the beginning of the war have bought all available self-contained lighting sets, especially those suitable for searchlight work at ports and harbour entrances. All available telephones of the field type, too, have been bought up. Arc lamp carbons are practically unobtainable, and in very many instances arc lamps are being supplanted by half-watt lamps for outside lighting purposes. Odd and old stocks of electrical supplies are being cleared out from contractors at good prices, and the familiar 10-in. opal shade is becoming a scarcity indeed. All stocks of motors and dynamos are practically exhausted by now, with no hope of replacement within what used to be considered a reasonable period.

Bhavanagar.—This wealthy native State has recently had a specification drawn up by the Lahore Government Electrical Inspector for an electrical plant for palace, house, and street lighting. Not many firms tendered, although the specification was a reasonable one—in fact, only a few select firms were invited to quote—so that the successful tenderer should get in at a rate to secure a handsome return.

An Electrical Conference.—An important conference of electrical inspectors and engineers in the service of the Government was opened in Calcutta on November 1st. Mr. J. W. Meares, electrical adviser to the Government of India, presided. The *Pioneer* states that the conference was convened at the suggestion of the Government of India with the concurrence of the Provincial Governments. We are indebted to our contemporary for the following summary of the opening remarks by Mr. Meares:—

Mr. Meares in the first place remarked that that was the first conference of its kind, and hoped it would be followed by many more held annually, and he then went on to bring before the conference the various questions which were down for discussion. The first of these had reference to rules relating to electricity in mines. Mr. Meares had prepared a rough draft based on the British Home Office rules, and intimated that as a result of the conference and his consultation with the technical advisers of the Indian Mining Association, he hoped to prepare a revised draft, which, after it had been put into legal shape, would, he trusted, meet with general approval when formally published for criticism. Mr. Meares then turned to the Electricity Act and the rules under it. He referred to the early legislation concerning electricity in England and restrictions thereby imposed upon a great industry, and went on to express his belief that the electrical industry in India had not been seriously handicapped by defects in the law. He emphasised the fact that the rules in force under the Indian Act could be relaxed when it was necessary, and added that it remained for electrical engineers and inspectors to use the power of relaxation for the good of the industry while safeguarding life and property. A matter he had lately to discuss was that of the so-called compulsory clauses of the Electricity Act. Outside capital had always been shy in India, and would be more so in future, while the secret of unlocking the vast supplies of indigenous capital had only to a small extent been solved as yet. He was told that one of the chief causes of that shyness, so far as electric supply to towns was concerned was the fear of the specification in licences granted of compulsory works in streets where no return was likely to be secured. On this point Mr. Meares declared, "If compulsory areas hinder enterprise, then, in my opinion, compulsory areas should be severely limited or altogether banished, and I believe this view will be generally accepted." Mr. Meares next turned to questions concerning installation work, and on this subject he said he did not suppose it was possible, or even desirable, that there should be rigid and uniform specification for electrical wiring all over India and Burma. At the same time, he said it might assist contractors who had branches all over India if the conditions to which they tendered, and the material they had to supply, were more or less the same everywhere. "There are boundless possibilities in connection with electricity in India," Mr. Meares said in conclusion, "and as yet only the fringe of them has been touched. We can do a great deal of good or harm according to the way in which we tackle problems which come up to us."

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

16,034. "Wave transmission." G. Constantinesco & W. Haddon. November 15th.

16,095. "Wave transmission." G. Constantinesco & W. Haddon. November 15th.

16,107. "Dynamo-electric machines." E. Girardeau. November 15th. (Convention date, November 16th, 1914, France.) (Complete.)

16,112. "Ohmmeters and like electrical measuring instruments." H. E. Trent. November 15th. (Complete.)

16,113. "Wattmeters and like instruments for the measurement of electrical power." H. E. Trent. (Complete.)

16,118. "Sparking plug." R. M. Alexander. November 16th.

16,145. "Valves." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). November 16th.

16,149. "Arrangements for phonographically recording and reproducing telephonic messages." F. Seelau & A. M. Newman. November 16th. (Convention date, December 5th, 1914, Germany.) (Complete.)

16,151. "Wireless telegraphy." Marconi's Wireless Telegraph Co., Ltd., and R. D. Bangay. November 16th.

16,155. "Means, such as glands or grips, for the cables of electrical apparatus and the like." E. A. Graham. (Complete.)

16,176. "Masts for wireless telegraphy." E. L. Peacock & Swan, Hunter and Wigham Richardson, Ltd. November 16th.

16,184. "Switch-holders for electric lamps." R. M. Neilson. November 17th. (C. C. Gordon, Portuguese East Africa.)

16,185. "Electric insulators." A. R. Muller. November 17th. (Addition to 27,738/12.)

16,207. "Telephonic transmitters." E. A. Graham. November 17th. (Complete.)

16,270. "Electric arc lamps." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). November 18th.

16,271. "Magnetically-operated prime mover." W. H. Higgins. November 18th.

16,281. "Wave transmission motors." G. Constantinesco & W. Haddon. November 18th.

16,290. "Portable electric battery lamps." Bernard Pordes. November 18th.

16,336. "Electro-deposition and extraction of zinc." U. C. Tainton and J. N. Pring. November 19th.

16,345. "Electric safety devices." British Thomson-Houston Co., Ltd., and H. N. Sporborg. November 19th.

16,349. "Electric incandescent lampholders." C. G. M. Bennett. November 19th.

16,364. "Arc lamp electrodes." Planiawerke Akt. Ges. fur Kohlenfabrikation. November 19th. (Convention date, December 31st, 1914, Germany.) (Complete.)

16,379. "Electric couplings." E. C. Goad. November 20th.

16,389. "Electric light fittings." W. H. Derriman. November 20th.

16,393. "Loaded line system." Western Electric Co., Ltd. (Western Electric Co., U.S.A.) November 20th. (Addition to 12,434/15.) (Complete.)

16,395. "Electrical switches." A. C. Wynne. November 20th.

16,402. "Electric signs." H. F. Lowenstein. November 20th. (Complete.)

16,408. "Magneto-ignition systems." Etablissements de Dion-Bouton Soc. Anon. November 20th. (Convention date, September 6th, 1915, France.) (Complete.)

PUBLISHED SPECIFICATIONS.

1914.

20,319. Line or Wireless Telegraph Systems. W. H. Shephard & A. F McKechnie. September 29th.

21,792. Electric Meters of the Thermal Type. P. M. Lincoln. October 30th. (November 5th, 1913.)

22,554. Art of Duplex Telephony. British Insulated & Helsby Cables, Ltd., W. P. Fuller, and H. H. Harrison. November 14th.

22,887. Telephone Receivers. J. W. Greenwood. November 23rd.

23,071. Electric Measuring Instruments of the Moving-coil Type. F. Holden. November 25th.

23,357. Electric Starters, more particularly for use on Motor Cars and the like. A. H. Midgley & C. A. Vandervell. December 1st.

23,544. Electro-magnetic Switches. British Thomson-Houston Co. (General Electric Co., U.S.A.). December 4th.

24,697. Electric Connecting Boxes. Sunderland Forge & Engineering Co. and G. C. Reed. December 28th.

1915.

757. Wire Joiner, for the purpose of Connecting or Joining Telegraph or other Wires. J. Parker. January 18th.

937. Electric Light Prepayment Apparatus. H. S. J. Booth & W. Miller. January 20th.

1,689. Portable Electric Head Lamps. E. Ricci & G. Ricci. February 2nd.

4,079. Means for Collectively Actuating and Controlling Alternating-current Motors. J. L. Routin. March 15th. (Patent of addition not granted.)

5,865. Means for Starting Internal-combustion Engines. Robert Bosch (firm of). April 19th. (April 17th, 1914.)

9,682. Electrically-operated Change-speed Gear. Oesterreichische Daimler-Motoren Akt. Ges. July 2nd. (July 14th, 1914.)

Smoke Abatement.—**The Manchester Air Pollution Advisory Board is endeavouring to obtain a grant to assist in the research work now being carried on by the Board with domestic heating appliances, and has decided to ask the Manchester Association of Engineers to apply to the Privy Council for a grant of £300 for the purpose.**

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Vol. LXXVII.] CONTENTS: December 10, 1915. [No. 1,985.

Page

Foreign Trade Organisation ... 737
Rubber ... 738
Electricity Supply Works and Coal Supplies ... 738
New Lamps ... 739
The Large Turbine and Supply Problems (*illus.*) ... 739
The British Standardisation Rules for Electrical Machinery... 741
A New High-Efficiency Incandescent Lamp, by E. A. Gimingham and S. R. Mullard (*illus.*)... 743
Notes from Canada ... 745
The Park Royal Engineering Works, Ltd. (*illus.*) ... 745
New Electrical Devices, Fittings and Plant (*illus.*) ... 746
Electrical Accidents in 1914 ... 747
Legal... ... 748
Making and Using Thermocouples, by F. G. Coburn ... 748
Diesel Engine Users' Association... ... 749
Business Notes ... 750
Notes ... 754
City Notes ... 758
Stocks and Shares ... 759
Share List of Electrical Companies ... 760
Market Quotations ... 760
Electrical Accidents in Mines (*continued*) ... 761
Our Trading Opportunities throughout the World (*continued*) 762
Some Difficulties of Design of High-Speed Generators, by Prof. A. B. Field, (*illus.*) (*continued*) ... 764
Correspondence—
  A Contractor's Complaint ... 766
  The A.E.G. Meeting ... 767
  The Institution and Alien Enemy Members ... 767
  Swiss or German? ... 767
War Items ... 767
New Patents Applied for, 1915 ... 768
Abstracts of Published Specifications ... 768
Contractors' Column ... Advertisement page xx

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NOTICE.

IN view of the recent Increase in the Postal Charges, our Subscription Rates for Great Britain and Canada will until further notice be increased to £1 1s. 8d. and £1 3s. 10d. respectively.

FOREIGN TRADE ORGANISATION.

OUR readers are already familiar with the main methods by which German industry has been able to make its abnormally rapid advance. The development of foreign trade has been one of the most important of these methods. Only since the outbreak of war has it become obvious how closely cause and effect were interwoven where Germany's foreign trade was concerned, how disinterested Teutons suggested developments and drew up plans, again apparently disinterestedly, so that only German equipment met the specification, how the necessary capital support was always forthcoming at the psychological moment, and how ultimately the whole project was controlled from Germany for the main or entire benefit of Germans.

The sinister feature of this policy and the only one to which objection could be taken was the secrecy and deceit with which the German control was obtained. Had the deal been fair and above board, it might have succeeded in most cases to practically the same degree, and no one could have raised any objection, for there is nothing wrong in a wealthy syndicate offering money for development schemes on terms favourable to firms associated with it, so long as the person accepting these terms knows their nature. If the negotiation amounts simply to advancing capital or taking up concessions with no definite "tying" to certain markets for the purchase of subsequent supplies, it is still less open to objection; but tying itself cannot be objected to, if it is a stated or obvious consequence of the original negotiation. Getting into fresh markets by this means is simply good business, and our business men must decide whether it is a method for us to adopt more extensively in future than in the past. With the conclusion of nominal peace we shall, so far as we are able to foresee, merely exchange one form of war for another. Our present enemies in the field may then be formidable enemies in trade. Their capital will be gone—if, indeed, it has not already vanished despite the "isolation" of the country—but the organisation and discipline of the nation will remain, and its captains will make herculean efforts to recover the lost position.

As for the neutral countries of the world, they will be very keen competitors. They have become possessed of no small portion of the Allies' wealth—directly by supplying costly war materials for which we have paid and (from the purely commercial standpoint) blown into thin air, and indirectly by taking advantage of markets from which we have temporarily withdrawn capital and energy. By both these means the neutral nations, chief amongst them the States, have acquired an immense advantage which they are entitled to use, and which they certainly will use to the best of their organisation and ability.

The National City Bank of New York announces the formation of a £10,000,000 company to develop foreign trade with the States, by promoting foreign loans and investment schemes, so as to create a market for American capital and manufacture. That is the sort of thing for which we must prepare. We cannot complain at the arrangement nor would it be of any use to do so. Such measures are legitimate, but for our own well-being they must be met by equally energetic measures. Cannot we have a big Empire loan or investment scheme for the same purpose? The financing of manufacturing industries has long been one of our weak places.

The new venture is probably the most ambitious yet made to further the commerce of the States, and it is admittedly a direct outcome of benefits derived from the war. The fields in which it is proposed to operate are South America and Russia—*particularly the latter.* We are not alone in realising the immense potentialities of the Russian Empire, and in recognising the fact that outside capital will be required for many years to develop those potentialities, whilst the chief benefits in supplying machinery and equipment will go to that country which makes the development possible. In the electrical field alone the requirements of Russia for power stations, for electric traction, for industrial power and domestic supply, will be immense in the immediate future, and the prospects are equally good in other engineering and in general industrial fields. Clearly the matter is a national one—if not for Government support, then for organised private support on a national scale. Henceforth we can hardly do without national support for the enterprise of our individual manufacturers; that powerful weapon has long been used by our chief rivals.

Rubber.

Rubber prices have kept up very well, though there has been a certain degree of fluctuation, which resulted in a rather uncertain tone amongst consumers, with a falling-off in the amount of new business being placed. The firmness of the market at times induced actual users of material to cover themselves ahead as far as possible, but, as the purchasing abated in this connection, so there were occasional spells when the tendency became reactionary. The activity of hostile submarines in the Mediterranean has had a sharp effect in raising prices, now that the Huns can score a success and have managed to put down a boat with a large consignment of rubber on board. After all, there is always the Cape route home if the worst comes to the worst, but, meantime, there is no doubt that proper steps are being taken to rid the Mediterranean of these Hunnish pirates and baby-killers. On the advancing prices, America bought liberally, for United States consumers are treated by their Press to a diet of falsehood, and apparently to very little truth; the United States Press has for weeks been announcing as facts things unknown, and not believed here to be the case. However, the fouling of our own nest by our censors seems to be part of the game, for any silly falsehood is apparently permitted to go over the cables so long as it reflects unfavourably upon the Allies, while any statement in our favour is withheld. So much for American news and the Censorship.

The pack of falsehoods about the Suez Canal, sent to New York by permission of the Censorship, resulted in an advance of 9 cents per lb. in the price of Ceylon plantation rubber to 68 or 69 cents per lb., an increase of 15 per cent. This was described as "an unfortunate interruption to the serenity which has surrounded the big rubber users of the United States ever since they made their peace with the British Government about 12 months ago, and agreed to keep crude rubber from falling into German hands." There is a fair-sized stock of crude rubber in the United States to-day, but if there were an interruption of Far Eastern shipments for much beyond a month, some of the large consumers might find themselves in difficulties. America, if hindered in the East would, of course, draw heavily on Para rubber from Brazil. As regards the Dutch position, it is now intimated by the Dutch Overseas Trust that that body will accept no further consignments of rubber. This is a distinct point gained to the Allies, for there is not the least doubt that Germany has been receiving a lot of rubber by way of neutrals.

The following figures show the Straits Settlement exports:—

	1913.	1914.	1915.
January	784	1,181	2,576 tons.
February	743	1,703	2,741 „
March	898	1,285	2,477 „
April	762	1,548	1,978 „
May	814	1,309	3,588 „
June	812	1,480	2,249 „
July	1,120	1,584	2,324 „
August...	1,315	1,325	2 295 „
September	1,057	1,602	4,725 „
October	1,144	2,006	2,641 „
Total	9,449	15,023	27,594 „

These figures include transhipments of rubber from various places in the neighbourhood of the Straits Settlements, such as Borneo, Java, Sumatra, and the non-Federated Malay States, as well as rubber actually exported from the Colony, but they do not include rubber exports from the Federated Malay States.

Electricity Supply Works and Coal Supplies.

The comparative scarcity and high prices of coal and the comparative dearth of labour, in the face of the large demands for both on the part of industrial establishments which are engaged on the production of munitions of war, are having a far from favourable effect in certain belligerent countries, especially in those whose national output of coal is inadequate to meet their own requirements, and the resources of the gas and electricity works which supply light and power to these establishments are being strained to cope with the situation. In France the first call on the domestic output of coal is made by the military authorities, the railways, the iron and steel works, the manufacturers of war material, and the gas and electricity works, and a similar observation may be said to apply also to every country at war. The difficult state of affairs in Italy, whose out-turn of coal is totally insignificant, has induced the Association of Working Electrical Undertakings (Associazione Esercenti Imprese Elettriche) to hold a meeting at Milan, under the presidency of Senator Esterle, in the presence of the representatives of most of the electricity works, including the Edison Co. the Conti Co., the Idroelettrica Ligure, the Adriatica Co., the municipal councils of Milan and Turin, &c. The object of the conference was not so much to discuss the question of coal supply, as water power is used to a large extent in the country, as to afford an opportunity for an interchange of ideas as to how the relations between suppliers and consumers of electrical energy should be regulated in an equitable manner under existing circumstances. It was eventually agreed that producers should arrange local meetings with the principal customers in every important district for the purpose of coming to special agreements in their mutual interests, particularly in regard to the supreme requirements of the industries at the present time. As will be remembered, a State tax has been in operation for some years, on the consumption of electricity—at least for heating and lighting purposes. The Association has sought to secure the abolition of the tax on the use of energy for heating, but the Ministry of Finance points out that the tax represents the law of the country, and cannot be modified without the previous approval of Parliament. However, to meet the case, the Minister of Finance proposes to ask the Ministerial Council to issue a special decree for an experimental period of six months, exempting consumption for heating from the tax, whilst on their part producers will have to keep special accounts of the energy used for this service as compared with the corresponding period a year ago. A statement to this effect was made by the President to the Conference, which, naturally, did not entertain any great expectations of a large extension of the application of electricity to heating under present conditions. In Italy electric heating has to be considered chiefly as providing a substitute for coal at the moment, but the reserve manifested by the Conference as to the possibilities of much development in the near future was more than shared a fortnight previously by an Italian engineer who contended, rightly or wrongly, that at the present high price of coal in Italy, it would be cheaper to use the latter than electrical energy for heating, even if the tax were entirely discontinued. Imported coal for domestic use is reaching £4 per ton in France, owing chiefly to the high freight rates and general labour conditions, but the cost is still higher in Italy, being £4 1s. 7d. per ton on rail at Genoa, and £4 12s. per ton at Milan. With these facts before us, it is difficult to believe the recent assertion made by the chairman of the Zurich Bank for Electrical Undertakings who, speaking of the dearness of coal experienced by electricity works in Spain, Portugal, Italy, and Russia, stated that the price paid by the Italian Officine Genovesi was 30 per cent. more than a year ago. If this rate were correct the company would be able to congratulate itself upon having secured coal at a comparatively low price under existing circumstances, especially as industrial coal cannot be put on rail at Italian ports at a price lower than that of coal for domestic consumption.

New Lamps. THAT the possibilities of electric lighting have by no means attained their limit with the tungsten filament is well exemplified by the remarkable invention which is described elsewhere in this issue—an enclosed arc lamp, in which the arc is struck between tungsten electrodes in an atmosphere of nitrogen. The description was contained in a communication to the Institution of Electrical Engineers by Messrs. E. A. Gimingham and S. R. Mullard, and the whole matter is of exceptional interest, for several reasons.

In the first place, this invention was not arrived at by a happy thought, a fortuitous train of circumstances, or a stroke of genius; it is the direct result of a research instituted by the Edison & Swan United Electric Light Co., Ltd., at their works at Ponders End, for the express purpose of developing precisely such an invention. We most cordially welcome this demonstration of the fact that some of our manufacturers are awake to the supreme importance of scientific research conducted on systematic lines with set purpose, and recognise the necessity of allocating to such a research a competent staff and adequate equipment. We trust that the Edison & Swan Co. will reap the fullest reward for this admirable example of successful enterprise.

In the second place, we see in this lamp the same materials as are used in the half-watt incandescent lamp, but used in a fundamentally different way, and we are irresistibly reminded of the clever paper on "Invention" that was read by Mr. Charles Turnbull before the Newcastle Local Section of the I.E.E. some years ago, in which the author pointed out how one invention might lead to another by a suitable metamorphosis.

Thirdly, the method of striking the arc in this lamp, by ionising the gas in the vicinity of the electrodes, involves once more the principle of the thermionic current which has been so ably applied by our American friends in the development of the kenotron rectifier and the pliotron amplifier—building on the foundation laid by Mr. T. A. Edison, Dr. J. A. Fleming, and Mr. O. W. Richardson—in the great research laboratory that we have held up to our readers as a splendid example.

The results obtained already are excellent, and will exert a material influence on many applications of the electric light; but we doubt not that further progress will be made. A research is actually in progress in the United States in the direction of utilising an arc between unconsumed tungsten electrodes, in an atmosphere containing vaporised salts, but in this case the arc is several inches in length. It is clear that this new field of investigation possesses vast possibilities.

THE LARGE TURBINE AND SUPPLY PROBLEMS.

DURING the past 20 years a radical change has occurred in our ideas as to central station design and practice, due in great part to the rapidly changing conditions of electricity supply. We have been passing through the "retail" stage, but are now rapidly approaching the "wholesale" stage, when quantity production of electricity will become an essential factor to success. Some measure of the changed conditions can be gathered from the increase in consumers and output during the period mentioned, in individual centres where conditions are favourable, as, for instance, in a Scottish city, where the consumers have multiplied by 55 and the output by 100, although no traction supply is included; or a Lancashire city, where with 20 times as many consumers as in '95, the output is 125 times as great, including traction supply, and 85 times, excluding the latter. The ratios for any town will vary according to the industrial conditions obtaining, and are, no doubt, increased in the cases mentioned, by the absorption of adjoining supply areas during the period referred to. The position to-day cannot be judged without some idea as to the rate of increase in output, which with the growing appreciation of, more particularly, electric power applications, has had a marked upward tendency in recent years, where favourable conditions exist for development.

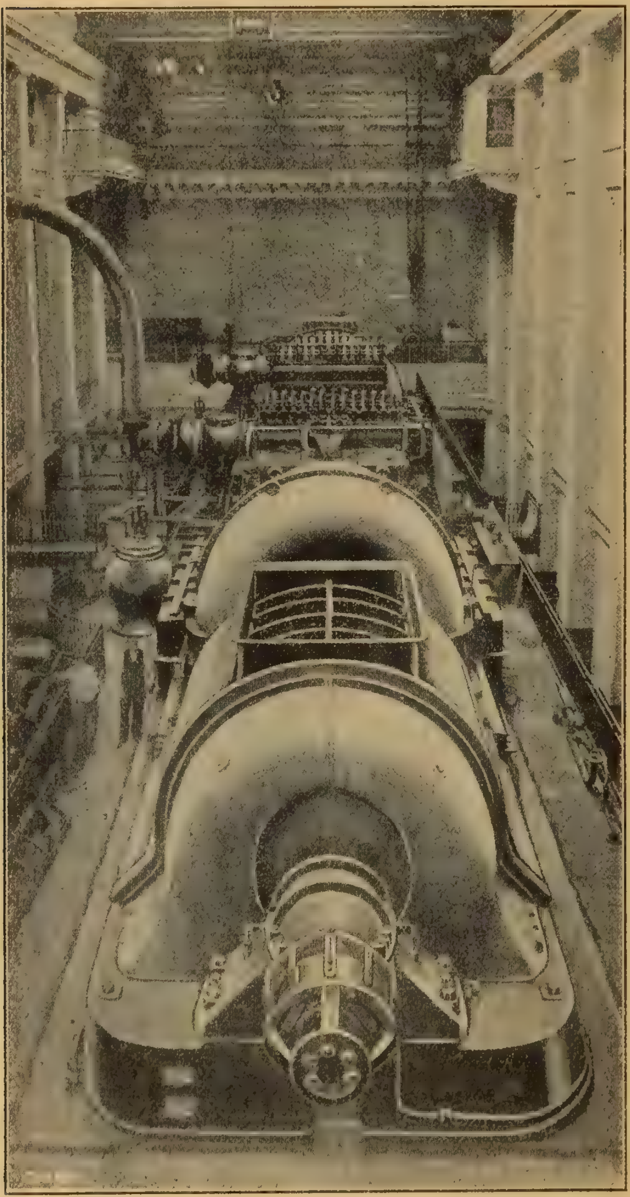
There is another feature which influences rate of progress and cannot be ignored in this country. Every industrial emergency resulting in interference with fuel or labour has the effect of increasing the rate of output of electricity, which is equivalent to an admission that electricity is the cheapest power and most convenient labour-saving agency on the market. The position is then that just as the lower-pressure direct-current station with direct retail distribution has given place to the medium-pressure alternating station with a combined distribution, partly bulk to substations and partly direct to the consumer, so will this phase of development be superseded by the bulk high-pressure generating station, designed to utilise to the full our existing means of producing cheap electricity, which will, in fact, be supplied in bulk to the distribution area.

A scheme of this kind would necessarily involve the use of only the largest turbine and boiler units available under the circumstances, because they would, relatively to the output, be the cheapest to purchase and operate, and in order to realise the full benefit of its capacity, it would probably require us to fit the supply area to the station, rather than as at present fit the station to the parochial needs of the area *at the moment.*

There is nothing novel in this idea, but, unfortunately, it is not appreciated by those who might benefit by it; neither does it appear to be appreciated that every pound spent in perpetuating any but the largest type of generating plant, where that can be utilised, is actually an obstacle to the production of electricity at minimum cost, and an additional burden on the consumer on whom obviously the excess cost must fall. In this connection the municipal boundary line has much to answer for; as a barrier to co-operation it probably has had no equal, and so far as municipal co-operation in electricity supply is concerned, it has more frequently proved insurmountable.

Curiously enough, our electricity suppliers, municipal and otherwise, in their dealings with consumers, are the most enthusiastic exponents of the principle of concentrating power production and of entrusting to experts the generation of power, although they show no inclination amongst themselves to practice what they preach to their consumers. Not only so, but extensions to individual plants are too frequently stopgaps, introduced solely to fill the pressing requirements of the next 12 months. In a time of stress like the present, and such as will probably exist during the next few years, the question which naturally occurs to us is whether we can afford to prolong our present methods of electricity supply—whether circumstances, such as the need for national economy in expenditure after the war and the paramount necessity of introducing into our industrial life economy in time and labour, in which electrical methods play such an important part, will not compel us in the near future to sweep away all artificial barriers to economic progress and abandon the narrow-minded methods of the past.

It is admitted that the miniature supply areas of this country do not individually in their present state of electrical development give scope for the use of really large turbines, but in the matter of the generating station there appears to be no reason why joint ownership should not be adopted in many cases, and, indeed, favoured by that Government department which, as regards municipal expenditure, is supposed to safeguard the poor ratepayer's pockets. Such a course would undoubtedly hurry up our electrical development at a time when it is most needed.



30,000-kw. and 35,000-kw. Sets in the Philadelphia Electric Co.'s Station.

It may be of some interest in this connection to draw attention to the progress of the big unit station in America.

The bulk supply station is, of course, no new thing in this country—on paper, at least—but the only really big unit plant which we can count on as likly to materialise within the next few years is the Barton station of the Manchester Corporation, which authority, it may be noted, supplies in several districts adjoining the city boundary. This station is planned to utilise 15,000 kw. and 25,000 kw. turbine units, but before the latter sized units are installed it is quite possible that the 50,000-kw. turbine, to which serious consideration is being given in the States, will have become a reality.

At the present time, New York City boasts a station laid out to accommodate eight 30,000-kw. turbine sets of a hybrid pattern, each machine consisting of two steam-electrical units, for traction purposes, while turbines of similar output are used in Chicago and at Philadelphia in the new Christian Street station, where, in addition to a 30,000-kw. unit, a 35,000-kw. turbine plant, the largest so far installed, has recently been put to work. Some details of this machine appeared recently in the *Electrical World*, which mentioned that it consisted of a 13-stage Curtis turbine operating on steam at 215-lb. pressure, 150° F. superheat, and exhausting into a 50,000 sq. ft. central flow surface condenser. The generator supplies a three-phase, 60-cycle current at 13,200 volts, and is coupled direct to a 150-kw., 250-volt exciter mounted on the shaft. The whole machine measures 63 ft. 2 in. in length, is 21 ft. 7 in. wide, and 15 ft. 10 in. high, the speed being 1,200 r.p.m., while as to steam consumption, 11·8 lb. per kw.-hour at the most efficient load, 25,000 kw., and 12·5 lb., at the full output of 35,000 kw., are guaranteed. The steam-raising plant of the new station will consist of 20 60,000-lb. boilers.

We illustrate another 30,000-kw. Curtis turbine set which has recently been installed in the Waterside generating station of the New York Edison Co., bringing the capacity of plant installed up to 500,000 h.p. This machine consists of a 10-stage high-pressure steam turbine and a two-stage double flow low-pressure turbine coupled to a generator on the same shaft, running at 1,500 r.p.m. Steam is supplied at a pressure of 185 lb. per sq. in. and exhausted into a 50,000 sq. ft. surface condenser.

The Westinghouse Co. is supplying the Commonwealth Edison Co., of Chicago, with a single shaft turbine unit of 35,300 kw. This will comprise a tandem compound Parsons type turbine coupled to a three-phase 60-cycle 12,000-volt generator rated at 35,300 kw. at 85 per cent. power factor, with a direct-coupled exciter. The turbine will run at 1,200 r.p.m. on steam at 220 lb. pressure with 200° superheat, and will exhaust into a 29-in. vacuum. This unit will measure 75 ft. long by 18 ft. 6 in. wide and 21 ft. high, over all.

Single turbine units of 20,000 kw. are also used in the New York, Chicago, Cleveland and Detroit Central Stations.

At the New Conners Creek station of the Detroit Edison Co. the first 50,000 kw. section of which is now in operation, a 150,000-k.v.a. plant is to be put down in six 25,000-k.v.a. units, and will be supplied with steam from boilers of exceptional size, each of 23,654 sq. ft. heating surface. Only two such boilers will be used for each turbine unit and no provision for spare plant, as usually understood, is made, although arrangements have been made for three boilers to supply two turbines, and the boilers can be safely operated at more than 170 per cent. of their ordinary steaming rates. The steam pressure is 225 lb. per sq. in., and 200° F. of superheat at 200 per cent. of rating is provided for. What are usually considered unavoidable heat losses are minimised by passing the air from the engine room through a pipe gallery, where it passes over the steam pipes, to the fan equipment of the boilers.

The *Electrical World*, referring to the discussion on economics of power-station design at the recent San Francisco Engineering Congress, mentioned that Mr. H. H. Barnes, jun., intimated that boiler pressures much higher than 250 lb. would be found feasible and economical; a pressure as high as 1,000 lb. was suggested as a possibility for turbo-generators of 40,000 kw. to 50,000 kw.

The opinion of Mr. C. W. Clarke is given that 400 lb. per sq. in. boiler pressures are feasible, and that high-steam pressure rather than very high superheat is to be preferred and would mark a decided gain in turbine efficiency. Steam pressures of 500 to 600 lb. per sq. in. could be looked for in due course, and would represent a gain of about 9 per cent. in turbine efficiency.

Mr. P. M. Lincoln considered that the capacity of the future unit would be fixed by the demand for such units rather than by any inability to produce them, and Prof. Miller remarked that a noticeable saving in labour would occur with the largest size turbines, and that as their efficiency could be but slightly improved with existing steam pressures and superheats, higher steam pressures would be introduced, marking a new departure in power plant practice and raising the efficiency on the Rankine cycle considerably above the present maximum of about 73 per cent.

Mr. H. G. Stott said that the 30,000-kw. steam turbine had surpassed the gas engine in thermal efficiency, reaching

26 to 28 per cent., which was only surpassed by the Diesel oil engine; the floor space occupied by the horizontal steam-turbine generator was only $\frac{1}{10}$ to $\frac{1}{15}$ sq. ft. per KW. It may be added that opinions on the operation of such large turbine units do not appear to anticipate any difficulties.

As regards increased boiler pressures, the Public Service Co. of Northern Illinois is installing a 10,000 KW. turbine unit which will run on steam at 300 lb. pressure and 200 superheat. The Babcock boilers supplying steam to this machine are constructed for a pressure of 350 lb. per sq. in.

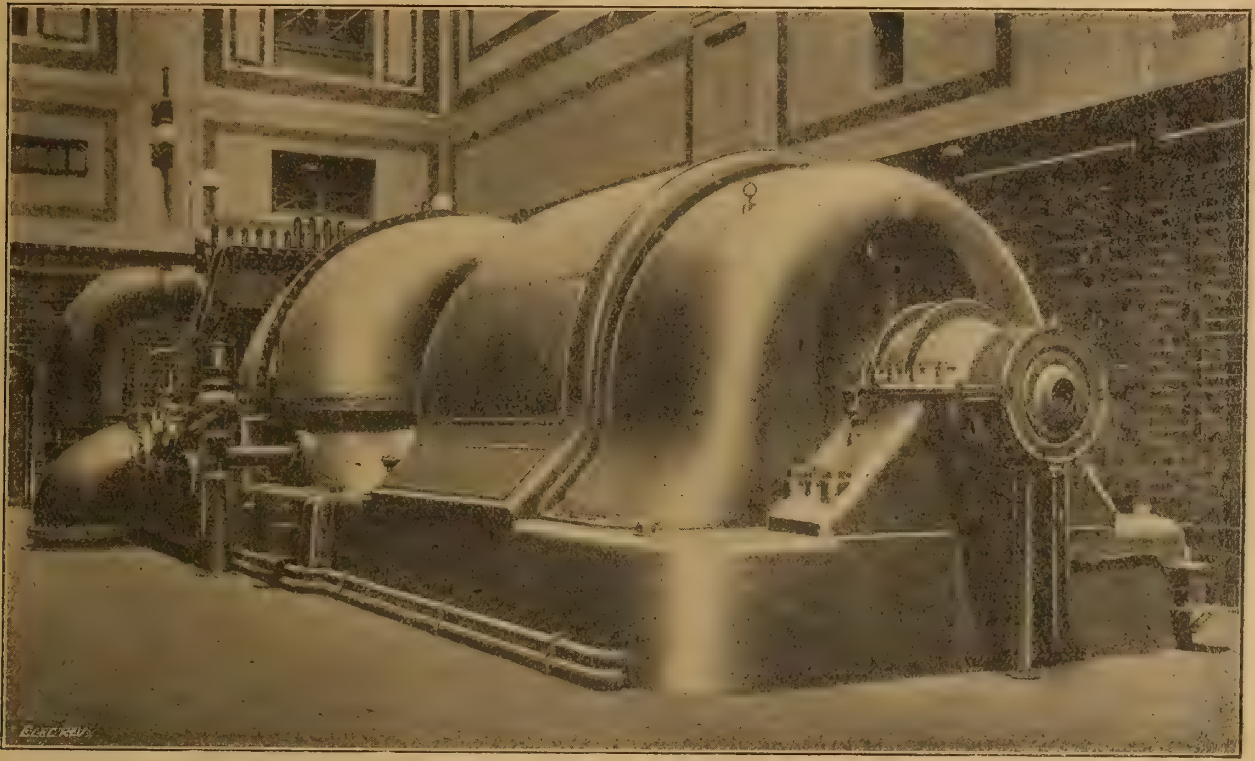
It is interesting to note that in this country so far as the feeling has been indicated at all, it appears to point in the direction of very high superheat for future turbine practice—as, for instance, in the Ferranti steam gas tubine. It is also almost certain that the development of large unit bulk supply generating plants would be accompanied by sufficiently favourable load conditions as to render the adoption of gas firing and by-product recovery an attractive proposition, the increasing price of coal being a probable contributing factor.

The fact that these ultra-developments are problematical at the present time does not detract from the economic necessity of adopting the most advanced methods of electricity supply available.

We must get away from the "municipal area" idea, remembering that the intensive development of one town far ahead of its neighbours, will result in far less advantage to the inhabitants, than the general development of the whole country; the former would have an infinitesimal effect on the price of apparatus as compared with enormous sales resulting from the latter.

THE BRITISH STANDARDISATION RULES FOR ELECTRICAL MACHINERY.

We have already briefly announced the issue of Report No. 72 of the Engineering Standards Committee, which deals with "Electrical Machinery (excluding motors for traction purposes)," and supersedes the Interim Report of 1904. The new Rules are extremely interesting, and undoubtedly constitute the fruits of a vast amount of work, not only on the part of the very representative sub-committee which drew them up, but also of the International Electrotechnical Commission. We may remind our readers in this connection that the Sectional Electrical Committee of the E.S.C. is also the British National Committee of the I.E.C. Perhaps the most important section of the report is that which deals with the limiting temperatures for insulating materials, a subject which has given rise to much controversy in the deliberations of the I.E.C.; the crucial point was the temperature to be adopted as a standard for the cooling air, it being held that the *maximum* temperature to which the cooling air might be expected to rise should be taken. Obviously, unless this were done, it would be impossible to specify the permissible temperature rise in such a way that the maximum limit permissible for the total temperature should never be exceeded. It was abundantly proved that the cooling air even in temperate climates often attained a temperature of 40° C., and this was the value advocated by the British and American Committees, but the Germans stood out for a lower value, being clearly averse to lowering the rating of their machines to the value assigned to it by other nations. The importance of universal agreement on this point was very great from a commercial point of view, as any nation which rated its machines by a lower standard would of course secure an unfair advantage over its rivals, to the prejudice of the purchaser.



30,000-KW. Turbo-Generator at the New York Edison Co's Waterside Station.

It is stated that the rules have been based on the limiting temperatures for insulating materials agreed to at the last Plenary Meeting of the I.E.C. held in Berlin in 1913, and that considerable advantage has accrued from the co-operation of the American Standards Committee in this work, a conference in London in March last being attended by Mr. H. M. Hobart and Mr. C. E. Skinner as the official representatives of the American Institute of Electrical Engineers. The Canadian National Committee of the I.E.C. was also officially represented at the conference.

The Interim Report of 1904 cannot be said to have commanded the approval and acceptance of the electrical industry in this country, and with a view to arriving at a working arrangement, pending the issue of the present report, the British Electrical and Allied Manufacturers' Association drew up a provisional code of standards, the first part of which was published in our issue of May 23rd, 1913; a supplement appeared in our issue of May 21st, 1915.

In issuing the latter, the B.E.A.M.A. stated that, owing to the approaching completion of the Engineering Standards Committee's Report, the original rules were reissued without alteration—otherwise certain changes would have been made; this statement, and the fact that the B.E.A.M.A. is represented on the sub-committee responsible for the new rules, lead us to infer that the Association will adopt the latter, at any rate so far as they cover common ground—for the Association code also deals with matters which are not touched upon in the present report.

The following is a brief summary of the more important features of the rules; the latter, of course, cannot be re-published in our pages in full. In a later issue we shall compare some of the provisions of the new code with those of its forerunners.

The first section is devoted to definitions, and is followed by standards of frequency, phase, and wave form for A.C. machines; these are commendably few, and call for a 50-cycle, three-phase, sine-wave standard generator. It is interesting to note that two-phase machines are explicitly banned. We then meet with definitions of eight types of generators and motors—open, protected, semi-enclosed, totally-enclosed, pipe-ventilated, forced-draught, drip-proof, and flame-proof—this section being, in fact, a glossary.

The standard for continuous rating is defined as the output at which a machine can work for an unlimited period and comply with these rules. This rating includes the equivalent of the overload that is commonly specified. For intermittent service two standards for short-time rating are provided—one hour, and half hour. Variable-speed machines are to have a definite rating for each of the limiting speeds. The maximum cooling air temperature to which the rules apply is 40° C., and this has been used in fixing the limits of temperature that may be attained, which are all included between 90° and 115° C.; the limits depend upon the materials employed for insulating the windings, being for rotating armatures with commutators 90° C. when the insulation is effected with impregnated cotton, paper and similar materials, and enamelled wire, and 110° when asbestos, mica, etc., is employed. Field magnet coils, A.C. windings in slots, and transformer windings, are allowed an extra five degrees. Commutators, slip-rings, and transformer oil are limited to 90° C. For cotton, etc., when neither impregnated nor immersed in oil, the temperature limit is placed 10° C. lower.

The duration of the temperature test run is of some importance, especially in the case of large machines, and the new standards of procedure are here very helpful; they permit the time required to attain the final temperature to be shortened by running the machine on overload at first, the load being afterwards reduced to rated conditions and kept constant long enough to make sure that the temperature of the machine would not exceed the standard if the test were prolonged until a steady final temperature had been reached.

The temperature recorded is to be the highest observable; when it is found that the temperature of a part goes on increasing after stopping the machine, the highest value is to be taken, and if the temperature on the other hand is falling, corrections are to be applied. Provision is made for the temperature test of a machine for intermittent service to commence when the highest of the observable temperatures of the windings is the same as that of the cooling air; this is obviously necessary, but the utility of a similar proviso in the case of a machine for continuous service is not easily seen, as it is expressly provided that the latter may be run at an excess load if desired, to reduce the period of test. The *highest* observable temperature is to be taken, no matter whether it be obtained by resistance measurement or by the use of a thermometer; no doubt is left, however, as to which method is regarded by the Committee as the more reliable, as the resistance method is definitely prescribed for all field coils except those of very low resistance (series windings), and for other windings when practicable; in certain cases the thermometer may be used alone, although the resistance method is practicable, but in such cases the temperature limit is placed 5° C. lower. A notable innovation is the employment of temperature detectors—thermocouples or resistance thermometers—which are to be embedded in the windings of machines over 3,000 KW. and 3,300 volts, if specified in the first instance. When these detectors are embedded between two coils in one slot, an extra allowance of 5° C. over the standard limits is made, whereas if the detectors are between the insulated coil and the iron core, the par values must be taken for the limits. If, however, the rated pressure of the machine exceeds 5,000 volts, the permissible limits are reduced by 1° C. for each thousand over five, evidently to allow for the increased thickness of the insulating material. The temperature coefficient of the change of resistance of copper is neatly defined by the formula $1/(234.5+t_0)$ where t_0 is the initial Cent. temperature of the winding; the sequence of the figures makes them easy to remember.

Entirely new mechanical tests are prescribed; any machine must be capable of withstanding for 15 seconds a load in amperes 100 per cent. in excess of its standard rating, at rated voltage—for 30 seconds in the case of a motor for intermittent service—and an induction motor must not be stalled by a torque less than 75 per cent. above normal rating. Motors with short-time rating, other than the squirrel-cage induction type, must be able to exert a starting torque 100 per cent. in excess of the normal full load.

Under the heading "Commutation Tests" it is specified that a D.C. machine with fixed brushes shall work "practically sparklessly" from no load to the rated load; we appreciate the difficulty of defining the permissible degree of sparking, but it will be seen that the difficulty has not been overcome, and compliance with the rule remains a matter of opinion.

High-pressure tests are to be applied for one minute between copper and iron, and range from twice rated pressure plus 500 volts (R.M.S.) for very small machines to twice rated pressure plus 5,000 volts for those of the largest size and pressures over 5,000 volts. Rotating field windings, however, are subjected to a test pressure ten times the rated pressure. Current and pressure transformers are to be tested at the rather curious value of 2¼ times the rated pressure + 2,000 volts. Various other pressure tests are specified for particular cases, and the desirable insulation resistance in megohms is indicated by the formula

$$\frac{\text{Rated pressure in volts}}{1{,}000 + \text{Rated output in K.V.A.}}$$

with a minimum of one megohm; but strict compliance with the formula is not insisted on, and it is pointed out that insulation resistance higher than the value indicated should not be asked for, as the insulating material may be damaged by the severe baking to which it may have to be subjected. The test is made with a pressure of about 500 volts, continuous.

Information to be given on the rating plate is specified in great detail, there being six cases to provide for; an interesting innovation is the requirement that on transformers the rating plate shall carry a vector diagram showing the phase relations in a three-phase transformer, and a connection diagram showing the relation of the various terminals to the windings. This is a very practical and useful stipulation, and will prevent many mishaps. The terminal marking is a necessary complement to the diagrams, and is intended to indicate at once the (relative) pressure and polarity of the primary and secondary windings.

The last section deals fully with the information to be given with the inquiry and when ordering machines.

The list of standard pressures for electrical machinery, which formed a prominent feature of the report of 1904, is here relegated to an appendix, which refers to them as the pressures in use on systems already in operation, and to which, therefore, manufacturers have conformed; but it is stated that the question of standard pressures for new systems is under consideration. Another appendix relates to the highest internal temperatures attained and their relation to the maximum temperatures to which various classes of insulating materials may be subjected, these being in the case of impregnated cotton, silk, paper, etc., 105° C.; in the case of mica, asbestos, etc., 125° C.; and in the case of cotton, etc., not impregnated, 95° C. Enamelled wire is at present classed with impregnated cotton for want of reliable data as to its endurance, and the limits for refractory materials such as pure mica, porcelain and quartz are not yet determined. It is interesting, however, to note that the ability of mica and asbestos to withstand a temperature of 150° C. or more is recognised, though it is not considered advisable in the light of present knowledge to exceed 125° C. In this connection we may mention that at a recent meeting of the American Institute of Electrical Engineers it was stated that some of the generators at Niagara Falls which were built with mica insulation have been running for 20 years at temperatures up to 285° C. without injury, and some of the speakers advocated the acceptance of higher temperature rises for mica insulation than the A.I.E.E. rules allow. The machines referred to were wound with rigid bars, and it was pointed out that with modern high voltages and wire-wound coils it was difficult to insulate with mica, owing to the flexibility of the conductors. There was a decided consensus of opinion in favour of allowing a maximum temperature of 150° C. for mica and asbestos, but not more.

(To be continued.)

A NEW HIGH-EFFICIENCY INCANDESCENT LAMP.

By E. A. GIMINGHAM, M.I.E.E.; and S. R. MULLARD, A.M.I.E.E.

(*Abstract of Communication to the Journal of the* Institution of Electrical Engineers.)

In 1913, experiments were started in the lamp research laboratory of the Edison & Swan United Electric Light Co. at their Ponders End works, with the object of making a lamp having the usual characteristics of the ordinary incandescent lamp, that is to say as regards the shape and size of bulb, stem, and cap, but having as the source of light an arc having electrodes of tungsten or other suitable refractory conductor burning in an inert gas such as nitrogen or argon. The present paper describes the results of this work.

The first lamps constructed were made with the electrodes in contact, one of the electrodes being connected to an expansion strip constructed of a strip of molybdenum, to one side of which was welded a thin strip of copper or other suitable material having about the same coefficient of expansion. A spiral filament of tungsten or molybdenum was mounted close to the strip and wired in series with the arc circuit. To prevent the strip moving too far and the arc breaking, a thick wire was sealed into the glass support; this wire acted as a stop and maintained the correct length of arc gap.

For alternating-current lamps the electrodes were constructed of fused tungsten and were of equal size.

For use with continuous current, in one form of lamp the positive electrode was constructed of a globule of fused tungsten, while the negative electrode consisted of a number of tungsten wires or filaments mounted in the form of a brush. The whole of the parts were assembled as shown in fig. 1, and sealed in an ordinary incandescent lamp bulb, which, after being thoroughly exhausted of air, was filled with nitrogen at a pressure of approximately two-thirds of an atmosphere.

When connected to a continuous-current circuit through a suitable resistance the current passing through the coil A produced sufficient heat to cause the expansion strip B to warp, thus separating the electrodes E, E, and striking an arc between them. The temperature of the heating coil then dropped to a very dull-red heat due to the added resistance of the arc itself. The heat from the arc was more than sufficient to keep the expansion strip hard against the stop F, and thus to maintain the requisite length of arc gap.

The arc burned steadily and the electrodes emitted an intense white light. The lamp had, however, many disadvantages, the most important being the tendency of the electrodes to stick together, with the result that the expansion strip failed to separate them slowly. Again, a considerable amount of sputtering took place when the electrodes separated, which, in consequence, shortened the life of the lamp. However, in the course of development, principally by altering the shape and size of the electrodes, a lamp was evolved from which a life of over 100 hours was obtained. Other attempts to overcome the sticking of the electrodes included altering the physical state of one electrode, also the use of a short-circuiting piece placed between them, which on the current passing was removed. These and other devices did not entirely overcome the troubles of sticking and sputtering.

The whole problem was then tackled from another direction. It was assumed, from the results so far obtained, that if the difficulties of striking could be overcome there were possibilities of obtaining a satisfactory source of light, the whole of the light emanating from a source of very small dimensions.

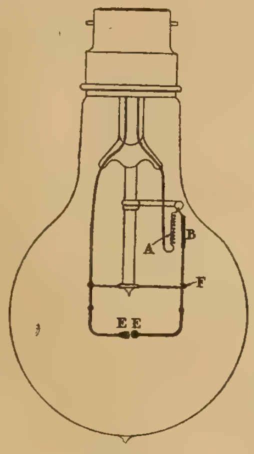


Fig. 1.

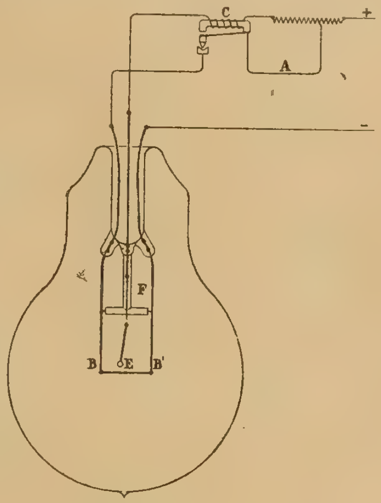


Fig. 2.

It is well known from the experiments of Sir J. J. Thomson, Dr. Fleming, and others, that the filament in an incandescent lamp gives off a strong negative discharge, and if an additional electrode sealed adjacent to the filament be charged to a positive potential, a current passes between the filament and this electrode. This principle was applied to overcome the difficulties encountered in making an arc incandescent lamp.

The first attempts on these lines were made with a lamp suitable for an alternating-current circuit. This lamp consisted of two small globules of tungsten fixed at a definite distance apart. As a means of breaking down the resistance of the gas within the arc gap, a filament was mounted adjacent to the electrode; this filament, when made to glow brightly for a few seconds, acted as an ionising agent and made the arc gap conducting.

As used in the lamp, this ionising circuit was connected in parallel with the arc circuit through an auxiliary single-pole switch and suitable resistance. On starting, the ionising circuit was completed for a few seconds and then broken by means of the switch. This resulted in an arc being momentarily struck between one of the electrodes and the filament, this being followed by an arc between both electrodes, the filament which acted as the ioniser being now entirely out of the circuit.

This lamp showed great improvement as regards both facility in striking and life.

Efforts were then directed to make a lamp for continuous-current circuits. At the start, the construction of this lamp was similar to that used for alternating current, with the exception that the negative electrode was smaller. To start the lamp the filament acting as the ioniser was brought to high incandescence and then cut out by means of a switch in the positive lead. Difficulties were experienced in inducing the arc to leave the tungsten-filament ioniser and pass to the negative electrode. This trouble was due to the difficulty of bringing the negative electrode to a temperature high enough to form an arc. In the alternating-current arc the electrode which momentarily formed the arc with the ioniser helped to form the arc proper, but with the continuous-current lamp the arc persisted in passing between the positive electrode and the ioniser.

Later on, negative electrodes were made, to which in the majority of lamps the arc would strike, but it was felt necessary to provide thoroughly for the protection of the ioniser. This was desirable, inasmuch as the prolonged action of the arc tended to damage the ioniser, which after a time added to the difficulty of striking.

To try and obtain an ioniser which had a longer life than the previously used tungsten filament and which retained its activity throughout the life of the lamp, a study was made of the action of other materials than tungsten for use as an ioniser. It is well known that several refractory oxides possess to a very high degree the property of emitting electrons; experiments were therefore made with mixtures and combinations of tungsten with zirconia, yttria, thoria, and other oxides of the refractory class.

As a result of continued experiments, a satisfactory filament giving powerful ionisation properties was evolved, it being found that if the filaments were carefully made they were not destroyed by the action of the arc and that they lasted considerably longer than a filament of pure tungsten, this being no doubt due to the difference in the physical state of the two filaments. However, difficulties still remained in the matter of restarting. The action of the arc after a time naturally destroyed the ionising properties of the filament, and in some cases difficulty was experienced in restriking after 200 hours' burning. This deterioration of the ionising properties of the filament was only local, being merely around a short length directly opposite the anode.

To overcome this objection, a short length of expansion strip similar to that used in fig. 1 was linked between the anode and its stem lead. A lamp constructed in this manner is connected as shown in fig. 2, which illustrates a lamp suitable for a continuous-current circuit. Three leads are necessary through the lamp stem; on one is mounted the electrode E, while the other two hold the filament, acting as an ioniser, B B'. The positive main lead is divided into two circuits, one of which, A, passes through a resistance and the contacts on the electromagnetic switch C to one pole of the ioniser B, the other being taken through a resistance and the coil on the electromagnetic switch to the positive electrode of the arc circuit E. The negative main lead is connected to the remaining ioniser lead B'.

In operation, the current first passes through the ioniser circuit, causing the filament to incandesce at a temperature sufficient to ionise the gas between it and the positive electrode. At first a small current flows in the arc circuit, this current rapidly increasing until the cut-out is operated. This breaks the ioniser circuit and the arc is "struck," the striking being assisted by the removal of the ioniser circuit, which, of course, shunted the arc circuit. The heat rising from the arc causes the expansion strip F to warp, and this moves the arc to another position on the ioniser.

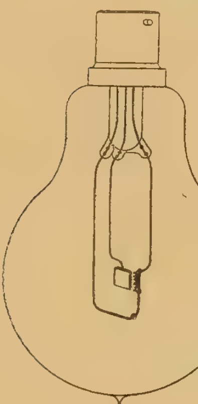


FIG. 3.

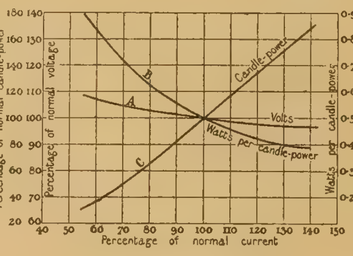


FIG. 4.

On switching off the current the electrode returns to its original position, having left the inactive part and coming to rest opposite the still active portion of the ioniser. By this means the lamp may be restarted at any period of its life without difficulty.

In this lamp practically the whole of the intense white light emanates from a small globule of fused tungsten 1/10 in. in diameter.

Any size or shape of electrode may be made, the construction of the higher candle-power lamps being arranged as shown in fig. 3. Here the expansion strip is dispensed with, use being made of the fact that in the more powerful arcs there is a greater tendency for the arc to pass across the shortest gap. In this case, after striking from the filament to the edge of the electrode, the arc rises to the thickened portion immediately opposite.

Another method adopted for controlling the arc stream in lamps of high candle-power is to employ an extra lead through the stem, holding a smaller electrode fixed between the positive plate and the filament, and situated at a definite distance from the former. By the operation of change-over switches in the circuit an arc is first struck between the filament as cathode and the small electrode as anode. On this electrode becoming brightly incandescent the change-over switch quickly operated brings into the circuit the large plate electrode, at the same time breaking the negative connection to the filament and changing the polarity of the small white-hot electrode. This latter now being negative, an arc is immediately formed between it and the large positive plate. This arrangement enables electrodes of any size to be used, and the filament being out of the circuit is completely protected.

A flat electrode is also employed. To obtain the best results a definite relation of surface to volume must be maintained. This type of lamp is made in sizes of 500 to 1,000 C.P., the maximum intensity being given in a direction at right angles to the plane of the electrode.

Comparison with Arc and Incandescent Lamps.—As compared with the carbon arc lamp no regulating mechanism is required, and there is therefore a saving in the initial cost of production. The loss of light due to obstruction by the electrodes is small compared with that in the carbon arc, and there is no trouble from flickering or from the arc wandering. The arc is completely enclosed, so that there is no danger from fire. No re-carboning is required, and the lamp needs no attention whilst in use. The light-giving surface for the same output is greater than the crater of the carbon arc, and the electrodes can be so arranged as to concentrate the light in any desired direction.

Filaments of incandescent lamps are always distributed round the stem and thus occupy a fairly large area, whereas in the new lamp the light-giving surfaces are concentrated in the centre of the bulb. In the same way that a carbon lamp appears yellow in comparison with the ordinary half-watt lamp, so does the latter appear yellow when contrasted with the new incandescent arc. For high candle-power lamps the bulbs are much smaller than for metal-filament lamps of corresponding candle-power, *e.g.*, electrodes to give 500 C.P. can be placed with safety in a bulb 4 in. in diameter.

Characteristics of Lamp, etc.—Curve A (fig. 4) shows the percentage variation of pressure with current. As will be seen, the curve is similar to that for an ordinary carbon arc, though showing greater stability. The pressure across the arc steadily decreases with an increase of current, and if this is continued until the sputtering point is reached, the pressure suddenly drops.

A representative efficiency curve is given by B in fig. 4, which shows the efficiency for the normal working current to be about 0.5 watt per International C.P., or 2 C.P. per watt. The current may be increased until the tungsten reaches the sputtering point, at which the efficiency is about 0.3 watt per C.P. or 3.33 C.P. per watt.

Curve C in fig. 4 shows the variation of C.P. with current. Lamps have been made with a life of 500 hours, and it is hoped that further experiment will make it possible to obtain a true half-watt lamp with a life of 800 hours. During life the average decrease in C.P. is about 10 per cent.

Some experiments to determine the effect of varying the pressure across the supply mains show the arc to be very stable. A voltage drop of 20 per cent. in the case of the small lamps, and 25 per cent. in the larger sizes, was necessary before the arc was extinguished.

As compared with the carbon-filament lamp (3.5 watts per C.P.), with an intrinsic brilliancy of about 375 C.P. per square inch, and metal-filament lamps giving 1,000 C.P. per square inch, the intrinsic brilliancy of the new lamp at an efficiency of 0.5 watt per C.P., or 2 C.P. per watt, is approximately 10,000 C.P. per square inch. The colour of the light can be made to vary from a bright yellow when running at low efficiencies, to a very intense white light when the lamp is run to the sputtering point of the electrodes. The range of intrinsic brilliancy between these limits is approximately 400 to 30,000 C.P. per square inch.

Comparison with the spectra of various lamps clearly shows the continuity and strength in the visible spectrum of the new lamp, the other sources of light showing weakness in the green and at other points.

A great advantage of a lamp of this type is its adaptability (by altering the shape and position of the electrodes) for so varying the light distribution as to make it most suitable for the particular purpose for which the lamp is required. Where even illumination is required in all directions, spherical electrodes are most suitable. Electrodes can be made of any desired shape, however, and a flat plate or disk mounted vertically is an ideal light source for projection purposes.

The lamp is made for both alternating and continuous-current circuits, and the present intention of the Edison and Swan Co. is to put forward only the continuous-current lamp in its present form for optical projection and general scientific work where a concentrated point source of light is required. The lamp is so suitable for projection work that there is every reason to believe it will supersede all other sources of light for this purpose. It gives constant, uniform screen illumination, whilst there is no flickering and no danger of fire in kinematograph work, as there often is from the intense heat of the ordinary carbon arc. The bulb of the lamp, although smaller, does not become so hot as those of the half-watt metal-filament lamps. Moreover, the lamp requires no attention whilst burning, so that the whole of the operator's time is free to attend to his apparatus. Lamps of 1,000 to 2,000 C.P. are suggested as very suitable for kinematograph projection, and lamps of 200 to 300 C.P. for ordinary lantern work.

The lamp is very suitable for use in small searchlights, for daylight and night signalling, and as projection arcs for stage purposes. It should prove useful in photography, and for the purpose of colour-matching by artificial light. Microscope illumination and micro-photographic work offer two fields of usefulness for the new lamp, and undoubtedly there are many special purposes for which the lamp is particularly adapted.

Experiments have shown that the lamp burns satisfactorily in series on high-voltage circuits, and future development lies in the adaptation of the lamp for street lighting, and for the illumination of large halls, etc.

Although much work remains to be done for the complete development of the lamp, and such development takes place slowly in these troublous times, the laboratory tests have clearly shown its commercial possibilities.

The authors are indebted to Dr. J. Fox for his valuable help in providing the photographs of the various spectra.

NOTES FROM CANADA.

[From our Special Correspondent.]

The Quebec Streams Commission a few months ago let a contract for the construction of a large concrete dam across the St. Maurice River, which flows into the St. Lawrence a little above the City of Quebec. The dam, however, will be about 240 miles up the river from its confluence with the St. Lawrence. The height of the dam will be 80 ft. maximum, and its length about 2,000 ft.; its cost is to be about $1,500,000. A storage reservoir will thus be created which will hold rather more than a cubic mile of water, giving a minimum flow of about 6,172 cu. ft. per second for 300 days. This reservoir, it is said, will be greater than that created by the Assouan dam.

The same Commission, by constructing a dam at a cost of about $100,000 across the foot of Lake St. Francis, on the east side of the St. Lawrence River, some 50 or 60 miles below Montreal, expect to secure effective regulation of the water powers available, thus increasing very considerably the power which may be developed. Power is generated at several points now, but during the winter the minimum flow is very much less than the flow in the spring, when the ice and snow melt. The proposed dam will provide a large storage area which will tend largely to balance up the available maximum and minimum flows.

On the Northern portion of Quebec Province, in the Ungava region, on the Great Whale river, which flows westward into Hudson Bay, occur a number of falls of comparatively high head. Within 20 miles of the mouth of this river are three falls of 150 ft., 230 ft., and 65 ft. respectively; at other points there are falls of 136, 170, and 315 ft. The Hamilton river, which flows into the Atlantic on the Labrador coast, has a sheer fall of 302 ft., while the fall of the river itself within a distance of 12 miles is another 460 ft.; the estimated power available due to this total fall of some 760 ft. is 300,000 h.p. This Ungava district is, however, too far away from any population, and is too cold, to admit of the development of these great water powers for a good while to come, unless it be done in certain cases for electro-chemical purposes, such as the fixation of atmospheric nitrogen, etc. There have already been brief accounts in some of the papers hinting at the proposed erection of a large power plant in Labrador for such work.

It is difficult to see how such a scheme could be made profitable unless both the power and the raw materials could be had almost for the asking, as the distance from available markets and the lack of transportation facilities would go a long way to offset cheap power and raw materials.

It is not usual to associate Canada with power possibilities derived from coal. The Provinces of the Middle West, however, being deprived by nature of the water powers so liberally possessed by Ontario, Quebec, and British Columbia, have instead coal deposits of no inconsiderable extent, though they are mostly of a low-grade quality, viz., lignites. Owing to the use of gas producers and gas engines the objections to lignite and coal of comparatively low calorific value is rapidly disappearing so far as power production is concerned.

Reference was made a year or more ago in this column to the Hudson Bay Railway, which will open up a new and much-needed route for grain shipments from the West. The idea, of course, is to transport the grain from the great wheat-growing areas to a port on Hudson Bay, and ship it thence to European ports. The interest of this railway line to electrical engineers lies in the fact that investigation is being made of water power sites along the route with a view to, possibly, building an electric line. Wireless stations have proved a great boon during construction, especially in enabling the men to be supplied with news of the world. The route will apparently be opened during 1917.

Women Workers.—The Liverpool Branch of the Electrical Contractors' Association on Wednesday last week decided to admit women to the industry. The branch decided that women should be trained in various branches of electrical work, and that they should receive their initial lesson in the first week in December.

THE PARK ROYAL ENGINEERING WORKS, LTD.

As many of our readers are aware, the firm of Spagnoletti, so well known in the past as a pioneer in certain directions of electrical manufacture, has now been merged into the Park Royal Engineering Works, Ltd., whose modern factory was completed during the present year. The original business established in 1851 had gradually expanded to such an extent that complete re-organisation and rebuilding were necessary, and as a result the new works, which we illustrate herewith, came into existence. These are laid out on the modern one-storey bay system, with ample north lighting, and are heated throughout by anthracite stoves.

The machinery is electrically-driven throughout on the group system, with three-phase motors, and for artificial lighting both the half-watt and ordinary tungsten lamps are employed—in fact, advantage has been taken to introduce the best possible conditions for obtaining good work, and with very satisfactory results.

Erecting Bay, Park Royal Works.

An up-to-date plant and machines, together with large test rooms, are provided; for testing and experimental work the equipment includes a large battery capable of every combination of connection, potentiometers, e.h.t.-transformers, and all the standard laboratory instruments.

Our view, fig. 2, illustrates a bay devoted to the manufacture of special fittings for ship work, such as bronze distribution boxes, junction boxes, terminal boxes, and ironclad switchgear; in close connection with this and the main erecting shop, is a light machine bay for dealing with the numerous small operations necessitated in switchboard erection and the fitting up of distribution and junction boxes.

Ship Fittings Department.

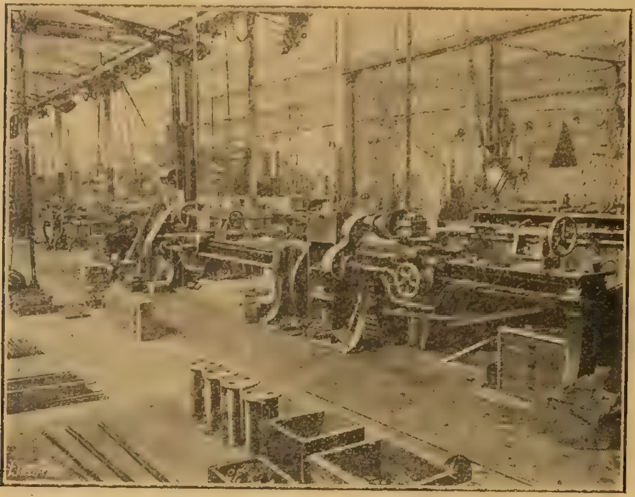
Tramroads are provided for the distribution of material between the various departments. In recent years the firm has patented improvements in fool-proof switchgear for high-tension control; in other directions, particularly in connection with ironclad and mining electrical plant, important improvements have been incorporated, and are now regular features of the firm's standard designs.

Bay 9 is devoted to the manufacture of circuit breakers, bells, portable telephone sets and wireless telegraph apparatus; in bay 10 the erection of steel-cased switch and distribution boards is carried out.

Fig. 3 shows a bay equipped with heavy lathes and automatic machinery, a portion of the tool stores being shown in the background; another bay at the northern end of the factory houses a number of drilling and milling machines.

A well-lighted instrument shop is provided, where the well-known voltmeters and ammeters, associated for so many years with the name of Spagnoletti, are manufactured; here also are assembled railway signal and telegraph instruments and other electrical precision instruments.

Adjoining are coil winding rooms for the winding of solenoids for switchgear and instruments. The lacquering departments and buffing houses are on the western side of the factory; hardwood cabinet work in connection with teak and mahogany instrument cases is carried on in another department, as also pattern making in connection with the numerous small brass, gunmetal and malleable parts used in the firm's productions.



General Machinery Bay.

Well organised stores, separate paint and varnish shops and a mess room, are also included in the new works, which are exceptionally well situated in regard to railway facilities and mark a very great advance on those formerly in use at Shepherd's Bush.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

The "Razzo" Hand Lamp.

A new single cell portable hand lamp, known as the "Razzo," has recently been introduced by the Equipment and Engineering Co., of 2, Norfolk Street, Strand, W.C. This is fitted with a 1½-volt bulb in an efficient reflector, which throws a beam of light to a very considerable distance, and should prove very useful for a variety of work under the present conditions of darkness. Fig. 1 indicates one of its uses, *i.e.*, that of enabling tramway conductors to punch their tickets accurately and give the right change.

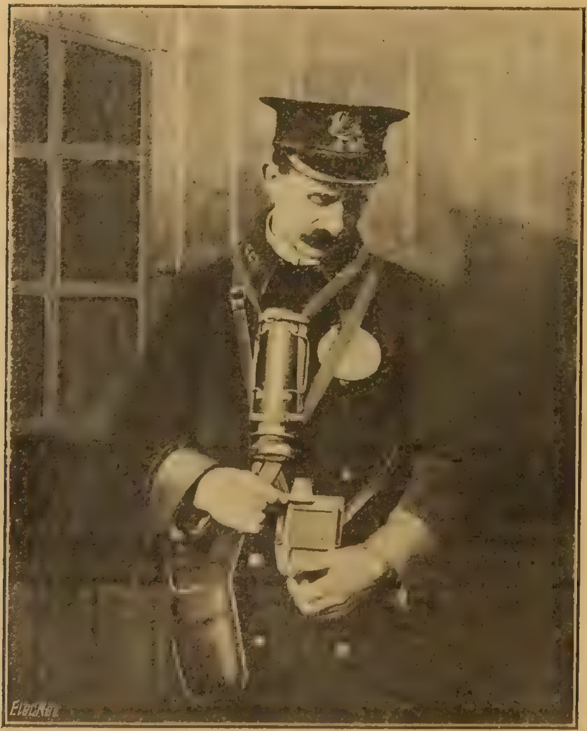


Fig. 1.—"Razzo" Lamp in use by Conductor.

Standard types of dry cell are used which can be obtained easily anywhere, and approximately 50 hours' light is given.

The lamp is made in three finishes: pressed steel (black), seamless brass (burnished finish), and seamless brass (nickel plated). It weighs complete 39 oz. and measures 2⅞ in. diameter by 9 in. long.

A New Insulating Material.

A new insulating substance known as Stern-Condensite is one of the latest additions to the field of moulded insulation. It belongs to the general class of substances made by reactions between phenol and one of the aldehydes, formaldehyde being the one used in this case. The Dickinson Manufacturing Co., of Springfield, Ill., U.S.A., which has been engaged in the production of electrical insulation and sundry composite parts for the past 40 years, is now turning out a large number of such parts in Stern-Condensite. The material is described as a plastic substance that can be readily moulded in its uncured state into any shape, with or without metal parts. After being cured under heat and pressure it leaves the mould in a finished state, presenting a lustrous black appearance like polished ebonite.

The "Migas" Detector.

The insistent demand for an apparatus capable of detecting the presence of gas in coal mines, and measuring its amount, has led many inventors to apply their talents to the solution of this problem; amongst these Messrs. Arnold Philip and L. J. Steele appear to have met with exceptional success, judging by the claims put forward for the "Migas" detector, which has just been put on the market by The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C. The Coal Mines Act of 1911 laid down certain limits for the amount of gas that might be present under specified circumstances, which range from 0·25 to 2·5 per cent.; the "Migas" detector, we are informed, by direct reading indicates any percentage of inflammable gas between 0·02 and 3 per cent., thus covering the whole range, to a degree of accuracy within 0·03 per cent. The readings, it is claimed, are fully equal in accuracy to the results obtained by the most careful chemical analysis, and are obtained at once, whereas analysis involves reference to surface laboratories and a delay of at least an hour from the time of taking a sample, even supposing that the colliery possesses a chemical laboratory, which is not often the case. With the detector a reading at any point can be made within 15 seconds. We illustrate the instrument herewith; it is strongly made and quite portable, weighing only about 13 lb., and can be used by observers without any special training. Assuming that it is as good as it is said to be, the instrument will be of immense value to colliery managers.

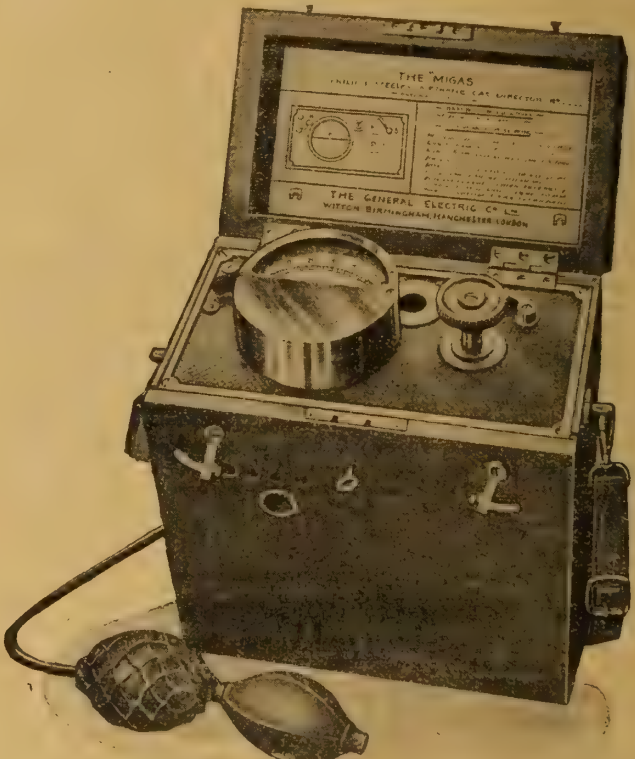

THE "MIGAS
THE GENERAL ELECTRIC Co Ltd
WITTON BIRMINGHAM, MANCHESTER LONDON

Fig. 2.—The "Migas" Mine Gas Detector.

Automatic Electric Furnaces.

In the heat treatment of special tool steels it is important to eliminate the personal factor as far as possible, so that the result may not depend upon the skill of a workman. At a recent meeting of the American Iron and Steel Institute (reported in *Met. and Chem. Engineering*) Mr. T. F. Baily described an automatic electric heating furnace provided with special pyrometers which actuate electrically-controlled hydraulic valves when the material has reached the proper temperature, and discharge the steel for quenching. The furnace has shown a thermal efficiency of 92½ per cent. The pyrometer is placed ½ in. from the metal at the point of discharge, and so liberal a period is allowed for heating up that the piece is heated uniformly throughout, there being therefore no material difference between the temperature of the pyrometer and that of the steel.

ELECTRICAL ACCIDENTS IN 1914.

(Concluded from page 714.)

The corresponding accidents to unskilled persons are less excusable, as the men should not have been allowed to attempt the work. In many works, sometimes even in large works using a very considerable amount of electric power, no technically qualified person is employed, and unskilled workmen are consequently permitted to attempt repairs or alterations at great risk to themselves. The two fatalities occurred on travelling cranes. In one case the driver was oiling the gear on the crab whilst the conductors were live, and in the other a fitter was repairing the crane and came into contact with the live trolley wires. In both cases the system was 440 volts, three-phase. Of the non-fatal accidents the victims were described as labourers (13), fitters (9), bricksetters, oilers, &c. They were mostly attempting to do some work on the electrical apparatus for which they were quite incompetent.

That the testing of electrical apparatus in electrical manufacturing works is largely carried on by apprentices and pupils is again indicated by the ages of the persons meeting with accidents. The fatal accident occurred, however, to an experienced electrician, who touched wires at 2,000 volts apparently under the impression that they were dead. Artificial respiration was carried on for two hours without success. In another case a man touched some testing leads at 12,000 volts pressure. He was rendered unconscious, but was brought round by artificial respiration. In the other cases the injuries were mostly burns from short circuits. The testing departments of electrical manufacturing works are often carried on in a very unsatisfactory manner. There is unnecessary exposure of live conductors where they are liable to be accidentally touched. Any old connecting cables with damaged insulation are considered good enough. Even in high-pressure testing unnecessary risks are run. In one large armature winding shop it was customary to test the armatures by applying 2,000 volts between the commutator and the spindle. A twin flexible cable was connected to a transformer in a cabin, the other end being moved about to whatever part of the shop a test was required, perhaps 20 or 30 yards from the cabin. The cable terminated in bare ends projecting from short vulcanite sleeves. There was only one tester, who could, of course, not be at both ends of the cable at the same time. An accident occurred at an armature under test, the armature winder, who was applying the ends of the test leads, getting a shock. The tester was walking back to the test cabin, where at the moment, there was no one to switch off the current. In this shop, also, there was no one qualified or instructed in first aid methods, someone having to be fetched from another department of the works.

Amongst the miscellaneous accidents there were three fatalities. One occurred to an electrician in a large iron works in switching on a lighting circuit transformer, arranged across one phase of a 460-volt, three-phase system, at a totally enclosed ironclad switch, the case of which was not earthed. The switch was of a well-known type, having fuses in the same box so arranged that when the switch is in the "off" position the fuses are withdrawn from the contacts, and by opening the cover they can be renewed in safety. The apparatus was intended by the makers for use with cartridge type fuses. As so often happens, however, the cartridge fuses had been replaced by wires. The electrician in question had the duty of switching on the lights at dusk, and, in order to prevent other employés switching on before the proper time, it appears that he had disconnected one end of one of the fuse wires, and had closed the cover of the switch. Later on, when he went to turn on the lights, he had evidently forgotten that the fuse was disconnected, and the effect of putting the switch to the "on" position was to make the fuse-wire live, and bring it into contact with the metal case, giving him at the same time a shock, which proved fatal. The accident would, no doubt, have occurred to any other employé attempting to turn on the lights. At the inquest it was urged that the apparatus was advertised as being "fool-proof." It is evident that this description requires some qualification. In the second fatal case the man received a shock from a 200-volt two-phase motor, the frame of which was live and not earthed. He was about to start up the motor, and had turned on the main switch but not the starting switch. He was engaged in shifting the belt on to a loose pulley, and his hand was trapped between the pulley and the belt. A man who went to his rescue also received a shock. The third fatality occurred to a boy who climbed up on to a roof where he had no business, and took hold of two wires of a 440-volt three-phase system. Amongst the non-fatal accidents two were due to stay wires of poles becoming live. In one case an electrical engineer took hold of a stay wire and was unable to let go. His two assistants, who were fortunately at hand, succeeded in pulling him off by his clothes. The system was 440 volts three-phase, and the leakage was due to the failure of an insulator.

Amongst the electric shock accidents there were several cases where the victim was brought round by means of artificial respiration. On the other hand, in several of the cases which ended fatally no adequate measures were taken to attempt to restore animation. In one case the patient was sent on an ambulance to the hospital, where the doctor pronounced him dead. At the inquest the doctor stated that as he was informed that the man had received a 5,000-volt shock, it would have been of no use if artificial respiration had been carried out in the first instance. In another case (440 volts three-phase) artificial respiration was started by the employés. Fifteen minutes after the accident a doctor arrived and pronounced the victim dead, and no further efforts at resuscitation were made. In another case (200 volts two-phase) artificial respiration was conducted until a doctor, ten minutes afterwards, pronounced life extinct, and no further efforts were made. Similarly in two other cases efforts were abandoned after 25 and 30 minutes respectively, on the doctor pronouncing the patient dead. In my report two years ago I drew attention to a letter by Dr. Reginald Morton, which appeared in the *Lancet* and other papers, pointing out that death from electric shock is in general at first only apparent, and that by means of artificial respiration, promptly and carefully carried out, patients may often be revived, even as long as two hours from the time of the accident. In general, however, the medical profession appears to be somewhat ignorant on this matter, with the result that in many cases adequate efforts at resuscitation are not carried out.

TABLE III.—Showing Voltage and System in Fatal Cases

Number of fatalities.		Voltage of system.	Voltage of circuit or probable voltage of shock.	System.
1*	...	6,600	500	3-phase
1	...	5,000	2,900	"
1	...	2,000	1,150	"
1	...	2 400	2,400	1-phase
1	...	2,000	2,000	"
1	...	500	290	3-phase
1	...	460	265	"
2	...	440	440	"
7†	...	440	250	"
1	...	400	400	"
1	...	400	230	"
1	...	240	140	"
1‡	...	200	200	2-phase
20				

* Shock from neutral conductor. † 1 fall due to shock. ‡ 1 fall due to shock.

It will be noticed that all the fatalities were due to shock from alternating current; 18 were due directly to shock and two to fall following shock. Fifteen were from pressures of 440 volts or less. Most of the shocks being to earth from touching one conductor only of the system, the voltage received by the victim was less than the voltage between phases.

In my visits during the year I again found numerous examples of dangerous switchgear and other apparatus contravening the requirements of the Regulations. In high-pressure and extra-high-pressure stations switchboards without any protection of conductors within easy reach of persons in the passage-ways were noted. In one case there were bare conductors at 10,000 volts along one wall with a gangway about 3 ft. wide; a single iron rail 12 in. out was all the protection. At the far end there were isolating switches requiring to be operated at intervals of a few days, necessitating the use of the passage while the conductors were live. In another case, although the passage was wider, there was not even a hand-rail. The excuse sometimes offered is that only authorised persons are allowed in the passage-ways. When an accident happens to the authorised person, and experience shows that such persons are by no means immune, he is blamed for not having been more careful. In one case such a passage-way was also used as a store room. Sometimes where bus-bars and isolating switches are placed out of reach from the floor, lamps for lighting the passage-ways are placed close to them, so that when a lamp fails and requires renewing the attendant will have to get up dangerously close to the live conductors. In some cases where the protection was adequate as regards ordinary routine operations and inspection, and where duplicate bus-bars were provided, the arrangement was such that when cleaning or other work should have to be done the advantage of the duplicate bars was lost. Thus the generator and feeder cells were arranged for connecting to either set of bus-bars by selector switches. Both sets of selector switches were, however, in the same compartment, and the two sets of bus-bars were not separated, so that when it should become necessary to clean the insulators of the isolating switches or bus-bars or otherwise work upon them, it would be necessary to shut down on both sets and therefore to stop the supply. This point has been overlooked in a number of public supply stations from which the supply is supposed to be continuous. In some cases a still more obvious mistake has been made in putting the isolating switches in the same compartment with the oil switches, so that unless special screens are provided for covering up the live side of the isolating switches, which is not always practicable, an oil switch cannot be overhauled without shutting down the whole switchboard. On a 2,000-volt direct-current switchboard there were double-pole switches having exposed blades 5 in. apart with the handle arranged as a cross piece between. Although there was a flange at each end of the handle, the arrangement was obviously very dangerous.

Further examples of medium pressure three-phase switchboards, mostly with oil switches, were found on works where the supply had to be maintained continuously, including night time and Sundays, and where no provision was made for isolating the oil switches or other parts when any work should become necessary. On some switchboards, fuses, even for main circuits, were placed at the back in positions (*e.g.*, between the bus-bars and the slate panels) where they could not be reached without danger. On a 550-volt switchboard having three rows of double-pole switches, the switches of the lower rows were arranged so that their handles came between the blades of the switches in the row above. In a works using large electric welders, the primary switchboards, 440 volts alternating, having bare switches, fuses, &c., were placed behind the welders, where they could only be reached by standing on the welding machines, and where the metal hoops being handled would be liable to be accidentally brought into contact with them. At a large new dock, the cranes had bare switchboards in the confined space of the driving cabins. The connector plugs for the main cables to the cranes were not protected by switches, and were so designed as to be liable to short circuit on plugging in. The most common faults in works concern the distribution fuseboards. Fuse-holders which cannot be handled without risk of touching live metal, and in which the fuse-wires are unprotected, are still supplied for new installations. In one 400-volt, three-phase installation, cartridge fuses with thumb-screw terminals were found in iron cabinets and over non-insulating floors. In a timber yard having portable electric saw-benches out of doors on a 440-volt, three-phase system, the flexible conductors were not protected by switches, and the fuses were of a type dangerous to handle, and the metal saw-benches were not earthed.

LEGAL.

Electrical Machinery for China Stopped.

A quantity of electric light apparatus intended for Chinese public lighting installations was the subject of an application in the Prize Court on December 2nd, when the President, Sir Samuel Evans, was asked by the Crown, under Article 4 of the Reprisal Order, to require the sale of this machinery and payment into Court of the proceeds.

The machinery had been seized at North Shields on board the Danish steamer *Cathay*, shipped at Copenhagen, Christiania and Gothenburg.

Mr. D. Stephens, counsel for the Crown, stated that the vessel contained all kinds of machinery manufactured in Germany, and a miscellaneous collection ranging from electric light plant to Epsom salts.

Mr. Dunlop, on behalf of the Electric Lighting Co., of Pekin, asked for the release of a quantity of electrical machinery. The packages captured included 21 packages of installation machinery, made to order for the public electric lighting company, of Pekin. The firm paid £3,300 for the machinery on July 18th of this year. It was made by Messrs. Koerting Bros., of Hanover, and the Allgemeine-Elektricitäts Gesellschaft, of Berlin. There was no defiance of any Order in Council; the goods were sold before the war. To sell the machinery now, according to the Crown's request, would be destructive of the neutrals' right to the release of the goods. The machinery was made to specification, and would be of little value to purchasers in this country. In Pekin it was badly wanted.

His Lordship said he would have this machinery detained until the claimants had elaborated their proof.

Fourteen packages of machinery and 10 packages of pumping appliances for the Tientsin Native City Waterworks, Ltd., were ordered to be detained. They had been shipped by A. Borsig, of Tegel, and 16 cases of electrical appliances for the Sunkiang Electric Light Co., Shanghai, were ordered to be sold. These were shipped by the firm of Siemens, of Berlin, and the President made the remark that they were chiefly fittings and smaller pieces in general requirement, and would sell as readily in this country as in China.

Tramway Accident Claim.

Before a jury, in the Court of Session, Edinburgh, a Glasgow woman claimed from the Corporation of Glasgow £500 damages in respect of personal injuries. She stated that a car on which she travelled overshot a stopping place, and was stopped so suddenly that she was thrown against the front of the inside of the car and injured. For the Corporation, it was stated that the car stopped before the stopping place was reached, that the woman had no occasion to rise when she did, and that she should have held on by the straps or bars. The jury returned a verdict for pursuer and assessed the damages at £300.

Motor Supply Used for Lighting.

At Dewsbury Borough Court, on November 30th, George Strecker, trading as M. Strecker & Son, pork butchers, Dewsbury, was summoned by the Corporation on an allegation that he fraudulently took a lighting supply from his motor supply after his lighting meter had been disconnected. The Town Clerk said the summons was taken out under Sec. 23 of the Electric Lighting Act, 1882, which was to the effect that a person who committed an offence under the Act was guilty of simple larceny. He described the offence as a serious one. Previous to March, 1912, defendant used electricity both for power and lighting purposes, and the charge for the latter was 1½d. per unit higher than for motive power. In March, 1912, the electrical engineer received a letter from Strecker to the effect that he would not require electric light again, so his meter was disconnected. On November 14th of this year, however, two electrical inspectors and a constable visited defendant's premises, and, seeing the sitting-room over the shop lighted up, went in. On inspection, they found that the electric light was connected to the ordinary fittings by a flexible wire to the cut-outs controlling the motor for a sausage chopping machine. They further found that the flexible had been continued to two more lampholders, which were, however, without globes. On defendant agreeing to pay £1 15s. which the Corporation claimed, the Bench allowed the case to be withdrawn.

Electro-Generator Co., Ltd., *v.* Erman.

On Monday, before his Honour Sir W. Lucius Selfe, in the West London County Court, the Electro-Generator Co., Ltd., of Shepherd's Bush Road, W., contractors for electric power installations, sued M. Erman & Son, electrical engineers, Thames Ironworks, Blackheath, for £13 6s. 6d., balance of an account. Counsel for the plaintiff company explained that the claim was admitted, but the defendants had a counterclaim for £55, the price of a motor which had been returned.

After the case had been heard at some length, the luncheon interval was reached. On the Court resuming, Counsel announced that during the interval the claim and counterclaim had been settled on terms marked on Counsel's brief. The record was then withdrawn, and the case dropped.

Munitions Act Case.

At a meeting of the Munitions Tribunal for Edinburgh and District, Andrew Wark, fitter with Bruce Peebles & Co., applied for a certificate, alleging various reasons for the application. The representatives of the employers said they had no desire to keep this man on account of the quality of his work. If he had applied to the firm he would have received a certificate right away. The first the firm knew of the man's desire to get away was the application to the Court. Sir Andrew Fraser, the President, said the Tribunal could not give a certificate as applied for, but the firm of course, could give one.

British Electric Traction Co., Ltd.

Mr. Justice Astbury, on Tuesday, resumed the hearing of the petition for confirmation of the reduction of the capital of the above company, and for the sanction of a scheme of arrangement. Mr. Russell, K.C., addressed the Court for the company, and Mr. Clauson, K.C., opposed on behalf of the income certificate holders. The hearing was adjourned to Wednesday.

MAKING AND USING THERMOCOUPLES.

By F. G. COBURN.*

Platinum wire for rare-metal thermocouples should be chemically pure, 0.6 millimetre in diameter—and all wire bought at any one time should be specified to be in one length and drawn from one ingot. The platinum-rhodium wire should also be 0.6 millimetre in diameter, and should be 90 per cent. chemically pure platinum, alloyed with 10 per cent. chemically pure rhodium. These wires are expensive. One and one-half ounces of this wire equals about 25 ft., and an ordinary rare-metal couple for laboratory work should be about 4 ft. in length.

The advantage in specifying that all the wire of any one kind bought at any one time shall be in one piece and drawn from one ingot is that, having two such wires and making up a thermocouple from the wire at each end, they may be compared with a standard, and the resulting curve used for all thermocouples made from that lot of wire. It is then simply necessary to check one point on the curve, such as the melting point of salt, or get a comparison in the furnace for one point.

The iron and constantan combination has two great advantages: low price and reasonable uniformity. Iron wire for thermocouples should be 0.172 in. in diameter. The constantan wire may be the same size or, if desired, one or two gauges smaller. These two kinds of wire should also be specified to come in one length and be drawn from one ingot, to save thorough comparison of each couple made, and it should further be specified that the wire of each kind be thermo-electrically uniform along its length. Any variation in the wire, such as slag particles or difference in internal stresses, may give rise to parasitic currents.

If both ends of a length of wire are taken to a millivolt meter and a plumber's torch is passed along the line, the electromotive forces generated up to a bright-red heat should not be equivalent to more than 10 deg. C., or 18 deg. F., in either direction. It is a good plan, also, to require that wire furnished shall be, within this tolerance, thermo-electrically equal to the wire in use. That is to say, if a piece of iron wire being purchased is fused to a piece of iron wire in use, the couple thus formed should not show an electromotive force equivalent on the iron and constantan scale equal to more than 10 deg. C. when the junction is heated to approximately 1,000 deg. C. By maintaining uniformity in this way all the couples in the plant are very nearly alike, and better results will be secured from the installation.

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* In the *American Machinist*.

A piece of each kind of wire having been cut to the length of the desired platinum-rhodium thermocouple, the hot junction should be formed by fusing the two ends together. This may be done with the oxyhydrogen blowpipe, in the electric arc, or in the oxyacetylene flame. The fusion should be complete, and it is well to have at the junction a button about the size of a pinhead. The junction having been made, a current should be passed through the two wires to anneal them, from 12 to 15 amp. being sufficient. Sometimes makers of thermocouples twist the ends together before fusing; but this is bad practice, for a thermo-electric contact will be made in the twist, at some distance back from the fused junction, and such a contact is bound to give trouble.

One of the two wires of the couple should be encased in a small insulating tube and the two wires inserted in an outside tube or sheath. These tubes may be of porcelain or of fused silica. In either case the outer tube or sheath must be glazed on the outside. Porcelain is the best, and if used it should be the genuine Marquardt mass or Royal Berlin porcelain. This material is gas-tight, and will stand a temperature of about 1,300 deg. C., far beyond the range that the iron and steel metallurgist usually has occasion to go. These tubes are very fragile, however, particularly when hot, and do not endure rapid temperature changes.

If silica tubes are used, they should be made of pure fused silica, such as will not be affected by nitric, muriatic, sulphuric, or acetic acids, ammonia, or organic acids of any strength, and absolutely insoluble in water; and the coefficient of expansion should be sufficiently low so that the couples may be subjected to sudden temperature changes without danger of breaking. Up to 1,100 or 1,200 deg. C. these tubes are satisfactory. Above that temperature the silica breaks down and the platinum is attacked.

The reason for enclosing a rare-metal thermocouple in a gas-tight sheath is that the furnace gases, and particularly those in the iron or steel-treating furnace, attack the platinum and shorten its life very rapidly, and also change the thermo-electric characteristics of the couple.

If the couple is to be used under conditions previously described, it must be covered by a black iron pipe sheath ¾ in. or 1 in. in diameter; and for exceedingly high temperatures, such as that of iron at welding heat, where the couple is to be in constant service, a thick graphite sheath may be necessary.

The design of the head is a purely mechanical proposition. It must be such as to hold the porcelain or silica sheath, and also the iron sheath, if one is used, and must carry the wires through without a possibility of short-circuiting them. Where connections to the couples are to be made and broken at all frequently, it is well to design the head so that the lead wires are terminated in a double plug fitted into sockets in the head, and in this case the connections should be made non-reversible, either by using flat plugs with their planes at right angles to each other or cylindrical plugs of different diameters. The former type is a stock article in ordinary porcelain and does very well, but there is considerable danger of breakage.

In the construction of base-metal couples, the hot junction should be made by welding, in practically the same way as the rare-metal junction. Where the equipment is available, an electric butt weld is admirable, because it is quickly and effectively made and is very durable. The wire should not be twisted. It is not necessary to anneal an iron and constantan couple.

Since the base-metal couple need not be enclosed in a silica sheath, unless it is to be used in a furnace where there are gases that would attack the metals, it is sufficient to enclose the couple in a black iron pipe sheath, and to prevent short-circuiting it is best to put insulators on both wires. These insulators should be about 1 in. long, about ⅜ in. outside diameter, and about 0.2 in. bore, of porcelain, such that they will not break down at any temperature up to 1,000 deg. C. The same remarks regarding the head apply to these couples as to rare-metal couples. It should be noted that for laboratory work it is not necessary to furnish heads, as the wires themselves will lead directly to the icebox for connection.

As has already been emphasised, the cold junction temperature is very important. On an annealing furnace in the shop, for example, where there are a number of thermocouples, the cold junctions would all be carried to one point and there enclosed in a box into which a thermometer projects, so that the cold junctions of all the couples are the same, and so that the temperature may be known and allowed for. If rare-metal couples are in use, the lead wires from the heads to the cold junction box should be of copper wire, as at ordinary temperatures the thermo-electromotive force between platinum and copper and between platinum-rhodium and copper is inconsiderable.

Where iron and constantan couples are used, the lead wires should be of iron and constantan wire respectively; but they may be much smaller than the thermocouple wires themselves. A diameter of 0.051 in. is ample. The wire may be obtained in the form of a rubber or braid-covered twin conductor, which is a very convenient form indeed. The wire thus purchased should be compared thermo-electrically to the corresponding wires of the thermocouples, to see whether it will show, for any temperature up to that obtaining around the outside of the furnace, any thermo-electromotive forces between corresponding wires. There are devices now on the market for maintaining a constant cold junction temperature. These devices consist principally of a closed box with binding posts or similar arrangements for making the connections between the lead wires and the wires going to the galvanometer, and a small incandescent lamp with a thermostatic switch in its circuit, this switch being inside the box. The switch being adjusted to any given temperature, it will close when the temperature in the box goes below that point, thus turning on the lamp; and when the temperature has reached the upper limit the circuit will open. Regulation to within ½ deg. F. is claimed for this device, and in an installation using galvanometers it is very valuable. These devices are not cheap by any means, but an ingenious electrician can construct one, as the thermostatic switches may be purchased at a nominal price.

For laboratory work the temperature of melting ice is the best at which to maintain the cold junctions, because all calculations are referred to this standard, assuming that the Centigrade scale is used in all laboratory and scientific work. No allowances are necessary. The simplest way to make the connection is to provide a good-sized glass bottle, of about a quart capacity, having a mouth about 2½ in. in diameter, with the cork bored for small test tubes. These test tubes should be filled with mercury and the bottle filled with shaved ice, which should have some water in it. Then one thermocouple wire is pushed down into one test tube full of mercury, and the lead wire from the galvanometer or potentiometer is also pushed down into the mercury, making the junction in mercury at 0 deg. C. It should be noted that the wire from the measuring instrument should be insulated right down to its tip. If the bare wire were used, the junction would be made at the surface of the mercury, which might or might not be at 0 deg. C. It probably would not be.

This glass bottle may then be set in a bucket and packed around with waste. The ice will remain for two or three hours, provided there is no source of heat near by. But it is better to use a Thermos bottle instead of the ordinary glass bottle, as then the 0 deg. C. temperature may be maintained for hours.

No equipment is complete without standard couples of platinum and platinum-rhodium wire. These standard couples should be at least three in number: one to be used as the primary standard, the other two as secondary standards. All comparisons should be made with one of the secondary standards and occasionally the two secondary standards should be compared with each other. If they show any difference, they should both be compared with the primary standard, to see which one is out; and this is the only use to which the primary standard should be put. The rest of the time it should be, figuratively speaking, packed in cotton and kept in the safe.

In addition to these three standards, there should be one or more standard base-metal couples, for convenience in comparing other base-metal couples with the standard. It is not necessary to provide sheaths and insulators permanently for the standard couples. They should be kept hung up in a locker.

DIESEL ENGINE USERS' ASSOCIATION.

At the November meeting of the Association, the acting hon. secretary reported the names of further undertakings and firms who had joined in the movement to endeavour to obtain more favourable terms from the Inland Revenue authorities in the matter of the allowance off profits for depreciation of Diesel engine plant before assessment for income-tax purposes. In this connection, it was pointed out that the present inadequate allowance of only 5 per cent. on the diminishing or written-down value of the plant corresponded to an assumed life of 58 years for Diesel engines if the residual value of the plant at the end of the term was taken to be 5 per cent. of the original value. The allowance of 15 per cent. recommended by the Association as fair and reasonable under the circumstances corresponded to an assumed life of 18 years for the plant.

The discussion on the subject of cracked and seized pistons was resumed by Mr. J. M. Ferguson, who had been invited to attend the meeting. He spoke of the practice and experience of Messrs. Willans & Robinson, Ltd., on these points, and laid stress on the great importance of using metal of the special quality necessary for pistons of Diesel engines. He considered that the casting should be carried out in the engine maker's own foundry, under his direct control and supervision. He also referred to an arrangement devised and patented by Mr. P. H. Smith for a renewable plug or core in the piston head.

Mr. P. H. Smith, who also attended the meeting by invitation remarked that the fundamental cause of cracks in Diesel engine pistons was a highly heated core trying to expand, but being restricted in so doing by a comparatively cold and very stiff ring of metal surrounding it. The consequence of the core attaining a higher temperature than that of the remainder of the metal of the piston was distortion and buckling, and in cooling after the engine was shut down the core did not quite resume its original unstrained condition. This action being progressive with alternate heating and cooling, the stresses became higher until fracture occurred. It was noticeable that Diesel engines working continuously day and night gave very little trouble from cracked pistons as compared with other similar engines working more intermittently. Some makers were endeavouring to find a cast-iron for pistons which would not "grow" on repeated heating and cooling. Such an iron was very pure, high in manganese, and low in silicon, and, being mainly of Swedish origin, was practically unobtainable at the present time. Although Mr. P. H. Smith thought that there was much to be said in favour of using such a class of iron, he did not think that the ultimate solution of the trouble of cracked pistons would be found in the adoption of any particular grade of cast-iron. He then referred to two general systems of piston construction which had found favour in the case of larger sizes of pistons, namely, pistons with renewable heads, and water-cooled pistons. He himself had not much faith in the renewable head, though it had some advantages. The renewable head was introduced, not so much with the idea of preventing fractures as to reduce the cost of replacing a fractured piston. It did not remove the cause of cracking, as there was still the very hot core surrounded by a stiff colder ring, though it must be admitted that some renewable heads were designed in such a manner as to carry away a greater amount of heat from the hot core than was possible with ordinary methods of piston construction. He considered that a further objection to the renewable head was that the quality of metal selected on account of its resistance to a tendency to fracture being usually soft, it would probably be liable to burn in the centre, and the wear in the ring grooves in the softer metal would also be more rapid. He then described his arrangement of a renewable core in the piston head, which had already been referred to by Mr. J. M. Ferguson, and which he considered would provide a solution to the trouble of cracking. This is made in two parts so as to reduce stresses to a minimum in the core as well as in the piston. The core proper, or inner portion, is fixed on to a recess in the piston head by a gas-tight joint well removed from the region of highest temperature, and is surrounded by a separate annular ring. The core is free to expand laterally and longitudinally, and the annular ring is similarly unrestricted. To reduce any tendency to crack in the remaining portion of the piston head, the recess which contains the core is stepped, the depths of the steps gradually increasing, and the top edge of the recess is sufficiently removed from the hottest region to avoid cracking or fraying out. In the larger sizes of pistons, the difficulty was to avoid not only cracking, but also seizure, and, in Mr. P. H. Smith's opinion, all Diesel engine pistons exceeding 16 in. in diameter should be water-cooled or oil-cooled if the mean effective pressure was as high as 95 to 100 lb. per square inch.

The discussion was continued by other members.

BUSINESS NOTES.

Lamp Shade.—Messrs. Pope's Electric Lamp Co., Ltd., Hyde Road, Willesden, have issued a shade for electric lamps, to enable consumers to comply with the prevailing restricted lighting regulations. A supply of such shades will be sent to any buyer or seller of the lamps on application.

Board of Trade Inquiry.—A Sydney local agent wishes to obtain agencies for British manufacturers of electrical machinery and apparatus, particularly wire-drawn lamps. Particulars can be obtained from the Board of Trade Commercial Intelligence Branch in London, quoting reference C.I.B. 55,495.

Aluminium Works in Norway.—It is reported that the Council of State of Norway has granted a concession to the Hoyang Faldene Norsk Aluminium Co. to acquire and work the Hoyang-Elys. The company is to have a share capital of £659,000, of which banking interests have guaranteed £219,000, and preliminary applications for shares for £273,000 have been made by Norwegian capitalists. It is calculated that the output of aluminium will amount to 4,000 tons per annum.

Catalogues and Lists.—The Dowsing Radiant Heat Co., Ltd., 39 and 40, York Place, Baker Street, London, W.—68-page well-illustrated catalogue and price list of electric heating and cooking apparatus, including hot-bar radiators, luminous electric radiators, convectors, and radio-convectors, electric cooking ranges, kettles, grills, sterilisers, and other utensils, and various accessories for use in connection with heating and cooking installation work. A green-covered booklet of 32 pages, entitled "Economise by Using Electricity," shows and gives prices and concisely stated particulars of a variety of Dowsing domestic devices. The company, in addition to having taken over last year the business of Messrs. Eastman & Warne, have recently purchased that of the Phœnix Electric Heating Co., and they have now acquired the goodwill, patterns, secret processes for manufacturing heating elements, also the drawings and stock of heating elements, of the British Prometheus Co. When they have sufficiently extended their works they will be able to supply heating elements previously made by these firms.

Messrs. Townshends, Ltd., Ernest Street, Holloway Head, Birmingham.—New list illustrating and giving prices of electric light fittings for industrial use, shop-lighting, &c., including half-watt lanterns, enclosed and open types, reflectors for metal-filament lamps, &c.

Messrs. Willans & Robinson, Ltd., Rugby.—42-page illustrated catalogue containing full descriptive particulars, half-tone and line illustrations, sizes, code-words, &c., respecting the Willans-Oddie Simplex direct-acting steam pumps. The valve gear and its action are detailed, also its advantages. The information relates to standard sizes of boiler-feed pumps, compound pumps, hydraulic pumps, and service pumps. Some pages are devoted to the arranging and fitting up of pumps, the setting of the valve gear, re-setting without centre dabs, and some other matters. Code-words for parts, and a list of metric equivalents of dimensions given in the pamphlet, are included.

"Z" Electric Lamp Manufacturing Co., Ltd., Standen Road, Southfields, S.W.—Folding sheet notifying the trade concerning their publicity and advertising efforts, past, present and to come, and giving particulars and a composite illustration of their various specimens of publicity literature that are available.

The Century Electric Co., St. Louis, U.S.A.—Illustrated circular showing their small single-phase motors driving respectively a cream separator, potato peeler, refrigerator, &c.

Messrs Siemens Bros. Dynamo Works, Ltd., of 38 and 39, Upper Thames Street, E.C., have issued a new Wotan showcard for trade display. It is of attractive design, and is provided with a collapsible box arrangement having a black velvet background against which a cut-out of the Wotan lamp is silhouetted. It is produced in effective colours, and is of handy size (11 in. by 7½ in.) for use for counter, desk or window display. Copies will be supplied to customers on application.

Long-Suffering Motors.—What a well-made motor will stand is exemplified by the case of a mill, the whole of the plant in which was electrically driven by Crompton motors, installed many years ago. A group of four motors, installed on the second floor of the mill, was accidentally precipitated to the basement, and the building caught fire. After the flames had been extinguished, the motors were taken from the débris with a view to making use of them, if at all possible, in a temporary mill. After refilling the bearings with oil and replacing some of the brushes, it was found that all the motors were in satisfactory running order. The motors in question were installed a long time ago, and they have been superseded by a more up-to-date design by Messrs. Crompton & Co., attention having been given to high efficiency, low temperature rise, and large overload capacity with sparkless commutation throughout the whole range of load.

Trade Announcements.—The head office of the Efandem Co., Ltd., is now situate at Fallings Park Works, Wolverhampton. Mr. W. J. Fahn has ceased to take an active part in the conduct of the business, and Mr. Walter Howcroft has resigned his offices of managing director and secretary. All orders given on behalf of the company will be signed by the secretary, Mr. Peter Smith.

Messrs. H. Field & Son, electricians, of Leeds, are giving up the business.

Liquidations.—British Diesel Motor Vessel Co., Ltd.—This company is winding up voluntarily.

Eureka Patent Gas Engine Starter Co., Ltd.—A meeting of creditors is to be held at the office of the liquidator, Mr. T. Forster, 1, Cathedral Gates, Manchester, on December 15th.

Maxim Lamp Works, Ltd.—A petition, presented by A. Hurst and Co., Holborn, for winding up this company, is to be heard on December 14th.

Felgate Installation Co., Ltd.—A meeting is called for January 8th, at 51, Market Place, Reading, to hear an account of the winding up from the liquidator, Mr. A. G. West.

Bankruptcy Proceedings.—J. Swainson, electrical contractor, C/M and Manchester.—Supplementary dividend of 1⅜d. in the £, payable Dec. 17th, at 27, Brazennose Street, Manchester.

For Sale.—The Tramways Committee of the Leeds Corporation invites tenders for six Lancashire boilers, fitted with mechanical stokers, superheaters, &c. Particulars are given in our advertisement pages to-day.

LIGHTING AND POWER NOTES.

Accrington.—Rating Appeal.—An appeal is to be made against the assessment for income-tax purposes of the Corporation's electricity undertaking.

Argentina.—A joint stock company has just been formed in Trelew, capital of the territory of Chubut, for the supply of electric light and power to the town and district. All of the capital has been found locally, and the board comprises prominent business men of Trelew.—*Review of the River Plate.*

Barrow.—The T.C. has authorised the payment of £38 to members of the staff for overtime worked during the quarter ended September 30th. In order to meet the difficulties arising through depletion of staffs, the Electricity Committee will meet every two months instead of monthly.

Bath.—Mains Extension.—The Electric Lighting Committee has recommended that a new feeder be laid at a cost of £1,400 to supply a local works with additional power.

Belfast.—The Police Committee of the Corporation reported that the public electric lamps were being put out of commission and replaced by gas, the object being to relieve the pressure on the power station.

The Electricity Committee reported that the claim against the insurance companies in connection with the fire at the power station had been settled for £3,808.

In view of the small margin of plant available consumers have been asked to reduce their lighting as far as possible between the hours of 4 and 5.30 p.m.

The Treasury has refused the application for sanction to capital expenditure amounting to £6,700 for mains.—*Northern Whig.*

Bredbury and Romiley.—The Stockport T.C. has asked Bredbury for consent to its proposed application for an order under Sec. 6 of the Electric Lighting Act, 1909, but the D.C. has declined to agree.

Burton-upon-Trent.—Proposed Loan.—The Electricity Committee's report regarding the heavy demand upon the present cables, and recommending the laying of new cables, has been referred to the Finance Committee, which recommends the Council to make application to the L.G.B. for sanction to a loan of £3,500 for carrying out the work.

Canada.—Niagara Falls Proposal.—Another scheme to further develop Niagara water power has been brought forward by the Hon. P. A. Porter. This proposes to dam the gorge three-quarters of a mile south of Queenstown, about 6 miles below the Falls, which would submerge the Whirlpool and lower rapids below a long narrow lake. The drop of the river from the Falls to Lewiston, 7 miles below, is about 100 ft., providing, according to the estimate, 2,000,000 H.P. The scheme also includes a ship canal and locks to connect Lakes Ontario and Erie, and, on the Canadian side, a canal and locks connecting to the Welland Canal. Mr. Porter estimates the cost of the scheme at about $100,000,000.

Clayton.—Prov. Order.—The Electrical Distribution of Yorkshire, Ltd., has intimated to the U.D.C. its inability to proceed with its application for a provisional order, owing to the refusal of the B. of T. to sanction such orders until the end of the war.

Dartford.—Proposed Loan.—The Electric Lighting Committee proposes to apply for sanction to borrow £600 for mains required in connection with the Council's housing scheme.

Eastbourne.—The Electricity Committee has received an application from the London Electric Firm for terms for a supply of electricity should they remove their works to the town; the estimated requirements are 24,000 units a year.

East Ham.—Price Increase.—The Electricity Committee having reconsidered the suggested increase of 10 per cent. on the charges for current supplied to private consumers and to the tramways undertaking, now recommends that, in view of the decreased consumption, together with the extra cost of generation and materials, the charges for electricity be increased as follows:—Private consumers, by 10 per cent.; tramway supply, by 5 per cent., the increases to take effect in respect of current supplied during the March, 1916, quarter; the question of the charges for public lighting was deferred until a subsequent meeting. The Committee's recommendation was adopted.—*Stratford Express.*

Ewell and Worcester Park.—Prov. Order.—The application of the South Metropolitan Electric Tramways and Lighting Co. for a prov. order for E.L. has been deferred until after the war.

Fakenham.—E.L. Scheme.—The Walsingham R.D.C. has been informed that the promoters for the E.L. scheme at Fakenham had intimated that they were prepared to pay any reasonable expenses to the Council, and the clerk was instructed to draft an agreement with the company for submission to counsel and the Fakenham P.C.

Finchley.—Owing to a breakdown at the Council's electricity works, the supply of electricity was interrupted from 3 p.m. on Sunday till 8 a.m. on Monday morning, and the streets in the Council's area were in complete darkness. Owing to the failure occurring on a Sunday, many residents were unable to obtain other means of lighting.

Hastings.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £500 for house services.

Harrogate.—The Corporation electricity department has issued an interesting booklet on the subject of "Electricity Supply for Residences," which deals particularly with the operation and possibilities of the rateable value tariff of 15 per cent. of the rateable value plus ½d. per unit, and the supplementary contract tariff for water-heating apparatus having 100 per cent. load factor and automatic control, of ⅓d. per unit. Data relating to a house rented at £60 per annum is given, in which case, owing to the electrical labour-saving improvements introduced, one servant was easily dispensed with, and a considerable annual saving resulted. The pamphlet discusses the use of electric fires with automatic temperature control; briefly refers to the electric iron—not less than the 600-watt iron, with wall socket, being recommended for heavy household work; vacuum cleaners and hot-water service.

Hornsey.—Loan Sanction.—The L.G.B. has sanctioned the raising of a further £500 in connection with a loan of £6,000 for supply mains.

Hythe.—Street Lighting.—The Sub-Committee appointed to consider the question of the charges for public lighting by the Folkestone Electric Light Co., reported that the charges for normal lighting were £850 per annum, but having regard to all the circumstances the company would accept £425 if all public lamps were extinguished, and in the event of the lighting being resumed the charges would be *pro rata.* The offer had been ratified by the directors of the company, and the Committee recommended its adoption as a fair and reasonable settlement.

London.—Marylebone.—Arrangements have been completed for linking up the Council's electricity undertaking with that of the Central Electric Supply Co.

The B.C. recently applied for sanction to borrow £5,450 for mains and house services; as a result of negotiation with the L.C.C. the application has been amended to £3,800. The Finance Committee has recommended that a sum of £5,156 be advanced out of general fund account as a temporary loan to the electricity department for the hiring of apparatus to consumers.

Manchester.—Excess Profits.—The Corporation Parliamentary Sub-Committee had before it a tabular statement showing the computed profits of various municipal departments. In the electricity department, the computed profits for purpose of excess profits duty were put at £163,210 in 1914, and £169,553 in 1915, the average of the best two pre-war trade years was placed at £159,308, and the profit in respect of the year 1915 £10,245. In the tramway department the computed profits are £165,496 in 1914, £106,549 in 1915, the average of best two pre-war trade years is £160,293, and the loss in respect of 1915 £53,744. The Committee adopted a resolution expressing the opinion that enterprises owned and carried on by municipal authorities should be excluded from the operation of the excess profits duty clauses of the Finance Bill. If that is considered undesirable then it is alternatively suggested that the several undertakings of a municipal Corporation should be consolidated and treated as one trade or business, the excess profit duty being charged on the total profits after deducting the total losses.

Restricted Lighting.—The Watch Committee has been notified by the Home Office, in reply to its petition for the withdrawal of the order for restricted lighting owing to the number of fatal accidents, that the question of amending the order is under consideration, and probably the new order will apply from two hours after sunset instead of one hour as at present.

New Zealand.—The Gisborne B.C. has decided to submit the following loan proposals to the ratepayers:—For electric light and power, £10,000; for the tramway service, £30,000.—*Otago Witness.*

Newquay.—Price Increase.—On December 3rd a B. of T. inquiry was held relative to the application of the Newquay Electric Light Co. to increase its maximum charge from 6d. to 8d. per unit. After discussion, it was agreed that the maximum price to private consumers should be 7d. per unit, the price not to exceed 6d. per unit after the expiration of one year after the conclusion of peace, but with liberty to the company at the expiration of this period to refer the question of a higher price than 6d. to arbitration by the B. of T.

Padstow.—Street Lighting.—The U.D.C. has accepted the offer of the Electric Supply Co. of a rebate of £4 on the original charge of £39 for public lighting for the half-year, owing to suspension of lighting.

Plymouth.—Three Months' Working.—The electrical engineer's quarterly return of the working of the electricity undertaking to the end of September, shows that on the Prince Rock section 712,466 units were sold, producing an estimated revenue of £6,524, as compared with 640,917 units and £6,119 in the corresponding period of last year. On Newport Street section 612,825 units were sold, producing £4,935, as against 564,185 units and £4,338 received last year. At the end of September there were a total of 2,929 consumers connected to the mains.—*Western Morning News.*

Queensbury.—Prov. Order.—The Electrical Distribution of Yorkshire, Ltd., has notified the Council that the company's application for a prov. order must be deferred until after the war, and if the Council was favourable to the proposal the company was prepared to proceed with the necessary preliminary work. The present Council is in favour of the proposals, and expressed a hope that the company would renew its application on the termination of the war.

South Shields.—The electrical engineer, Mr. H. S. Ellis, reports that the authorities have agreed to a certain amount of very much reduced lighting in the streets. This consists of two 20-C.P. lamps on each arc lamp standard, and one 20-C.P. lamp on each ordinary standard, the lamps being dipped in green paint and the surrounding globes coloured black, in such a way as to leave only one-third of the bottom part of the lantern transparent. Owing to the restricted lighting the output for lighting purposes is down very considerably, and, owing to shortage of labour, the output for traction purposes shows a falling off of 10 per cent. for November as against October; the power output has increased about 20 per cent. for the year up to date, which to some extent compensates for the serious loss in revenue for lighting purposes.

Sheffield.—Financial Estimates.—The general manager of the electricity undertaking has submitted a statement of estimated income and expenditure on revenue account for the years ending March 25th, 1916 and 1917. The total working expenses for the 12 months ending 1916 are estimated at £165,889 (as against the manager's original estimate of £87,308), and for the following year at £217,103. Against these figures is reckoned an anticipated income of £277,450 for 1916 (original estimate of £199,240) and £337,650 for 1917, thus leaving a gross profit of £101,561 for 1916 (original estimate £111,932) and £120,527 for 1917. After allowing for interest, the estimated profit is put £65,490 for 1916 (original estimate £61,086) and £61,270 for 1917. From this has to be deducted the sinking fund charges estimated at £53,069 (original estimate £56,834) and £54,919, so that there remains an anticipated surplus of £12,421 for 1916, and £6,351 for 1917. The surplus for 1917 is based upon the main contract for coal at Neepsend being placed at a favourable price. If the present day prices obtain, the financial result is likely to show an adverse balance. Mains are to be extended in various parts of the city at an approximate cost of £2,395.

Southampton.—The Electricity Committee has decided not to purchase, at the present time, any additional motors for hire purposes. The electrical engineer reported on the delay in the deliveries of coal, and the Committee has decided to obtain alternative tenders for three and six months' supplies. The Committee has decided to have a defective boiler and furnace at the electricity works put into working order as soon as practicable, and directed the electrical engineer to report twice in each year as to the condition of all the machinery and mains.

St. Annes.—In order to minimise risk of a failure of supply of electrical energy such as was recently experienced, the D.C. has approved a proposal for obtaining a second-hand boiler.

Stockport.—With reference to the application of the Cheadle and Gatley U.D.C. for a supply of current to that district, the T.C. has decided to offer the supply on the same terms and conditions as those offered to the Bredbury and Romiley U.D.C.

Sutton.—Bulk Supply.—The South Metropolitan Electric Tramways and Lighting Co. has this week commenced taking a bulk supply of current from London, the mains having been laid and transforming gear installed at the Sutton power station, pending the dismantling of the present steam plant.

Swansea.—A Wayleave Difficulty.—The Electric Lighting Committee recently reported that the work in connection with the supply of electricity to certain works was being held up owing to the question of payment for wayleave, &c. The Council had expended £4,000 in the purchase of cable which was lying idle. The Midland Railway Co. and the Rhondda and Swansea Railway had granted free wayleaves, the Duke of Beaufort was only charging a nominal amount of 5s. per annum, while the owner of a canal over which it was necessary to carry a cable originally asked £10 a year, which had been reduced to £1 per annum during the continuation of the war, after which a fresh agreement would be necessary on one month's notice. It was pointed out that the value of land was much enhanced by a supply of electricity. It was decided that the town clerk should wait on the owner of the canal and obtain, if possible, better terms.

Tasmania. — According to the *Australian Mining Standard*, the chief engineer of the Government hydro-electric department, Mr. J. H. Butters, recently reported that there was no reason why the Great Lake electric supply scheme should not be available for use in January next, provided certain small items were delivered. Apparently the pipe lines are complete, and the power station machinery being erected; the transmission line work is proceeding rapidly, while work at Hobart is well in hand. The Government passed a resolution to purchase the Hobart Gas Co.'s electrical undertaking for £108,000, it being represented that the hydro-electric business would suffer if the present agreement for a minimum bulk payment of £5,000 a year by the company to the Government were allowed to remain in force.

Tarporley.—The U.D.C. has granted Messrs. Cluetts permission to erect overhead lines for the purpose of installing the electric light at the Parish Church.

Tonbridge.—New Cooking Tariff.—The U.D.C. has decided to alter the tariff for current for heating and cooking to 1d. per unit with a minimum consumption of 8s. per quarter, plus the usual meter rent. The previous charge was 2d. per unit.

Wanstead.—Prov. Order.—The U.D.C. has received an intimation from the County of London Electric Supply Co. that it is not at present proceeding with the application for a prov. order for E.L. in the Council's district.

Weymouth.—Loan Sanction.—The T.C. has received the sanction of the L.G.B. to the borrowing of £1,020 for mains (repayable in 15 years), and £910 for services (repayable in 25 years). On account of the abnormal conditions now prevailing, the Council has decided to make for the period of the war a meter charge of 2s. 6d. per quarter as from December 31st next.

Wimbledon.—The T.C. at its meeting on November 1st instructed the town clerk to open up negotiations with the Fixed Price Light Co. with a view to terminating the agreement of August, 1912. The town clerk reported that Messrs. Handcock and Dykes, consulting engineers to the Fixed Price Light Co., had intimated that their clients were prepared to treat provided they could be satisfied that the Council had the power to purchase the Fixed Price Light undertaking in Wimbledon, and could make payment in fulfilment of any understanding that might be arrived at without proviso or reservation; that their clients would in the meantime consider the basis on which they would terminate the agreement and asking for any early reply, as in the event of the agreement not being terminated by mutual consent, conditions will render it necessary for them to raise the price of electricity to their consumers. The Committee has informed Messrs. Hancock and Dykes that the Council is not prepared to extend the period of the agreement, and further asked for payment of outstanding accounts. The application for a prov. order for the supply of electricity to the parish of Cuddington has been deferred.

York.—Year's Working.—The annual accounts of the electricity undertaking show that the income from private lighting was £23,987; from public lighting, £2,756; from power supplied to the Tramways Committee, £6,021; rents of motors, &c., amounted to £1,034, making a total of £33,798. The total working expenditure was £18,702, including £462 for war allowances, leaving £15,096 to be transferred to the net revenue account; after payment of interest and sinking fund charges amounting to £12,549 and income-tax of £281, there was a surplus of £2,265, which has been transferred to the reserve and renewals account.

TRAMWAY and RAILWAY NOTES.

Australia.—A recent issue of the *Commonwealth Engineer* described the progress made in connection with the Victorian Railways Newport power house, which will supply the Melbourne Electric Railways. The 36-acre site of this station is about 200 yards distant from the Yarra River, the ground being covered with basaltic rock, which has been used for concrete work in the foundations. The main building, measuring 310 ft. long and 415 ft. wide, is built with steel pillars and reinforced plaster walls; the transformer and switch houses are of brick. The concrete (cement, sand and water) has been applied to the walls by a compressed air apparatus which projects the mortar into the required position. The first section of the power plant, consisting of six 10,000-kw. Parsons turbo-alternators and exciters, is being erected. Current will be generated at 3,300 volts and stepped up to 20,000 volts for distribution to the sub-stations. A wet air cooling plant is being installed, also two 350-kw. auxiliary turbines and a test pond for 12,500-kw. capacity, together with special arrangements to facilitate the testing of any steam-electrical set. Some nine miles of cables for auxiliary plant are led through cement conduits in the foundations. An electrically-driven 60-ton crane, with a five-ton auxiliary hoist, is provided in the engine-room. The assembling of the first 12 Babcock boilers and Green economisers has been practically completed; the complete equipment will consist of 24 boilers each evaporating 30,000 lb. of water per hour, working at 210 lb. pressure and supplying steam superheated to 600° F. The boilers are erected in pairs, each pair with a 75-ft. steel chimney and fan equipment. Mechanical coal conveying and suction ash plants are being provided, the former for supplying bunkers over the boilers and adjoining coal stores. The condensing water is obtained from and returned to Hobson's Bay, and a pair of rotary screens is provided in each inlet conduit.

The Government Bill providing for the temporary control of the Melbourne tramways, after they have been taken over by the Government from the Melbourne Tramway and Omnibus Co., provides for a Board, consisting of five members, appointed by the Governor in Council; the Board is to have power to borrow up to £500,000 by way of overdraft or debentures, to provide for the running of the tramways. A tramway fund is to be created, and all moneys received by the Board are to be paid into the fund, except certain amounts which will be required to meet working expenses. The Board will be appointed as soon as the Bill is enacted, and will remain in office until October 31st, 1917, or until such date earlier as the Governor in Council may determine on.—*Melbourne Age.*

Belfast.—According to figures supplied by the general manager, the effect of providing a 20-minute service on certain Corporation tramway routes which formerly had a 10-minute service, has been a weekly net loss of £80. The 10-minute service is to be restored.

Bradford.—Recently Mr. C. J. Spencer, the Corporation tramway manager, reported on the question of adopting a system whereby the collection of fares by conductors would be avoided, the suggestion being that tickets should be purchased in advance, the proposal having a bearing upon the employment of women conductors. He considered the suggested system unworkable, and likely to result in the employment of a larger instead of a smaller staff. Mr. Spencer states that he is attracted by the idea of volunteer labour as employed at Birmingham, and considers it would be desirable to consider it for future use; he also suggested that a certain number of women conductors should be employed on certain routes as an experiment.

The Committee decided to defer the question of employing women until it had seen the result of an appeal for men of between 40 and 50 years of age, and also that the recommendations of the manager with regard to volunteers be adopted.

Blackpool.—Tramway Accident.—A collision occurred on the Corporation tramways, close to the central station, on December 2nd, when the town was enveloped in a heavy fog. Both cars were damaged, and two or three passengers complained of shock, while a lady conductor had a fortunate escape from serious injury.

Colchester.—Female Conductors.—The T.C. has decided to have 10 females instructed with a view to their employment as conductors on the electric tramcars.

Continental.—Italy.—The Consiglio Superiore dei Lavori Pubblici has approved of the scheme for the electrification of the whole of the Sangritana line. The kilometre subsidy has been increased to 10,000 lire for kilometre for 50 years.

The Sindaco of Verona has been authorised to invite tenders for carrying out the construction of the Valpantena electric tramway, which is to be worked by the syndic.

Two weeks' experimental running of four electric goods trains on the Bardonecchia-Modane trunk line, including the Frégus tunnel, have given most satisfactory results, and, in consequence, the goods service in and out of Italy will be forthwith established. The passenger service on the same section, hitherto in operation between Bussoleno and Bardonecchia, will shortly be extended to Modane.

Derby.—Female Conductors.—The T.C. has decided to employ women conductors, owing to the scarcity of male labour.

Keighley.—Extensions.—The T.C. has applied for an extension of time until August 7th, 1917, for the completion of the overhead equipment for electrically-propelled vehicles from the tramway terminus at Ingrow to Oxenhope.

L. & Y. Railway Electrification.—To supply energy to the last electrified section of the L. & Y. Co., *i.e.*, from Manchester to Bury, *viâ* Heaton Park, and for future lines which it is understood will be converted to electrical working, a power station has been built a few miles out of the city. The initial plant consists of two 5,000-KW. 6,600-volt turbo-alterators, by Messrs. Dick, Kerr & Co., which will supply three-phase current to two sub-stations at Victoria Station, Manchester, and at Radcliffe; also a third turbine unit consisting of a 500-KW. three-phase 25-cycle Westinghouse geared turbine set, to generate current at 440 volts, for auxiliary uses.

The main switchgear has been supplied by the British Thomson-Houston Co. Three 1,000-KW. Dick, Kerr rotary converters with transformers are installed in each sub-station for supplying the trains which, as pointed out in a short article on the special form of conductor rail used, which appeared on page 315, will be supplied with direct current at 1,200 volts pressure. The train equipments are also by Messrs. Dick, Kerr, and each motor coach will be equipped with four 200-H.P. motors.

Newcastle.—Traffic Difficulties.—The City Council, on Wednesday last week, considered a resolution that the Tramways Committee be instructed to arrange that the last car shall leave the City Terminus at 10.30 on each week day, and 9.30 on Sundays. An amendment that the Committee be instructed to reconsider the matter, with a view to giving further travelling facilities, was carried. Mr. R. Mayne, chairman of the Tramways Committee, said the Tramways Committee was conscious of the inconvenience caused, but it was carrying 50,000 more workmen per week. It had the offer of 120 volunteers, and if it had the offer of 240, who could be properly trained, a modified service could be given at night. The difficulty was to get men who could train during the day. He thought there were many men in the city whose occupation would enable them to give their services during the day—insurance agents and ministers of the Gospel. Under the present system the outward bound cars leave the city about 9 o'clock.

Sheffield.—Tramway Estimates, &c.—Owing to the severe strain on the motormen and conductors, in consequence of the heavy traffic at Christmas, the City Council is recommended to authorise the Committee, if it deem it advisable, to suspend the tramway service altogether on Sunday, the 26th inst. It is anticipated that the working of the tramways for the years ending March 25th, 1916 and 1917, will show net balances of £34,974 and £23,635 respectively. These figures are subject to any adjustment which may be necessary in respect of the "Excess Profits" tax.

Stockport.—The T.C. has approved a recommendation of the Tramway Committee, that with a view to inducing more regular attendance to duty a gratuity of 2s. per week be paid to all motormen, conductors and inspectors who work a complete week in accordance with the duty sheets of the department, pending the return of the members of the department now with the Forces.

TELEGRAPH and TELEPHONE NOTES.

Hull.—The Corporation Telephones Committee has agreed to grant female operators a bonus of 1s. 6d. per week, no previous provision having been made for female employés. As regard the male staff, the Committee has agreed to recommend the Council to adopt the Post Office scale of bonuses, 3s. to those in receipt of less than £2, and 2s. to those receiving between £2 and £3 weekly.

Japan.—Hitherto no private person has been permitted to establish or work any apparatus for wireless telegraphy in Japan. According to a new regulation, however, which came into force on November 1st last, radio-telegraphy may, subject to a licence being first obtained, be installed for private administration outside the State telegraph and telephone area, in vessels and in aircraft. A licence may also be obtained by persons who conduct experiments in wireless telegraphy.

Leyton.—With a view to economy, the Establishment Committee of the U.D.C. is considering the desirability of establishing a central telephone switchboard with extensions.

Russia.—The Minister of the Interior has applied to the Council of Ministers for an allocation of 350,000 roubles, to construct a fourth telephone line between Petrograd and Moscow.

Wireless Telephony. — It is announced from Christiania that Mr. Frost, the Norwegian manager of the radio-station at Stavangar, has devised a new apparatus for wireless telephony, and has associated himself with the Marconi Co. in the matter. At present further experiments are being made with the apparatus at the English Marconi station to ascertain the reliability of the system.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Adelaide.—January 19th. P.M.G. Common-battery switchboard. See "Official Notices" November 19th.*

January 26th. Deputy P.M.G. Twenty tons of galvanised-iron wire, 400 lb. to the mile.*

Brisbane. — P.M.G. January 26th. — Galvanised-iron wire. January 5th.—Jointing sleeves and copper-clad steel wire. See "Official Notices" November 19th.

January 26th. Deputy P.M.G. Telephone instruments, parts and accessories.*

Sydney.—January 31st. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

February 7th. Metropolitan Board of Water Supply and Sewerage. For No. 1 pumping station at Ultimo. Two centrifugal pumps and electric motors (4,000 gallons per minute each), switchboards, starters, &c. Contract No. 1,301.*

February 28th. Municipal Council. Tenders for induction regulators. Specifications (11s. 6d.) from the Electric Light Department, Town Hall, Sydney.

Melbourne. — January 4th. P.M.G. Electric measuring instruments, telephone parts, and automatic common-battery telephones.*

Beckenham.—December 12th. U.D.C. 2,000 tons of Midland slack coal (100 tons per week from January 1st, 1916), for the Electricity Department. See "Official Notices" December 3rd.

Brighton.—December 14th. Electrical fittings, for the B. of G. Mr. Horace Burfield, Clerk, Parochial Offices, Prince's Street, Brighton.

London.—West Ham.—December 16th. Three months' supply of electrical fittings, for the B. of G. Forms of tender from Mr. T. Smith, Clerk, Union Road, Leytonstone, N.E.

Nuneaton.—December 24th. Corporation. Supply and erection of an overhead line, for the Electricity Department. See "Official Notices" to-day.

Redditch.—December 28th. Council. Eighty tons per week, for three months, of D S. nuts or rough slack. See "Official Notices" to-day.

Reigate.—December 15th. Lubricating oil for six or twelve months, for the Corporation electricity works, suitable for Diesel engines and air compressors. Particulars from the Electrical Engineer.

South Africa.—Durban.—January 5th. Corporation Telephone Department. (1) Telephone apparatus and materials; (2) underground cables; (3) 540 c.i. pipes, 9 ft. long, for cables. Messrs. Webster Steel & Co., 5, East India Avenue, E.C., are the Corporation's London agents.*

Spain.—January 26th. Construction and installation in the Cadiz Naval Arsenal of an electric power plant. Conditions, &c., from the Negociado Quinto de la Segunda Seccion (Material) del Estado Mayor Central de la Armada, Ministerio de Marina, Madrid. Deposit £800. Local representation.—*Board of Trade Journal.*

January 28th. Sixty years' electric tramway concession, Monte del Pardo district, Madrid. Direccion General de Obras Publicas, Ministerio de Fomento, Madrid.

Walthamstow.—December 15th. U.D.C. Supply of low-tension cable, for the Electricity Department. See "Official Notices" December 3rd.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Dartford.—The following orders for coal have been placed:—

John Waddell & Co.—800 tons Yorkshire Main, at 25s. 6d. per ton.
Cleeves & Co.—500 tons Yorkshire slack, at 24s. 2d. per ton.
Wallace, Spiers & Co.—One truck of Yorkshire "Thurcroft," at 23s. 7d. per ton.

Grimsby.—The Public Lighting Committee has accepted the tender of Messrs. W. Lucy & Co., Ltd., to supply, for a period of two years, house service boxes at an approximate cost of £260, and house fuse boxes at an approximate cost of £201; also the tender of Messrs. Ed. Bannister & Co., Ltd., to supply up to 200 tons of Brodsworth nutty slack, at 15s. 7d. per ton.

Middleton.—The E C. has accepted the tender of Messrs. Spurrier, Glazebrook & Co. for cylinder and engine oils, and that of Mr. R. Taylor for extensions required at the electricity station boiler house.

Sheffield.—The City Council has accepted the tender of Messrs. Thos. A. Ashton, Ltd., at £215, for electric light fittings at the King Edward VII Hospital.

Southampton.—The Electricity Committee has received the following tenders for the purchase of 450 yards of 1-in. high-tension concentric lead-covered paper-insulated cable and 800 yards of ·025 cable:—

		450 yds. 1·00 lead-covered cable.	800 yds. ·025 cable.
B.I. & Helsby Cables, Ltd.	(accepted)	£121	£91
Mackintosh Cable Co., Ltd.	.. ..	133	94
Pirelli-General Cable Works, Ltd.	..	129	103
W. T. Henley's Tel. Works Co., Ltd.	..	124	93

The following tenders have been accepted by the Tramways Committee for the supply of a motor-generator:—

		Generator and motor.	Switchboard.
Lancashire Dynamo Co.	.. (accepted)	£181	£100
British Westinghouse Co.	(not to specification)	202	128
Phœnix Dynamo Co., Ltd	.. ..	211	141

Also the tender of Thermit, Ltd., for welding 140 tram rail joints, at 25s. per joint.

Stockport.—The Corporation Hospitals Committee has accepted the tender of Messrs. McClure & Whitfield, for wiring for the laundry and electric irons.

The Tramways Committee has accepted tenders of the following firms for stores:—Messrs. Dick, Kerr & Co., Ltd., H. Hollingdrake and Son, B.T H. Co., Ltd., Baxendale & Co., Wilkinson, Heywood and Clarke, the Liverpool Jute Bag Co., Spicer Bros.. Ltd., Rostron Bros., McClure & Whitfield, Brecknell, Munro & Rogers, and the Brush Electrical Engineering Co.

Weymouth.—The T.C. has accepted the tender of Mr. Bryer Ash for 300 tons of stock coal for the electricity works, at £1 3s. 4d. per ton; and that of the Direct Coal Supply Co., of Yeovil, for 250 tons of best Admiralty smokeless coal.

FORTHCOMING EVENTS.

University College, London.—Friday, December 10th. At 5 p m. Lecture on "Domestic Electric Heating," by Prof. A. H. Barker.

Friday, December 17th. At 5 p.m. Sixth lecture on "Electric Heating and Electric Furnaces," by Prof. J. A. Fleming, F.R.S.

Greenock Electrical Society.—Friday, December 10th. At 7.45 p.m. At Temperance Institute, 19, West Stewart Street. Paper on "Electric Tramways," by Mr. J. Punch.

Friday, December 17th. At 7.45 p.m. Special Open Meeting.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 11th. At 2 p m. At Neville Hall, Newcastle. General Meeting.

Royal Society of Arts.—Monday, December 13th. At 4.30 p.m. At John Street, Adelphi. Cantor Lecture, on "Optical Glass" (Lecture III), by Dr. W. Rosenhain, F.R.S.

Illuminating Engineering Society.—Tuesday, December 14th. At 8 p m. At the Royal Society of Arts, John Street, Adelphi, W.C. Paper on "Recent Developments in Electric Incandescent Lamps in Relation to Illuminating Engineering," by Prof. J. T. Morris.

Post Office Telephone and Telegraph Society of London.—Tuesday, December 14th. At 6.30 p.m. At the I.E.E., Victoria Embankment, W. C. Fifteen-minute papers on "Supervision as seen from Below" by Mr. S. A. Coase; "Phonograms," by Mr. B. R. Mead; "The Deficit on the Telegraphs," by Mr. W. H. F. Webb.

Association of Supervising Electricians.—Tuesday, December 14th. At 7.15 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Electric Lifts," by Mr. H. Marryat.

Institution of Civil Engineers.—Tuesday, December 14th. At 5.30 p.m. At Great George Street, Westminster, S.W. James Forrest Lecture on "Electrical Railways," by Mr. H. M. Hobart, to be read by Mr. J. A. F. Aspinall; also Special General Meeting.

Nottingham Society of Engineers.—Wednesday, December 15th. At 7.30 p.m. At the Welbeck Hotel, Milton Street. Paper on "The Evolution of High-Speed Steel," by Mr. A. W. Shepherd.

Institution of Electrical Engineers.—Thursday. December 16th. At 8 p.m. At Victoria Embankment, W.C. Paper on "The Design of High-Pressure Distribution Systems," by Mr. J. R. Beard.

(Western Local Section).—Monday, December 13th. At 5 p.m. In the Old Library of the South Wales Institute of Engineers, Park Place, Cardiff. Paper on "The Design of High-Pressure Distribution Systems," by Mr. J. R. Beard. After the meeting there will be an informal dinner.

(Manchester Local Section).—Tuesday, December 14th. At 7.30 p.m. At the Engineers' Club. Paper on "The Design of High-Pressure Distribution Systems," by Mr. J. R. Beard.

(Scottish Local Section.)—Tuesday, December 14th. At 8 p.m. At Princes Street Station Hotel, Edinburgh. Paper on "Electric Heating: Its Present Position and Future Development," by Mr. G. Wilkinson.

(Birmingham Local Section).—Wednesday, December 15th. At 7 p.m. At the University, Edmund Street. Paper on "Notes on the Ignition of Explosive Gas Mixtures by Electric Sparks," by Mr. J. D. Morgan.

(Students' Section).—Wednesday, December 15th. At 7.45 p.m. At the I.E.E., Victoria Embankment, W.C. Paper on "The Aluminium Electrolytic Arrester with an Introduction on Electrical Disturbances," by Mr. A. G. Ramsey.

Institution of Mechanical Engineers.—Friday, December 17th. At 6 p.m. At 11, Great George Street, Westminster, S.W. Paper on "Engineering Colleges and the War," by Dr. R. M. Walmsley and Mr. C. E. Larard.

Electro-Harmonic Society.—Friday, December 17th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, December 17th. At 7.30 p m. At Bolbec Hall, Newcastle. General Meeting.

Manchester Association of Engineers.—Saturday, December 18th. At Grand Hotel, Aytoun Street, Manchester. Topical Discussion Evening.

NOTES.

Electrical Engineer Recruits.—As we go to press we learn that the London Electrical Engineers (Headquarters 46 Regency Street, S.W.) are now open for recruiting again.

Electricians and Instrument Repairers Wanted.—There is a great and urgent need for the above for the Royal Engineers Wireless Section. We would draw the attention of suitably qualified men wishing to enlist for the period of the war to a notice appearing among our official advertisements to-day.

Fire Caution.—The British Fire Prevention Committee has issued a special Christmas "Fire Warning," free, for the public use in connection with public and private Christmas entertainments, &c. Electricity users are warned not to make the slightest change in electric wiring without consulting a competent electrician or an electrical inspector. Copies of the "Warning" are obtainable from the Committee, upon written application with the necessary return postage enclosed.

Nitrogen Fixation in Russia.—It is reported in Scandinavian papers that a large company with strong capital backing has been formed in Russia for the purpose of manufacturing nitrates from the nitrogen of the air. The process to be used is the well-known Birkeland and Eyde process. All arrangements with the Norwegian company, owners of the Birkeland and Eyde patents, have been made and a plant is being built in the North of European Russia, off the White Sea.—*Metallurgical and Chemical Engineering.*

Electric Heating and Electric Furnaces.—In his fifth lecture at University College, London, last week, Prof. J. A. Fleming dealt with the products of the electric furnace—carborundum, graphite, aluminium, calcium carbide, quartz glass, and the ferro-alloys being the principal substances. The enormous industry that has grown up at Niagara, in connection with the supply of cheap electric power that is available there, was described, after which some views of the aluminium works at Lochleven, in Scotland, were given. A great advantage of the smelting of aluminium from bauxite was shown to be the continuity of the process, which is carried on day and night, the raw materials being added and the molten metal tapped off without interrupting the process.

The quartz glass which is now so widely used, and is of constantly increasing importance, is prepared electrically; in the perfectly transparent forms the air bubbles, said the lecturer, are eliminated by heating the material in an electric furnace under a pressure of 500 lb. per sq. in. The importance of the ferro alloys dates from the discovery of the remarkable effects of small percentages of manganese, tungsten, vanadium, nickel and molybdenum on the dynamic qualities of steel. While 0·5 per cent. of vanadium raises the tensile strength of steel only from 36,300 lb. per sq. in. (ordinary carbon steel) to 45,620 lb., it increases the resistance to shock enormously—vanadium steel standing 12,776 shocks, whilst carbon steel endured only 4,200. Most of the "special steels" are made in electric furnaces. Such minute percentages cannot be directly mixed with the charge, so they are introduced in the form of alloys with iron.

The lecture concluded with a brief account and demonstration of electric welding.

Appointments Vacant.—Switchboard attendant for Lancaster (27s. 6d.); electricians and instrument repairers for the Wireless Section, R.E. See our advertisement pages to-day.

Electric Propulsion of Battleships.—The following abstract of a paper read by Mr. W. L. R. Emmet, before the American Society of Naval Architects and Marine Engineers, appeared in a recent issue of *Shipbuilding and Shipping Record*:—The Navy Department of the United States has awarded to the General Electric Co., of Schenectady, N.Y., a contract for electric propelling machinery for the new battleship *California*, which is being built at the New York Navy Yard. This ship is of the largest and most powerful class which has been adopted by the United States. Her displacement is 32,000 tons, and her maximum speed is to be about 22 knots, requiring about 37,000 S.H.P. The contract with the General Electric Co. covers two turbine-driven generating units, four propelling motors (one for each shaft), switching apparatus, cables, instruments, &c., two turbine-driven exciting units, and a complete equipment of condensing auxiliaries and ventilating blowers, all driven by motors from the exciting units. In fact, it covers practically the entire engine room equipment except the main condensers.

Each of the auxiliary units is of 300 KW. capacity with a 240-volt direct-current generator geared to a high speed, non-condensing turbine. These turbines will exhaust into the heaters or into the main turbines, or both.

The motors which drive the auxiliaries will be designed for a considerable range of speed variation, so that the auxiliaries will be adaptable to economical conditions at different speeds of the ship.

The award of this contract was the result of a very long campaign conducted by the writer in which the equipment of the collier *Jupiter* has been an incident.

The *Jupiter* has now been in commission for two years and has proved an unqualified success. The steam consumption of the main drive with 190 lb. pressure, dry steam, and 28 5 in. vacuum is 11 lb. per H.P.-hour delivered to the propeller shafts, which is at least 30 per cent. better than is done by reciprocating engines in ships of the class. There is also evidence of further saving in the *Jupiter*, incident to the fact that her large slow-speed propellers are turned with a perfectly uniform angular motion and with entire freedom from racing, conditions heretofore unknown with such propellers.

The generators for the *California* are bipolar alternators, and the motors are arranged to be connected either for 24 poles or 36 poles. For economic cruising at 15 knots or less, one generator will be used with motors on 36 pole connection. For higher speeds the 24-pole connection will be used. The ship will be capable of operating at a speed of about 18·5 knots with one generator.

Speed variation with either motor connection will be effected by change of turbine speeds through the agency of variable speed governors designed to hold automatically any desired speed within usual ranges. This arrangement, which is also used in the *Jupiter*, entirely prevents racing and makes it convenient to hold a fixed peed irrespective of variations in sea, weather or steam conditions. t is thought that this feature will be valuable in fleet formations.

The steam consumption guaranteed on the *California* covers the otal steam required for the main turbines and engine-room auxiliaries as described above. The conditions are 250 lb. gauge pressure, dry steam, with such vacuum as can be produced under rial conditions. The guaranteed water rates per horse-power delivered by the propeller shafts are as follow:—At 10 knots, 4·6 lb.; at 15 knots, 11·4 lb.; at 19 knots, 11·1 lb.; maximum peeds, 11·9 lb.

Very heavy penalties are imposed in case these guaranteed conumptions are exceeded in trials, $25,000 per lb. for the two lower peeds and $20,000 per lb. for the two upper speeds.

At full speed the *California* propellers will make 175 R.P.M., this being about the lowest speed of propellers which is practicable within the space. The propeller speeds proposed for the sister hips with Parsons turbine drive is 240 R.P.M., and comparisons by Dyson's method indicate that this speed difference will give the *California* an advantage of about 9 per cent. in propeller efficiency.

The following table gives a comparison of steam consumption er effective horse-power between the *California* as guaranteed, the *Florida* and *Utah* which are driven by Parsons turbines, and the *Delaware*, which is driven by recipocating engines. These figures re taken from the published records of trials:—

	12 kts.	15 kts.	19 kts.	21 kts.	Prop. speed. 21 kts.
Florida ...	31·8	—	24 0	23 0	328
Utah ...	28·7	—	20·3	21·0	323
Delaware ...	22·0	—	18·7	21 0	122
California ...	17·3	15·2	15·0	16·4	175

Such a table as this affords the truest basis of comparison of rime movers in ships.

The estimated weight of the propelling machinery without conensing auxiliaries is 530 tons, and that of the turbines originally roposed was 653 tons.

Comparing the arrangement of the machinery of the *California* with the *Utah*, and a geared turbine equipment for a large warship hown in a paper by Sir Charles Parsons read in March of 1913, Mr. Emmet drew attention to the simplicity of piping, steam and acuum connections with the electric drive as compared with the other methods. The *California* has two turbines, the *Utah* has 10, and the proposed Parsons geared equipment has 32.

All of the steam passages between turbines in these arrangements involve loss of useful pressure, and many of them involve sk of vacuum loss through air leakage, for it must be remembered that ships are often subject to vibration and that there may be appreciable relative motion of these different parts through xpansion strains or working of the ship, or through their own ertia when the ship is vibrating or labouring in a seaway.

The Gas Turbine.—Messrs. Brown Boveri, of Baden, Switzerland, have for some time been experimenting with a view to producing a commercially practical gas turbine, designed apparently on the impulse principle. According to *Industrial Engineering* there is a group of bottle-shaped explosion chambers arranged radially around the shaft of this turbine. Each chamber has inlet valves for air and gas and an exhaust valve for the products of combustion. The operation bears points of resemblance to a two-cycle gas engine, and may be described in general as follows:—Air is forced into each explosion chamber in turn. The gas entry valves are then successively opened and gas is also forced in under pressure. When volatile liquid fuel is used, a spraying apparatus worked by compressed air, on similar lines to the Diesel engine, is resorted to. As the explosion chambers become filled with the predetermined proportions of gas and air, the mixture in each is fired by electric sparks. The exhaust valve in the neck of the explosion chamber is then opened and the hot gases rush out through a conical nozzle similar to that used in the two best known types of impulse steam turbines.

From the nozzle the now cooling and expanding gases impinge on the rotor. A fan keyed on the shaft is placed at the exhaust end to assist in drawing the hot gases through the rotor and accelerate the reduction of temperature. When the pressure in the explosion chamber has been spent an independent blast of air is forced through to perform the office of scavenging, as in the two-cycle reciprocating gas engine after the completion of the power stroke. In the case of the turbine, however, the time available for scavenging is longer. A fresh supply of fuel is next forced into the explosion chamber and the process continues. The exhaust gases can also be used to raise steam in a small boiler, the steam being used to drive the air and gas pumps, and also for the producer.

A gas turbine would occupy only one-third of the space required for a gas engine of equal power, and would average not more than a quarter of the weight.

A "Boots" Electric.—The well-known firm of wholesale and retail chemists, Messrs. Boots, whose headquarters are at Nottingham, have recently added another electric vehicle to their fleet, being the fourth in two months. The lorry, which we illustrate, is of the "Cedes" Electric Traction Co.'s make, the two rear wheels being fitted with slow-speed motors built into the hubs The lorry is a large one, being 21 ft. 6 in. long, and 7 ft. 6 in wide, and has a carrying capacity of 4 tons. Messrs. Boots are already using a three-wheel electric car built by Messrs. Thouvenin-Tollin, of Paris, an industrial truck of the Silvertown Co.'s make, a similar vehicle supplied by the General Vehicle Co., and two Napier electric chassis converted to commercial delivery vans, and several other electric vehicles are being added. We understand that the firm's experience with the electric vehicle has been extremely satisfactory.

Admiralty Board of Invention and Research.—The Board has appointed a number of permanent sub-committees to work in conjunction with the Central Committee, of which Lord Fisher is president. Submarines, mines, searchlights, torpedo-nets (not in ships), wireless telegraphy, and generale lectrical and electro-magnetic subjects are covered by a single sub-committee, forming Section II, and composed of the Duke of Buccleuch, Prof. W. H. Bragg, Mr. W. Duddell, Prof. Sir E. Rutherford, Dr. R. T. Glazebrook, and Mr. C. H. Merz.

Controlled Establishments.—The total number of controlled establishments is now 2,026. The staff of the Ministry of Munitions already numbers 3,000, and, according to Dr. Addison, it is growing daily. A list of 200 persons who are giving gratuitous services to the Minister of Munitions is published in the *Times* for Tuesday last. It contains the names of many scientific experts, employers of labour, and business men who are assisting. Among them the following appear:—Sir John Aird, Prof. H. B. Baker, Dr. G. T. Beilby, Mr. S. Z. de Ferranti, Mr. W. Duddell, Sir R. A. Hadfield, Prof. J. S. Haldane, Mr. Alfred Herbert, Prof. B. Hopkinson, Sir A. B. W. Kennedy, Mr. Michael Longridge, Mr. W. T. MacLellan, Mr. S. S. Moore-Ede, Sir H. Norman, M.P., Sir B. Redwood, Mr. J. Swinburne, and Prof. Sir J. J. Thomson.

Educational.—Portsmouth Royal Dockyard School.—On Wednesday, December 1st, Rear-Admiral A. W. Waymouth, supported by the Dockyard officers, distributed the prizes to the engineering, electrical and shipwright apprentices, under instruction in H.M. Dockyard School at Portsmouth.

The annual report included the following remarkable summary of successes gained during the year by students of the school:—

Two Whitworth Scholarships out of four offered for open competition in Great Britain (Messrs. J. E. Wright and W. E. Park).

Nine Whitworth Exhibitions out of a total of 30 offered.

Four Royal Scholarships out of the five offered in mechanics for open competition in the United Kingdom.

Two Admiralty Prizes out of four competed for by apprentices in all the Royal Dockyards.

One Student Cadetship in Naval Construction and a number of Military Cadetships to the Woolwich Military Academy.

These excellent results should establish the position of the Portsmouth Dockyard School amongst the technical schools of the country.

Royal Technical College, Glasgow.—The annual report states that eight members of the Governing Body, 37 of the staff, and 1,774 students (past and present) joined the Colours; 91 have lost their lives, and nine have gained distinction. The facilities possessed by the College for the testing of materials have been freely placed at the disposal of the Government, and have been utilised by several sections of the War Office and the Admiralty, hundreds of tests having been carried out.

Institution and Lecture Notes.—Royal Institution.—The following are the lecture arrangements at the Royal Institution, before Easter:—Prof. H. H. Turner, a course of six illustrated lectures, adapted to a Juvenile Auditory, on "Wireless Messages from the Stars": How the Messages are Carried, December 28th; How the Messages are Received, December 30th; First Message, January 1st; Second Message, January 4th; Third Message, January 6th; Fourth Message, January 8th. Prof. W. A. Bone, three lectures on "Utilisation of Energy from Coal." Prof. Henry E. Armstrong, two lectures on "Organic Chemistry in War." Prof. Sir J. J. Thomson, six lectures on "Radiation from Atoms and Electrons." The Friday evening meetings will commence on January 21st, when Prof. Sir James Dewar will deliver a discourse on "Problems in Capillarity." Succeeding discourses will be given by Prof. E. G. Coker, Prof. S. P. Thompson, Prof. Sir J. J. Thomson, and others.

Association of Mining Electrical Engineers.—A meeting of this Association will be held in the Grosvenor Hotel, Deansgate, Manchester, on Saturday, December 18th, when a paper by Messrs. Izod and Rouillard, entitled "Centrifugal Pumping Plant of the Roodepoort Deep, Ltd.," will be read and discussed.

A coal-cutting demonstration took place on Saturday, at Bredisholm Colliery, near Glasgow, under the auspices of the West of Scotland Branch of the Association. A series of similar demonstrations will be held throughout the country, and the promoters are endeavouring to arrange that a different type of coal-cutter shall be explained on each occasion. Mr. Robert Rae, of Messrs. Anderson & Boyes, Motherwell, gave an interesting demonstration, the machine used being one of the latest type manufactured by his firm. Upwards of 150 managers and machinemen from all parts of Lanarkshire were in attendance.

Institution of Electrical Engineers—The Institution has been in correspondence with the Local Government Board with with regard to the periods sanctioned by the Board for the repayment of municipal loans, seeking to obtain extensions of these in respect of cables, conduits, storage batteries, and reinforced concrete. The Board has agreed to extend the period for conduits from 25 to 30 years, and for storage batteries from 5 to 7 years, but declined to receive a deputation on the subject.

The Council has made application, in the name of the Institution to the Research Advisory Council appointed by the Board of Education, for grants in aid of the researches which the Research Committee has in hand or has decided upon. The Council has approved a report of the Research and Wiring Rules Committees urging the desirability of carrying out an investigation into the mechanical and physical properties of rubber considered as an insulating material, and included it in the list furnished to the Research Advisory Council.

At the meeting of the Yorkshire Local Section on Wednesday last, Prof. A. B. Field read his paper on "Some Difficulties of Design of High-Speed Generators."

Foreign Trade.—Figures for November.—The following are the electrical and machinery figures given in the official returns for November:—

Imports.	Month of October. £	Inc. or dec. £	Eleven months, 1915. £	Inc. or dec. £
Electrical goods and apparatus, excluding machinery and uninsulated wire	131,334	+ 68,509	984,231	− 167,786
Machinery ...	752,664	+ 335,300	8,147,036	+ 1,986,883
Exports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	406,910	+ 169,967	2,922,017	+ 88,687
Machinery ...	1,602,563	− 137,070	17,717,897	− 12,161,040

Fatalities.—An adjourned inquest was concluded at Wallsend, on November 30th, relative to the death of James Nicholson, electrician, who was killed on November 19th by an explosion on board a vessel at Messrs. Swan, Hunter & Wigham Richardson's Shipyard.—John Lauder, fitter's labourer, stated that deceased and his mates were engaged on electric wires when there was a loud explosion and a flash of blue flame. Four men were injured, Nicholson was killed, and another man had since died.—John George Oliver, foreman electrical engineer, said that from his inspection of the scene of the explosion, he could find nothing to account for it. He had instructed one of the men to charge the battery, but gave no special instructions. Replying to the Coroner, witness said that if there had been no ventilation, or even defective ventilation in the place, that would accelerate the explosion. Questioned by Mr. F. E. Footer, who appeared for the Electrical Trade Union: Dibbage, the man he instructed to charge the battery, had no previous experience of the accumulator, which was a new type to the works. Frederick Whiteside, chargeman of fitters, said the ventilation fan was running at 830 revs. per minute John Hamilton Paterson, analytical chemist at the works, said the question of the ventilators did not affect the cause of the explosion Medical evidence attributed death to shock. The jury returned a verdict accordingly, and added that, in their opinion, the explosion was caused by a spark.

John Douglas, a Sheffield fitter, while working on a scaffold, on Saturday morning, at Stoke Works, grasped a live electric wire and was killed.

A Manchester coroner's jury inquired on Monday into th death of Frank Southern (21), a mechanics' labourer, who ha been employed by the British Westinghouse Co., Trafford Park On Friday last week he was working near a vertical borin mill which revolved at the rate of one revolution per minute Another man who was inside a large casting on the mill calle out to Southern in order to inform him that he might ease th boring tool. Southern, however, without waiting to receive th message, put his head through a vent hole and was caught b the boring tool, his head being smashed to pulp. It was stated a the inquiry that the deceased had previously been cautioned not t get his head where there was any danger of injury, and it wa surmised that he had forgotten the instruction. H.M. Factor Inspector Seal said that about 8,000 people were employed by th firm, and there had only been five fatalities in three years—a excellent record, having regard to the nature of the work con ducted. A case such as the one now being investigated, adde the inspector, was due to what might be called unpreventabl causes so far as the employers were concerned, and he could no suggest anything likely to prevent any similar accident in futur A verdict of "Accidental death" was returned, and Sir Wn Cobbett, who appeared for the Westinghouse Co., expresse sympathy with the relatives of the deceased.

A Cardiff paper states that Norman Price, Ystradmynacl employed at the Penallta Colliery, was killed on December 1st, b coming in contact with a live wire. It appears that Price hun his lamp on a live wire, while he attended to a tram that had le the rails.

Patents and Alien Enemies.—The Board of Trad has granted licences to Mr. J. J. Armfield and to Messrs. Gilber Gilkes & Co., Ltd., in respect of patent No. 22,565/12, granted t Honold; and to the Lilleshall Co., Ltd., in respect of patent N 409/13 granted to the M.A.N. Akt. Ges.

Volunteer Notes.—Engineering Institutions' Volun teer Engineer Corps.—Orders for Week commencing Decembe 13th, 1915.—By Lieut.-Col. C. B. Clay, V.D., Commanding.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

Monday, December 13th.—Sections 1 and 2, Technical; Sectio 3 and 4, Squad, Signalling Section and Recruits.

Tuesday, December 14th.—School of Arms with Architec Corps, 6 to 8 p.m.

Thursday, December 16th.—Sections 3 and 4, Shooting.

Friday, December 17th.—Sections 3 and 4, Technical; Section 1 and 2, Squad, Signalling Section and Recruits.

Saturday, December 18th.—Uniform parade. Time and plac to be posted at Headquarters later.

Sunday, December 19th.—Trench digging for Sections 1 and Parade at Victoria Station—time to be announced later.

Sections for Technical Parade at Headquarters, London Elec trical Engineers, 46, Regency Street, S.W.

Sections for Shooting Parade at Miniature Ranges.

Unless otherwise ordered, all Parades at Chester House.

E. G. Fleming,

Company Commander and Acting Adjutant.

Patents in War Time.—In a letter to the *Morning Pos* recently, Mr. H. Fairbrother pointed out the necessity of legislatio for the extension of the term of a patent, the manufacture which is stopped by the necessary requisition of works for th manufacture of munitions. At present there is no provision compensation for a firm making a patented article. They are e tirely stopped from doing so by this cause, and all the time the li of the patent is running on. "What of the firm making a patente machine under a minimum licence, or the patentee from whom th last, and perhaps only remunerative, part of his rights is taken He must pay the annual patent taxes, and gets nothing for it."

Inquiry.—The makers of the "Arkless" fuse a asked for.

Protecting Bright Articles from Rust.—In the *American Machinist*, Mr. A. L. Haas remarks that the ease with which bright surfaces of steel or iron will tarnish is one of the vexations of the machine builder. Machines and other goods for export are often subject to tropical temperatures before reaching their destination; the temperature may be sufficiently high to melt grease, and the atmosphere such that rust will easily form. Under such conditions special care is necessary.

The low melting-point of many greases and the subsequent troubles incident to complaints from oversea destinations have led some shippers to revert to the old white-lead and tallow coating. This is mixed with 4 lb. of tallow to 1 lb. of white lead, the latter being stirred into the melted tallow. Because of the acid in the tallow this coating must be removed at the earliest opportunity, using kerosene or turpentine; but there is no doubt that it protects from rust.

The question of protective coatings against corrosion is most difficult in the case of quantities of small-size articles. It is difficult to slush them effectively; to pack in solid grease is out of the question; simple oiling is insufficient, and to apply lacquer by hand is prohibitive on cheap goods.

A method which has been giving first-rate results in the case of buckles, rings and harness fittings generally may help to solve this vexed question elsewhere. Cheap varnish is diluted to two or hree times its volume with methylated spirits. On account of vaporation, the mixture is made up as required.

The apparatus consists of two oil drums, each minus one end. An ordinary 5-gallon drum, which is 11 in. in diameter, has ½-in. holes punched in the bottom and sides. The other drum may be of ¾-gallon capacity, of 12 in. diameter, or a 10-gallon drum, which s larger still.

The larger vessel is filled about one-quarter full, and the articles o be treated are put in the smaller vessel. The perforated drum is owered into the liquid, immersing the articles to be coated. Withdrawing the smaller vessel immediately, the major portion of he fluid drains back again in a minute or so. To finish draining and to harden the coating, the contents are then shot out on a wire draining surface and in 15 min. are ready to pack.

The process is really a cheap and effective form of cold lacquering in bulk. The articles remain bright for long periods of time, while the coating is not in the least obvious—in fact, it can hardly be detected—so that the appearance of the goods is not altered. Articles so treated will stand a long sea voyage, arriving at their destination in perfect condition, and will then keep free from rust or 12 months.

The quantity of bright buckles 5 gallons of the mixture will over has to be seen to be believed. Hundreds of gross can be reated daily by the addition of ½ to 1 gallon per day. An effective draining bed can be procured in the shape of a wire mattress. An inclined pan beneath it, with a draining hole at one corner, ompletes the apparatus.

Compensation Case.—At Southport County Court on Tuesday, Judge Thomas gave his sanction to an agreement under which the Lancashire and Yorkshire Railway Co. undertook to pay £100 to Percival Hingley, of Walton, as compensation for an ccident he received while in their employ. It was stated that Hingley was a wireman, and while engaged in his duties at the Formby power station he was severely burned about the body, ace and arms. He was in hospital for about 16 weeks, and was till receiving treatment. The railway company had offered him position as stores issuer, but he had refused this on the ground hat it would be a bar to advancement. He was able to use his ight arm, but his left arm and hand were permanently stiff. In greeing to the settlement, Judge Thomas said the company had made a fair offer.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. E. J. Foster has been ppointed draughtsman at the West Bromwich Corporation lectricity works.

During the absence of the Borough Electrical Engineer of Accrington (Mr. Harold Gray), who is serving with Accrington and Burnley Howitzer Brigade, the Acting-Engineer is o be paid an extra remuneration of £100 per annum from he date of Mr. Gray's enlistment.

During the absence of Mr. T. K. Richardson on sick leave, he Marylebone B.C. has appointed Mr. Leonard, the chief tation assistant, to carry out the duties, and has temporarily increased his salary to £350 per annum.

The Bermondsey Electricity Committee, in reporting the esignation of Mr. W. Tancred, first engineer-in-charge, tates that Mr. Tancred is a most efficient officer, and while t any time it would be sorry to lose his services, at the present time his resignation means a very great loss. Mr. Tancred's name is included with those of a number of the clerical staff who have asked for permission to enlist in the Army under Lord Derby's scheme. The Committee recommends the Council to refuse the permission asked for, and to request the Ministry of Munitions to exempt the staff from military service.

General.—In the Civil Service appointments, published in the *London Gazette*, we note that Mr. H. D. T. Waldram has been appointed by the Admiralty to be electrical station supervisor at H.M. Dockyards and Naval Establishments. Mr. Wm. McClelland and Mr. James McCaffery have been appointed electrical engineers in H.M. Naval Establishments.

Mr. Alderman Smith, J.P., has been re-elected chairman of the Barrow Corporation Electricity Committee, which office he has held since its formation.

Colonel A. Sinclair has been re-elected chairman, and Alderman Geo. Colwill vice-chairman, of the Swansea Electric Lighting and Tramways Committee.

Sergeant W. C. D. Miles, of the Willesden staff of the British Thomson-Houston Co., and formerly of the Rugby staff, has received a commission in the Westminster Dragoons. He has been in the Army since the outbreak of war.

Mr. E. Murray Paul, electrician at the Central G.P.O. Telephones, has joined the Wireless Section of the Royal Flying Corps, and is stationed in Ireland.

Councillors Evans and Stembridge have been appointed chairman and deputy-chairman respectively of the Sheffield Corporation Electric Supply Committee.

Mr. E. F. Clarke has been appointed temporary consulting and advisory engineer to the Sutton Coldfield T.C. electricity department at a fixed fee or salary of £125 per annum. Objection was raised to the appointment of Mr. Clarke, as he is a member of the Council, but it was stated that he had done wonderfully good work for the Council for a long time for nothing, and that the present temporary appointment would mean a saving running into three figures annually.

Mr. Samuel Lustgarten, of Monkseaton, electrical engineer, a natural-born British subject, has changed his name to Langton.

Roll of Honour.—Private Jack Murphy, of the Irish Guards, has been killed in action in France. He was formerly employed in the overhead department of the South Lancashire Tramways Co.

The Imperial College of Science and Technology has issued a list of past and present students and staff who are serving with the Forces. The information, which is corrected down to May 27th, 1915, is alphabetically arranged, and states the college, session or grade, rank, and regiment. An analysis shows that there are 715 officers and 470 men, making a grand total of 1,185.

Lance-Corporal Towler, of the 6th South Staffordshire Regiment, who was prior to enlistment on the electrical staff of the Sunbeam Motor Car Co., Ltd., of Wolverhampton, has died of wounds received in action.

Second-Lieutenant H. J. G. Davison, who was killed at the Dardanelles on June 4th, aged 28 years, was an electrical engineer, being an old Faraday House man.

Obituary.—Mr. C. J. Wollaston.—We regret to record the death, at the age of 95 years, of Mr. Charles James Wollaston, which occurred on November 27th at Burnham, Somerset. The *Times* describes the deceased gentleman as "an interesting link with the earliest days of submarine telegraphy," and says that he was "a member of the small company to which was transferred the concession granted by Louis Napoleon for laying a telegraph line under the English Channel." "He was one of the engineers in charge of the operations on the *Goliath*, which started on Wednesday, August 28th, 1850, from Dover to lay the line thence to Cape Grisnez." That cable soon ceased to work, but another concession was obtained from Louis Napoleon for permanent communication, which was to be established by October 31st, 1851. "To work this concession the Submarine Telegraph Co. was formed, and a real cable, containing four copper wires, was manufactured for the purpose at Wapping. Each of the wires was encased in a covering of gutta-percha ¼ in. thick, and the whole was protected by a layer of hemp yarn saturated with pitch and tallow, and by an outside covering of galvanised iron wires. The electrical testing of this cable, which weighed about 200 tons, was carried out by Mr. Wollaston, who was also on the Government vessel *Blazer*, by which it was laid. This vessel, having the cable coiled in its hold, reached the South Foreland early on the morning of September 25th, 1851, and, after landing the shore end, started across the Channel. Communication with the shore was maintained continuously. . . . Mr. Wollaston received a Civil List pension in March, 1900, in recognition of his services in the introduction of submarine telegraphy."

Eugen Hartmann.—The *E.T.Z.* announces the death of Eugen Hartmann, one of the founders of the firm of Hartmann & Braun, of Frankfort, at the age of 62.

Prof. Francis Richard Barrell.—The *Times* records the death of Prof. Francis Richard Barrell, Professor of Mathematics at Bristol University, which occurred suddenly while he was lecturing. He was 55 years of age, and among the books of which he was the author was one on "Electricity and Magnetism."

Mr. Thomas Parker.—We deeply regret to record the death, at the age of 72 years, of Mr. Thomas Parker, J.P., M.I.C.E., M.I.E.E., M.I.M.E., F.R.S.E., which occurred on Sunday last, after a long illness, at his residence at Ironbridge, his native village, in Shropshire. During the last few years Mr. Parker has been less prominently associated with the electrical world than was his wont in the earlier parts of his career, when his activities in electrical manufacturing and tramway and railway electrification work placed him in the front rank of the electrical industry. As a small boy he showed a strong inclination for mechanics, and he began practical work at a very early age. It is stated that in the early eighties of last century he discovered the action of nitric acid in facilitating the formation of the oxide in secondary batteries, and his patent rights in this connection, taken out in conjunction with Mr. Elwell, formed the subject of litigation, in which the rival claims of these two gentlemen and M. Gaston Planté were considered, the Court dividing the patent rights between the parties. Planté's interests were taken over by the Elwell-Parker electrical manufacturing firm, which began business about this time in Wolverhampton. Mr. Parker was intimately concerned with the manufacture of the plant and equipment for the Blackpool conduit tramway system, and the Electric Construction Corporation, Ltd., which subsequently took over the Elwell-Parker interests, equipped the first section of the Liverpool Overhead Railway. Other electric traction installations with which he was closely identified included the South Staffordshire Tramways, and his lighting installation work included the Oxford system. His connection with the Electric Construction Corporation ceased in 1894, and he formed the business of T. Parker, Ltd., which subsequently was transferred to the Rees-Roturbo Co. Latterly he has not been actively connected with any of these industrial concerns, but has devoted his attention to consulting practice, and one piece of work which passed through his hands was the electrification of the first section of the Metropolitan Railway about ten or twelve years ago. He was interested also in "Coalite." He once took an active interest in politics and stood unsuccessfully as a candidate in the Liberal interests.

Will.—Mr. H. Steel, of Steel, Peech & Tozer, Sheffield, left £652,418 gross and £645,273 net personalty.

NEW COMPANIES REGISTERED.

Fredk. R. Butt and Co., Ltd. (142,314).—This company was registered on December 4th, with a capital of £7,500 in £1 shares, to take over the business carried on by H. F. Bigge, F. R. Butt, J. H. Webb, and P. C. Kent, at 147, Wardour Street, W., and elsewhere, as Fredk. R. Butt & Co., and to carry on the business of scientific and general electrical engineers, manufacturers of X-ray, therapeutic, medical, electro-medical, wireless telegraph, and telephone and other instruments and apparatus, and equipment for operating theatres, surgeries, and hospitals, constructors of radio-telegraph and radio-telephone stations, etc. The subscribers (with one share each) are: H. F. Bigge, Penybryn, Copperkins Lane, Chesham Bois, electrical engineer; F. R. Butt, 164, Downham Road, Canonbury, N., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are H. F. Bigge and F. R. Butt, both permanent. H. F. Bigge is the first managing director. Registered office: 147, Wardour Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Sterling Telephone and Electric Co., Ltd.—Mortgage, dated November 11th, 1915, to secure £48,253 17s. 1d. charged on the company's undertaking and property, present and future, including uncalled capital and freehold land at Dagenham, Essex.

Rawlings Bros., Ltd.—Issue on November 19th, 1915, of £1,100 debentures, part of a series of which particulars have already been filed.

Barraclough Brothers, Ltd.—Particulars of £1,000 debentures, created July 27th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Jarrow and District Electric Traction Co., Ltd.—A memorandum of satisfaction to the extent of £200 on October 1st, 1915, of debentures created August 3rd, 1910, securing £20,000, has been filed.

Carville Site and Power Co., Ltd.—Issue on November 27th, 1915, of £10,000 debentures, part of a series of which particulars have already been filed.

Northampton Electric Light and Power Co., Ltd.—Particulars of £40,000 second debentures, created October 15th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £16,100. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to first debenture stock. No trustees.

A memorandum of satisfaction in full on November 11th, 1915, of two debentures dated January 13th and January 30th, 1911, securing respectively £500 and all moneys due for the time being to the Northamptonshire Union Bank, Ltd., has been filed.

Rhondda Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £4,000 of charges dated March 24th, 1911, November 13th, 1912, and March 11th, 1915, securing £250,000 has been filed.

CITY NOTES.

French Electrical Companies.

The Societé Electro-Métallurgique Française de Forges suffered severely from the influence exercised by the war. The gross profits declined from £613,000 in 1913-14 to £359,000 in 1914-15, and the net profits from £202,000 to £64,000, while the dividend has receded from £2 16s. to £1 4s. per share on an ordinary share capital of £600,000.

The Société d'Electricité de Paris, which has an ordinary share capital of £1,000,000, has only now proceeded to distribute the dividend for the year which closed on June 30th, 1914. At the general meeting held in January, 1915, the rate of distribution was fixed at 16s. per share on the ordinary capital, and £1 6s. 8d. per share on the deferred shares, less income-tax. This works out at 15s. 4d. on registered shares, 13s. 10d. on bearer shares, and 22s. 3d. on the deferred shares.

The Compagnie Parisienne de l'Air Comprimé reports net profits of £63,000 for the year ended with June 30th, 1915, as contrasted with £187,000 in the preceding year. The diminution, which had been foreseen, is attributed to the fact that the electrical department did not yield any results, whilst the influences of the war caused a considerable restriction in the consumption of compressed air, the production of which was also rendered more expensive owing to the advance in the prices of coal. It is proposed to pay a dividend of £1 4s. per share, as compared with £1 16s. per share in 1913-14.

The Société Générale des Nitrures, which was formed by French aluminium producing companies two or three years ago, reports that the company's investigations in 1914-15 were hampered by the war. Arising from experimental and installation work the company realised a gross surplus of £32,000, as compared with £81,000 in the preceding year, and net profits of £5,800, as against £32,000, on a share capital of £136,000. Four new patents had been applied for, and the investigations regarding a new method of manufacture had been successful. It is added that the Norwegian Nitrate Co. had fully responded to expectations.

The accounts of the *Compagnie Française des Câbles Télégraphiques, of Paris*, which has a share capital of £540,000, show that the receipts from the cable traffic in 1914 amounted to £355,000, as compared with £261,000 in the previous year, the increase being principally due to the growth in the Atlantic messages with America since the outbreak of the war. An augmentation also took place under the heading of various receipts, namely, from £28,000 in 1913 to £33,000 last year, chiefly owing to the participation in the United States and Hayti Telegraph & Cable Co. The share of the French Government in the working results of the Paris company was £51,000, of which slightly over one-half referred to the free transmission of official telegrams. The net profits amounted to £91,000, which permits of the payment of a dividend at the rate of 4 per cent., as against 2.4 per cent. in 1913. Out of the balance of £64,000 then remaining, two-thirds have been applied according to the convention with the State to writing down the internal guarantee and advances made by the State, and the other third has been placed to the contingency fund.

Cordoba Light, Power & Traction Co., Ltd.—The report for the year ended September 30th shows that the profit, after meeting all charges, is £19,035, and with £26,321 brought in, the total is £45,356. It has been customary, hitherto, to pay half-yearly dividends on the preference shares on February 1st and August 1st. In future the dividend period will correspond with the financial year of the company. A dividend at the rate of 6 per cent. (less tax) has already been paid on the preference shares for the half-year to January 31st, absorbing £8,150. To give effect to the alteration in the dividend period the directors now recommend the payment of a dividend at the rate of 6 per cent. per annum (less tax) on the preference shares for the eight months to September 30th, requiring £10,625, and £26,581 is carried forward. The period covered by the accounts was one of great depression in the Argentine, from which there was some recovery during the latter part of the year. Arrangements were concluded recently, with the consent of the Treasury, for the issue, on December 1st, of £500,000 6 per cent. promissory notes. This has permitted of the replacement of the notes which matured on that date and the repayment of other obligations of the company.—*Financial News.*

New Russian Electrical Companies.—The Elektrichestve Co., of Vyaznikach, began operation on October 1st/14th, 1915. The offices of the company are in the town of Vyaznikach, in the Government of Vladimir.

The Russian Co. "Elektrovod" is being formed with a capital of 500,000 roubles to exploit the electric station, waterworks and mills of the united villages near St. Enakaievo.

Automatic Telephone Manufacturing Co., Ltd.—The preference share and transfer books will be closed from 17th to 24th inst. for the purpose of preparing the dividend warrants on the 6 per cent. preference shares for the half-year ending 31st inst.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—The *Times* states that the directors have now decided to pay the interim dividend of 2½ per cent. on the ordinary shares which was postponed in July last.

Electrical Securities Trust, Ltd.—The report states that, after charging all expenses and interest due and accrued on debentures, amounting to £2,500, there is a loss of £710. No credit has been taken in the accounts for interests or dividends which may have accrued and which have not been paid within the period of the accounts. The directors regret that they have been unable to dispose of any of the investments held by the trust during the past year and so enable the trustees for the debenture-holders to make a further distribution.—*Financier.*

Companies Struck off the Register.—The following companies have been struck off the Register, and are accordingly dissolved :—

Auto Electric Vacuum Drying Syndicate.
Automatic Centrifugal Pump.
Boudjah Electric Lighting Co.
East Kent Electric Supply Co.
Filaments.
Radiographic Processes.
Simplex Lifeguard & Step Co.
Small Power Dynamo & Motor Co.
Treibel Smoke Combustion Co.
United Sherardizing.

Power-Gas Corporation, Ltd.—The report for the year ended September 30th, 1915, states that the results of the company's trading during the year have been satisfactory. The business has been further developed and important contracts made. The results for the year show a total profit of £20,743, plus £7,479 brought forward. A dividend of 6 per cent. per annum is to be paid on the ordinary shares, leaving £9,105 to be carried forward.

Manx Electric Railway Co., Ltd.—The accounts for the year ended September 30th show a debit balance of revenue account of £9,436. The debenture interest, amounting to £9,000 per annum, was paid in cash for the first half-year and funded by the issue of second debentures for the second half-year.—*Financier.*

Bullers, Ltd.—For the year ended July 31st, there is a profit of £27,860, plus £7,676 brought forward. Allowance for depreciation has been made. A further dividend of 5 per cent., making 7½ per cent. for the year, on the ordinary shares, is recommended, carrying £7,000 to reserve and £9,786 forward.

Portarlington Electric Light & Power Co., Ltd.—The profit and loss account on the first year's working showed a gross profit of nearly 10 per cent. on the preference shares. The revenue was £560. The number of lamps connected was stated at 1,345.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended October 29th, 1915, have amounted to 1,889,945, compared with 1,262,426 in 1914.

Western Telegraph Co., Ltd.—The directors have declared the first quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1916, being at the rate of 6 per cent. per annum.

Brazilian Traction, Light & Power Co., Ltd.—A quarterly dividend of 1½ per cent. on the fully-paid cumulative preference shares is announced.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—An interim dividend for the quarter to September 30th of 2s. 6d. per share, free of tax, is announced.

STOCKS AND SHARES.

TUESDAY EVENING.

The surprising part about the Stock Exchange markets is that they should keep as firm as they do in the face of general conditions. Had there been no European War going on, general depression might well have been expected in the ordinary course of events, having regard to the near approach of the end of the year and the tempting offers of Government stocks by France, Canada, and New South Wales. Now, however, with the war very much in evidence in the Near East, Stock Exchange prices are showing a robustness and a vitality that in themselves afford the clearest possible proof that the public at large have absolute confidence in the way the war is going to terminate.

The Stock Exchange through the present year has maintained cheerfulness and courage in the face of everything. Thanks largely, of course, to the action of its clients, the public, in refusing to sell, and in being ready to buy when cheap stock came on offer, the House all along has refused to indulge in optimistic prophecies as to the probable length of the war; but at last one finds a cautious disposition to put an earlier date to the conclusion of the struggle than Lord Kitchener did, for instance, when, seventeen months ago, he roughly estimated its duration at three years.

The markets for domestic securities have fallen upon some quietude, and Home Railway stocks gave way after their spasm of firmness. The Underground group is coloured by sympathy with the rest, although, considering the very substantial rise which has taken place in the income bonds of the Underground Electric Railways, the setback has been nothing alarming so far. The £10 shares dropped back more sharply, while the shilling shares keep fairly steady. London Electric ordinary £10 shares changed hands at 29s. 4½d. to-day, and languid interest is taken in East London ordinary stock at about 80s.

The real feature of the electricity supply market is the way in which the preference shares of the principal companies hold their prices. This is a distinguishing characteristic of industrials as a whole. The demand is greater than the supply, and the public are content to buy industrial preferences on a 6 per cent. basis: in some cases they are being bought to yield 5½ per cent., and even less. Why this should be, when there are so many more securities returning as good dividends from what used to be regarded as higher-class stocks, it is difficult to say; but evidently the public consider that preference shares in a home industrial undertaking, the progress of which they can watch more or less for themselves, are certainly as well worth holding as any Government or railway issues.

The only signs of weakness at the moment in electricity preference shares is that in Charing Cross preference and the Company's City preference, both of which have fallen ¼. Amongst the ordinary shares, Westminsters are the same fraction lower; and the only change in the debenture stocks is a fall of 2 points in London Electric 4 per cents. As we have indicated before, there will be no surprise felt in the Stock Exchange if the leading electric lighting companies find it necessary to cut their dividends in respect of the current six months, what with the increased cost of coal, the difficulty of obtaining labour, the obscuring of London's lighting, and the higher prices which have to be paid for materials.

What news there is from Mexico is read as being of a rather more favourable character, and there is just a slight inclination to buy some of the Mexican utility bonds again. On the other hand, the market for Mexican railway stocks is dull; and while this is so, it is not to be expected that prices of the utility descriptions can make any headway worth mentioning. Brazil Tractions have a tendency to crumble, the Rio exchange operating against the market, while there is a good deal of speculation as to what dividend the company will next declare on its common shares. The public are not buying much of anything at present, but are rather conserving their bank balances—probably with a view to making a good show at the bank by the end of the year.

Rio Tramway bonds keep very firm, the Firsts being 93 and the Seconds 78½. The Anglo-Argentine Tramway group is also steady, the 5 per cent. first debenture being wanted at 81. There is not much floating supply of it, and the absorption of two or three thousand pounds stock would have the effect of putting up the price at once. The British Columbia group shows no change, but, having regard to the way in which Canadian investments of all kinds are being taken, some kind of an upward movement in the British Columbia stocks is sufficiently likely to justify holders in retaining their securities. The company has passed through a bad time, and the recovery in Canadian industries takes time to spread to the west of the Continent, though of its ultimate coming little doubt is entertained.

The Telegraph market continues very firm, and the rises of last week have been followed by others in Eastern Extension shares, Indo-Europeans, Westerns, and Globe preference. The latter, at 10⅝, return 5⅝ per cent. on the money; and seeing that the ordinary can be bought to yield 6½ per cent., allowance being made for the payment of the dividend free of tax, a holder of the preference might consider the advisability of selling half his shares and exchanging into the ordinary, which would materially help the yield on the shares, and with very little extra risk. The company has just declared the usual quarterly dividends on both classes of shares. New York Telephone bonds are keeping close to 101; and American descriptions as a whole show an amount of resiliency which suffices to lift quotations well above any reaction which may occasionally befall them.

In the manufacturing group, a rise of 5 points in Callenders debenture stock reflects the demand for a comparatively small amount, which, coming on a market bare of stock, had this somewhat remarkable effect. General Electric preference have risen ¼ to 9¾; and Telegraph Constructions follow the trend of shares in the cable companies. British Westinghouse preference have again improved, the high yield on the shares attracting buyers. More than usual has been doing in British Aluminium ordinary, the price rising to 23s. 6d. on dividend prospects. Castner-Kellners at 59s., ex their dividend of 2s. 4 4-5d., are a trifle easier. Victoria Falls ordinary eased off to 7s., after being better, but the preference are good at 18s., and the 5½ per cent. debentures keep very steady at 94. On these last, the interest payments are distributed free of income-tax, and every now and again the company buys bonds in the open market for cancellation purposes.

Rubber shares recovered as the price of the material hardened up to 3s. 6d. per lb. Buying started again, though on a more limited scale than was the case three weeks back. Rumour said that a German submarine had torpedoed a cargo boat with 500 tons of rubber on board, and that it was the loss of this consignment which had the effect of stiffening the price of the raw material in Mincing Lane. However that may be, the markets both for the shares and for the produce appear to be decidedly good. On the other hand, the copper group is weak and heavy. The United States have ceased buying copper shares, and there is not much disposition on this side to set a lead. The companies engaged in working other base metals are very popular just now, and shares in the concerns which produce lead, spelter, zinc, etc., are distinctly good. In the armament division there is no fresh feature of importance.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Dec. 7, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	7¼	—	£6 18 4
do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	3½	—	7 2 10
do. do. do. 4½ Pref.	4½	3¾	—	6 0 0
do. do. City Pref.	4½	3¼	—	6 8 7
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4¼	—	5 17 8
do. 4½ Deb.	4½	87	—	5 3 6
City of London	9	12¼	—	7 7 3
do. do. 6 per cent. Pref.	6	11	+ ¼	5 9 1
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10	—	7 0 0
do. do. 6 per cent. Pref.	6	10¼	—	5 17 8
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	83	—	5 8 0
Kensington Ordinary	9	6	—	7 10 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4¼	—	7 1 2
do. do. 4 Deb.	4	75	—	5 4 0
Metropolitan	3½	2¼	—	7 15 7
do. 4½ per cent. Pref.	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	85	—	5 6 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6½	—	7 13 10
do. do. do. 7 per cent. Pref.	7	6	—	5 16 8
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6½	—	6 18 6
do. 4½ Pref.	4½	4⅛	—	5 9 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	100½	—	5 19 6
do. Def.	1½	22⅞	—	6 11 3
Chile Telephone	8	6½	—	6 3 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	12¼	+ ⅛	*6 10 6
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord.	7	128	—	*6 4 0
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	10⅜	—	*6 9 2
do. Pref.	6	10⅝	+ ⅛	5 12 6
Gt. Northern Tel.	22	33½	—	6 11 4
Indo-European	18	48 xd	+2	6 15 4
Marconi	10	1⅞	—	5 6 8
New York Tel. 4½	4½	101	—	4 9 1
Oriental Telephone Ord.	10	1 15/16	—	5 8 1
do. Pref.	6	⅞	—	6 17 2
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	6	+ ⅛	*7 12 5
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12⅝ xd	+ ⅛	*6 7 0
do. 4 Deb.	4	80	—	5 0 0
Home Rails.				
Central London, Ord. Assented	4	71	—	5 13 6
Metropolitan	1¼	24½	— ¾	5 2 0
do. District	Nil	15	−1	Nil
Underground Electric Ordinary	Nil	33/9	— 1/16	Nil
do. do. "A"	Nil	5 9	—	Nil
do. do. Income	6	77½	−3	*8 16 8
Foreign Trams, &c.				
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	95 xd	—	5 5 0
Anglo-Arg. Trams, First Pref.	5½	4	—	6 17 6
do. 2nd Pref.	5½	3½	—	7 17 2
do. 4 Deb.	4	76	—	5 5 8
do. 4½ Deb.	4½	76	—	5 18 5
do. 5 Deb.	5	81	+1	6 4 0
Brazil Tractions	3½	56	— ½	6 5 0
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
British Columbia Elec. Rly. Pfce.	5	58	—	9 11 4
do. do. Preferred	—	37	—	Nil
do. do. Deferred	—	33	—	Nil
do. do. Deb.	4½	62	—	6 17 1
Mexico Trams	Nil	42	—	Nil
do. 5 per cent. Bonds	—	49	—	Nil
do. 6 per cent. Bonds	—	44	—	Nil
Mexican Light Common	Nil	30	—	Nil
do. Pref.	Nil	42	—	Nil
do. 1st Bonds	—	49	—	—
Manufacturing Companies.				
Babcock & Wilcox	14	2 5/16	—	6 1 9
British Aluminium Ord.	5	23/6	+2/3	4 5 1
do. Pref.	6	18/8	—	6 9 9
British Insulated Ord.	15	10⅛	—	7 8 2
do. Pref.	6	5⅞	—	5 2 2
British Westinghouse Pref.	7½	88/6	+1/6	7 16 0
do. 4 Deb.	4	70	—	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	10½	—	7 2 10
do. 5 Pref.	5	4½	—	5 11 8
do. 4½ Deb.	4½	90	—	5 0 0
Castner-Kellner	20	59/- xd	−1/-	6 15 7
Edison & Swan, £3 pd.	Nil	9/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	57	—	7 0 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	14/-	—	8 11 5
do. do. Pref.	7	19/9	—	7 1 4
Gen. Elec. Pref.	6	9¾	—	6 3 1
Henley	20	12¾	—	*8 19 4
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	7¾	—	6 5 0
Telegraph Con.	20	81½	—	*8 1 0

* Allowance made for dividends being paid free of income-tax.

Excess Profits of Municipalities.—It was stated in the House of Commons on Tuesday, in reply to a question, that local authorities which made a profit on one business undertaking would be able to set this off against a loss on another undertaking owned by them.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, December 8th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a „ Nitric	„	..	..
a „ Oxalic	per lb.	1/2	1d. inc.
a „ Sulphuric	per cwt.	..	..
a Ammoniac Sal	„	..	..
a Ammonia, Muriate (large crystal)	per ton	£50	..
a Bleaching powder	„	..	..
a Bisulphide of Carbon	„	£23	..
a Borax	„	£25	£1 inc.
a Copper Sulphate	„	£43 10	30/- inc.
a Lead, Nitrate	„	..	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	..	..
a Potash, Caustic (88/90 %)	per ton	..	..
a „ Chlorate	per lb.	1/5	½d. inc.
a „ Perchlorate	„	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers	„	£11 10	..
a „ Recovered	„	..	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %)	„	..	..
a „ Chlorate	per lb.	1/4	½d. inc.
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	8½d.	2d. inc.
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	..	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	..	..
b „ Sheet, in ton lots	„	..	..
p Babbitt's metal ingots	„	..	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/1¾ to 1/2	..
c „ Tubes (solid drawn)	„	1/2½ to 1/2¾	..
c „ Wire, basis	„	1/2 to 1/2¼	..
c Copper Tubes (solid drawn)	„	1/2¼ to 1/2½	¼d. dec.
g „ Bars (best selected)	per ton	£112	..
g „ Sheet	„	£112	..
g „ Rod	„	£112	..
d „ (Electrolytic) Bars	„	£98 10	30/- inc.
d „ „ Sheets	„	£116 10	30/- inc.
d „ „ Rods	„	£105 10	30/- inc.
d „ „ H.C. Wire	per lb.	1/0⅝	⅛d. inc.
f Ebonite Rod	„	8/-	..
f „ Sheet	„	9/6	..
o German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/11½	½d. dec.
l Iron Pig (Cleveland warrants)	per ton	73/-	1/6 inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£28	..
g Lead, English Pig	„	£28 15	5/- inc.
g Mercury	per bot.	£16 15	..
e Mica (in original cases) small	per lb.	6d. to 3/-	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 14/- & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	..	..
p „ „ rolled bars & rods	„	..	..
p „ „ rolled strip & sheet	„	..	..
o Platinum	per oz.	210/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	„	£165 to £166	10/- dec.
g „ Wire, Nos. 1 to 16	per lb.	2/8	..
p White Anti-friction Metals	per ton	..	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Peat Fuel for Russian Electric Stations.—The Zemstvos' Association has, says a Moscow communication, been engaged on numerous communal questions, including that of the use of the peat bogs of Central Russia, in order to replace coal, which is now so scarce and expensive for raising steam, particularly for central electric stations, which would bring into existence a great number of manufacturing concerns. It is maintained that the institution of such stations would immediately result in great industrial activity in the Moscow district, and make it independent of the South Russian coal and Caucasian petroleum. At present the importance of electric transmission is very pressing in view of the scarcity of coal, and the disorganised railway transport system. The institution of such concerns on a co-operative basis is, however, hindered by the lack of a special law authorising the alienation of private lands for laying electric cables and overhead lines. In connection with this question, the association is seeking to have a local application of the law ruling at Baku, with respect to the land required for laying pipe lines and such like.

ELECTRICAL ACCIDENTS IN MINES.

(*Continued from page* 711.)

Of the three non-fatal accidents, one is of interest, as it shows the casual manner in which electricity is used for purposes of temporary lighting. Apparatus for the prevention of over-winding was in course of being installed in connection with the winding engines by contractors. To obtain sufficient light under the floor of No. 1 engine house, an electric lamp was attached by means of discarded shot-firing cable to two bare terminals of a portable lamp circuit. Under the floor of No. 2 engine house the rubber-covered cable of a portable lamp circuit was split open, the wires bared, and an attachment made. When the engineers had finished the work under the floor of No. 2 engine house they moved the shot-firing cable and lamp from there to No. 1 engine house, and used it for three days until, on April 15th, about 2.30 p.m., the foreman engineer noticed smoke rising up through a trap door in the floor of the engine house. On going to the trap door he found the cable burning; one of the workmen had noticed the fire, and he. in tearing down the cable, received a shock, but the voltage of the supply being low—120—it was not fatal. The colliery electrician said he was not aware of the existence of the lamps on the shot-firing cable until after the accident, but in making such a statement he proved himself either to be not speaking the truth or to have been very negligent in not giving proper attention to the plant under his charge. He was very seriously reprimanded by his employers.

In the Northern Division there occurred one fatal accident on the surface, one non-fatal accident below ground, and three above ground. The fatal accident was entirely due to the folly of four men, and one can scarcely believe that any men could be so ignorant of the dangerous element they were playing with. We have commented before on the same sort of thing. In this case, a boiler foreman and three other men were playing practical jokes. They intended to give the horsekeeper at the colliery an electric shock, and to do so they connected the handle of the donkey pump house door to a lighting switch. The horsekeeper, however, did not go near the pump house, but the fireman did, and he received a shock which killed him. The current was alternating at 220 volts. It appeared that the men had played jokes upon each other in the same way on previous occasions, but on this occasion it was a very wet night, so the deceased man made a good connection for the current to earth.

Two other electric accidents, which fortunately caused no injury to life but which might have been serious, are also reported. One which occurred in an underground engine house serves to show the possibilities of danger which are hidden in switch boxes. Owing to a fracture of the micanite insulation upon one phase of a three-phase 2,000-volt circuit, a short-circuit was caused across the phases in a main switch controller. The switch oil was heated up to flashing point and ignited, and burst off the top of the switch box. Mr. Nelson, Electrical Inspector of Mines, after making an inquiry, reported:—

> This is an accident which, though serious anywhere, would have been more serious had it taken place inbye, instead of near the shaft bottom. There seems no reason to doubt the explanation offered by the management, namely, that the explosion was caused by vaporisation of oil due to the arc set up by a short circuit within the switch-box. The oil appears to have been of good quality, and to have had a high flash-point. The only remedy it seems possible to suggest, namely, the better ventilation of such switch-boxes, had already been applied at Murton Colliery. Though such explosions are rare, one might occur conceivably even in a ventilated box if the arc caused by a short-circuit generated gas sufficiently quickly.

Another electrical accident containing dangerous possibilities occurred as follows:—A double wire armoured 3-core cable, carrying a 500-volt alternating current, served a small pump in one of the districts. The circuit was protected near the shaft-bottom by an overload trip-switch. A deputy going along the road saw flashes from the cable, and he promptly telephoned to the shaft for the current to be cut off, and sent for the electrician. It was found on examination that the cable had been punctured with blows from a sharp tool, such as a pick. Fortunately, there was neither gas nor coal-dust about; but, at the same time, there was plenty of wood, which might have taken fire had the accident not been detected in time. Mr. Nelson, Electrical Inspector of Mines, investigated the occurrence, and reported:—

> Examination showed the cable to be punctured, apparently by blows from a sharp tool, such as a pick. The overload trip-switch, which was supposed to protect the circuit, did not act. The reason the overload trip did not act is because such protection is in no way sensitive. The leakage current has to exceed the value at which the overload trip is set to operate before the latter is called into action. That is to say, the leakage current must first exceed the working current by perhaps 100 per cent. Clearly, a leakage of any value up to this overload value might produce open sparking indefinitely with only such protection as was provided at this colliery, and, it may be added, with only such protection as is usually provided below ground in mines. The contingency of a cable damaged by a pick or a nail, or by a fall of stone, may be held to be remote, but it cannot be ignored in all cases. The remedy, however, is to provide leakage cut-out protection which is called into action immediately any portion of the current, it may be a small portion, leaves the conductors provided for it to return to the generator by some other path—for example, by the cable armouring or, more directly, *via* earth. When such a leakage occurs there is a "fault" on the circuit, and the balance which normally exists at every instant between the current which enters and that which leaves the conductors of a healthy circuit is disturbed. Leakage cut-outs are brought into action by such disturbances of balance only, and they may be set to operate with any degree of sensitiveness. If it is desired to cut off the pressure from a circuit quickly should a fault occur—for example, in the event of a fall of stone on a cable in an atmosphere charged with coal-dust—the advantage which a leakage cut-out confers over an overload cut-out is at once clear. There can be no doubt that the protection of circuits below ground by this leakage method will become established practice in the near future.

In the York and Midland Division there were four fatal and nine non-fatal accidents. Of the fatal accidents, two occurred below ground and two on the surface, whilst four of the non-fatal accidents were below ground and five above ground. With reference to those which occurred on the surface, in one, a tipper working at the screens, was killed by an electric shock sustained by touching a bare place in a lighting cable which was, by mischance, at 500 volts above earth potential. The deceased was in charge of a "tippler," his duty being to tip the contents of the pit-tubs brought by an inclined creeper from the pit shaft, on to a band conveyor. Not far from the tippler there was an opening like a doorway, 5 ft. 9½ in. high, through which the tubs delivered the coal, and under the lintel of this opening passed three ordinary lighting wires, 14 gauge, rubber-insulated, tape-wound and braided. When standing at this point deceased cried out, and he was then seen to have hold by his left hand of one of the wires, which investigation showed to be bare for a space of about three-quarters of an inch. In this way he received the electric shock which caused his death.

The lamps on the circuit were 110-volt lamps, but the circuit was supplied by current from a 500-volt three-phase system, one wire of the circuit being connected to one of the phases of that system, and the other to a tapping taken from the transformer supplying the 500-volt current (which originated from an 11,000-500 volt transformer). The pressure between the line or phase to which the lamps were connected and the point in the transformer winding at which the tapping was taken was 110 volts. In this way the circuit, though nominally at 110 volts, was in reality a 500-volt circuit, as an earth on either of two phases would cause the lamp circuit to assume a pressure 500 volts above earth. After the accident it was found that one of the phases of the system, other than that supplying the lamps, was faulty, there being an earth in a small meter-transformer in the sub-station. In all probability the deceased received a 500-volt electric shock.

The above facts were brought out at the inquest, which was attended both by Mr. Nelson, H.M. Electrical Inspector of Mines, and Mr. Frazer, junior Inspector, and at the conclusion of the evidence, and following a suggestion of the Coroner, Mr. Nelson made the following recommendations:—

1. That the lamp circuit in which the accident occurred, and which it appeared that it had not been the duty of any particular individual to attend to, should have some man appointed definitely to maintain it.

2. That only low pressure should be used for lighting. (Since the accident properly transformed current of 110 volts, that is, without the possibility of any higher pressure being attained, has been used.)

3. That some means should be provided of indicating any defects in the insulation of the 500-volt surface system and of every system.

To these suggestions the management undertook to attend.

In the other case, a greaser got killed at the bye-product coke oven stamp. The motor and gearing driving the stamp were mounted on a travelling platform moving on rails about 10 ft. from the floor level. The main switch was mounted on the wall of the building and below the travelling platform; at a height convenient for the operator there was a controller. Three-phase current at 500 volts was supplied through the switch to overhead bare wires, and from these wires rubbing contacts supplied the motor. It was the duty of deceased to oil the machinery on the platform, but before doing so to switch off the current. He had apparently operated the switch handle for this purpose (for it was subsequently found in the off position), but afterwards by placing his right hand on the bare wire he got electrocuted. When the switch cover was removed it was found that the release mechanism of one knife was broken, thus leaving one phase alive. The release was controlled by a fine coil spring between the rocking-lever and one end of the knife. The other end of the knife which was struck by the rocking arm was worn away, and there was a slight groove worn in the saddle, so that when the switch handle was moved to the off position it would fail, without the spring, to open the switch. The wearing of these points would put excessive strain on the spring. There was considerable evidence of fusing in the box, and all three springs were gone. When the switch was found to be defective the question of proper maintenance arose. Regulation 4 of the Factory Regulations, applicable in the case, provides that:—

> Every switch intended to be used for breaking a circuit, and every circuit-breaker, shall be so constructed that it cannot with proper care be left in partial contact. This applies to each pole of the double-pole or multi-pole switches or circuit-breakers.

It was said that the switch had worked satisfactorily for four years, and was examined and found to be in working order by an electrician about seven hours before the accident; also that the ram driver had hold of the bare wires two hours before the accident. These statements were made to show that up to a short time before its failure the switch was acting properly.

Mr. Nelson was of opinion, however, after an examination of the switch, that it had not been properly maintained, and certainly its failure so soon after inspection by an electrician did not indicate efficient inspection or satisfactory maintenance. The switch had been in use for four years and evidently required renewal, though those responsible for the efficiency of the switch had not thought so, or knowing it, failed to attend to the matter.

(To be continued.)

OUR TRADING OPPORTUNITIES THROUGHOUT THE WORLD.

(Continued from page 711.)

The Trade of Japan.

Japanese Enterprise. When the Allied Expedition had finished their work at Tsingtao, the indignant Prussian soothed the people of the Fatherland with promises of frightfulness in days to come, when our gallant little ally, Japan, would duly be reckoned with—only let it "wait and see!" We noted nothing at the time to lead us to suppose that our Ally was quaking in her shoes. We have heard much, however, to prove that that spirit of enterprise and pushfulness which have characterised the progress of the Japanese nation during the last decade or two have been very fully employed, since the cessation of its part in the actual hostilities, in an attack on German trade in the Far East. With the general ambitions of Japan in China we have little immediate concern here. The time chosen for the negotiations seemed to be particularly unfortunate, and some of the proposals as affecting other nations seriously threatened for a few days to "put the fat in the fire." But Japan's commercial, industrial, and scientific activities are not in a state of suspense, whatever may be the present position of international negotiations. Ever since Teutonic trading activities were restricted by our Fleet, and our own exporting ability was limited by our other operations, the attentions of the Japanese have been increasingly given to outer markets. It will be remembered that early in the war a representative deputation went to Australia to see in what branches of trade there would be possibilities of mutual assistance, and a number of interesting proposals were advanced. How far these have proceeded we do not know, but reports from other markets show that Japanese travellers are at work where Germans used to be.

Japanese Manufacturing. The manufacturing enterprises of Japan have been referred to in these pages on various occasions, and there is little room for doubt that during the last few years great headway in electrical manufacturing work has been made. There is every reason to anticipate a continuance or acceleration of such progress, but the import figures show that the nation is at present dependent upon other countries for very substantial imports. For example, take "dynamos, electric motors, transformers, converters and armatures"; the imports of these into Japan for the past three years have been:—1912, £326,500; 1913, £373,500; 1914, £245,800. We quote below a few figures relating to other allied classes; the falls for 1914 are not of necessity due to the war; they are, in fact, due to the depression in the two previous years, when there was a falling off in orders placed:—

Imports.	1912.	1913.	1914.
Gas engines	£141,900	£124,200	£87,300
Pumps	61,800	110,400	67,900
Steam boilers and accessories ...	119,800	99,700	87,900
Water turbines and Pelton wheels	90,000	74,400	32,800
Dynamos, combined with motive machinery	96,200	64,400	44,500
Steam engines	36,800	58,100	46,200
Fuel economisers	8,600	14,900	8,600
Steam turbines	16,600	6,500	16,600

The foregoing figures are selected from tables given in the annual report (1914) prepared by H.M. Commercial Attaché, at Tokio, Mr. E. F. Crowe. In our estimation that report contains a great deal of material that is likely to be of value to British firms who want to hold and increase their business in Japan.

Our Excellent Position. It is always useful to know where we stand in comparison with other exporting nations, and this can be seen at a glance in the following figures:—

Machinery Imports into Japan.

From	1912.	1913.	1914.
United Kingdom	£1,456,300	£1,737,800	£1,354,500
United States	705,600	754,300	505,700
Germany	658,900	873,600	556,100
France	18,500	24,700	25,000
Other countries	148,300	362,300	104,900
Total	£2,987,600	£3,752,700	£2,546,200

As Mr. Crowe points out, these figures show that the United Kingdom remains well at the head of the list, and has, in fact, slightly improved her position, now enjoying more than 50 per cent. of the business. Though the war was not responsible for the falling off in orders placed for machinery to arrive in Japan in 1914, it certainly interfered to a considerable extent with the deliveries of German machinery. We are constrained to quote Mr. Crowe at length at this point. Comparing the figures up to the end of July, 1914, with those for the whole year, he says:—

Japanese Support for Home Industries.

"Up to the time when war broke out Germany had 25½ per cent. of this business; by December the percentage had dropped to 21¾. There is still a little more to come forward from Tsingtao and from places where German ships have run for shelter, but when this has all arrived imports from Germany will cease completely and British makers will at last have a fair chance of competing, and it is to be hoped that they will take full advantage of it. Since war broke out very few orders have been placed. At first there was an idea that it would be impossible to get delivery; then when it was seen that this would not be the case, buyers still held off owing to the general uncertainty as to what the future held in store; but confidence is gradually returning, and it is thought that within the next few months it will be possible to obtain a certain amount of orders. There are some points, however, which should be borne in mind. The most important is that Government departments in pursuance of the policy of 'Support home industries,' place their orders in Japan whenever they can possibly do so. Another important factor is that Japanese engineering works are increasing in number and in capacity. Were it not for the heavy duties it would, of course, be impossible for them to compete in a great many lines, but the duty and the freight give them a big advantage which enable them to come fairly near British prices. For this reason it becomes advisable for makers of certain types of heavy British machinery seriously to consider whether it would not pay them to ship only the small, delicate parts and have the heavy castings made locally, thus saving the duty and freight on the latter."

"Good castings are obtainable, pattern making is not very expensive, and there are a few works which could be relied on to do accurate machining, so that in cases where there is a probability of a demand for considerable numbers of the same machine it might be advisable for manufacturers to send out their own patterns or to arrange to have these parts made to drawings. Even in cases where only a few machines would be required, but where the incidence of the duty is extremely high on account of the weight, the question might be considered. Naturally, each case would have to be gone into carefully and judged on its merits, and it would be necessary to allow a reasonable margin of profit for the works out here. In estimating the cost of these castings, it should not be forgotten that imported coke, on account of the high rates of freight, costs roughly about 150 per cent. more than in the United Kingdom, and pig iron is about 50 to 60 per cent. dearer. It is true that Japanese coke can be obtained, but it is not suitable, and as double the amount is required there is little economy in using it.

Stock Required.

"To many manufacturers, however, it might seem that there would be a danger that machinery constructed in this manner might not be exactly up to the high standard they maintain, and for their benefit I put forward another suggestion which has much to recommend it. This is that makers of small machinery of a class which is sold in quantities in standard sizes, such as gas engines, electric motors, pneumatic drills, pumps, etc., should consign their goods to firms of high standing. By this means, stocks can be kept and a purchaser who finds that he can buy from stock will be more likely to go to the importer than if he has to wait for eight or nine months for delivery—in the latter case he will be tempted to try a Japanese-made copy of a foreign machine which he can get more quickly and more cheaply. The importing firms themselves are rarely willing to tie up their capital stocks, as the profit they can obtain is often eaten up by local high interest charges, while the manufacturer, who has naturally added a considerable amount to his price for standing charges and profit, would only be paying interest on the actual first net cost, and he would also, probably, be able to borrow money at a cheaper rate in the United Kingdom. The merchant would keep the bulk of the goods in bond, so that if it should prove necessary to ship them to some other market, this could be done without loss of the duty. Even if manufacturers do not care to adopt the scheme outlined above they might consider the advisability of some similar arrangement."

Mr. Crowe emphasises that the reason for bringing these suggestions forward is that the manufacture of machinery in Japan is making considerable progress, and unless some thought is given to the problem we may lose a part of the business which we now enjoy. "It should also be stated that both the ideas mentioned above have been tried during the past two or three years, with, as far as one can learn from the parties concerned, a considerable amount of success."

Many Small Workshops.

"One of the interesting features of engineering work in Japan is the very large number of very small establishments in existence—places which appear in engineering directories as "So and So's Engineering or Ironworks," but which really consist of a workshop with one lathe and two or three hands. They have no establishment charges, they work for a very small profit, and consequently they are able, in tendering for Government work, to put in exceedingly low prices. They do not quote direct, they are too small to do that, but a sort of broker takes the contract from the Arsenal or other department and then sub-lets it to these different works. As they are on such a small scale there is a good deal of irregularity in the output and the percentage of rejections is large, but none the less competition from such works is very severe. Naturally, the above remarks do not apply to the big works which are run on more or less foreign lines, although even in these there are points of difference which immediately strike the foreign engineer. For instance, the foreman is invariably on the side of the men and against the office. Then, again, there are no apprentices, no men of a better class gaining practical experience, by putting in a certain number of years in the works. The engineers are nearly all graduates of technical colleges with little practical experience. The workmen on the whole are industrious and eager to learn, but their rice diet appears to be against them, for in engineering jobs they lack the necessary bodily weight, and the percentage of days when they are absent on account of sickness is very high. Nevertheless, as their wages are low, and as they are gradually learning and picking up experience all the time, it is well worth while for any maker of machinery who supplies either this or the China market to watch developments and to change his policy as and when required."

In the section of his report dealing with the rubber industry, Mr. Crowe says that the manufacturers of insulated wire continue to make progress in the technical development of their manufactures, and are now undertaking business for export. The mechanical branch of the industry, which is more open to competition, does not progress so favourably; a number of small mills spring up annually, and each year sees as many disappear. Mr. Crowe gives a detailed account of methods of financing business with Japan, to which we refer below.

Terms and Conditions of Business.

One of the results of the systematised attempts to capture German trade has been the large number of inquiries received by the Commercial Attaché's Department relating to the openings for trade in Japan. To many of the inquirers the market is absolutely new, and, on that account, Mr. Crowe presents in more or less tabulated form as much information as he has found it possible to collect on the subject. Such a task has, he says, never been attempted before, and as it has been necessary to obtain particulars from many sources there may be errors and omissions, but he invites corrections for incorporation in future reports. He touches first upon the methods of financing business with Japan.

Financing Import Trade.

These are probably very similar to those in vogue in other countries, but for the sake of clearness they are set forth in detail, and we quote them below:—

"It is doubtless well known that there are certain old-established Eastern banks which make a speciality of this kind of business, and also that practically all the financing of Japan's trade is arranged through London.

"In connection with the import trade, the different methods whereby goods shipped to Japan are financed and paid for are as follows:—

"1. The shipper draws a bill of exchange on the importer against complete shipping documents for the relative goods, which he negotiates with a bank. The bank forwards the draft and documents to its branch office at the port of destination, who obtain payment of the amount of the draft on the due date of same, from the drawee, against delivery of the documents in question, thus meeting the advance made by the bank's office which negotiated the draft. The bills are usually drawn in the currency of the country where they are negotiated (the most common usance being either three or four months' sight), and bear interest at a rate fixed from time to time by the Associated Exchange Banks (at present 7 per cent.) from the date of the draft to the date on which the same is paid. Business done on the above lines is generally arranged by the importer in the first place by requesting the branch of the bank at the port of destination to open a documentary letter of credit, authorising its office at the port of shipment to negotiate the drafts of the shipper drawn in accordance with the terms of the letter of credit, he, in turn, undertaking to accept and pay the same in due course. The face value, plus interest, is collected at due date at current rate of exchange.

"2. Either the importer or the shipper may arrange with a bank to open a confirmed banker's letter of credit, whereby the shipper is to draw a bill of exchange on London correspondents of the bank, who accept the said draft, which is subsequently discounted in the open market. The relative documents are sent to the branch office or correspondents of the bank who bought the bill at the port of destination, and are delivered to the importer against payment of the amount of the draft, this sum being remitted to the bank's London office in time to meet it when due. The usual charge made for accepting such drafts is $\frac{1}{8}$ per cent. per month according to the usance of the same; generally bills are drawn at 90 days' sight (the commission therefore is $\frac{3}{8}$ per cent.).

"3. The shipper hands to a bank a draft and documents for goods shipped. The bank forwards the same to its branch office at port of destination, to be delivered to the consignee against payment of the draft, which amount is remitted either by T.T. or demand draft to be paid to the shipper, less the bank's commission for collecting the amount in question, the bank having made no advance against the goods.

"4. There is another way which is, however, only made use of by the largest firms who have head or branch offices in London. The manufacturer or agent, who is shipping the goods, draws a bill at four or six months' sight on the London office of the firm doing business in Japan, and after getting it accepted, discounts it in the open market. The goods are forwarded to Japan and the Japan branch makes a remittance to London in time to meet the bill at due date. Sometimes when firms have already got enough of their paper on the market they arrange with one of the well-known accepting houses to accept bills drawn on them.

"5. Firms doing both import and export business sometimes work independently of the banks, by sending their export documents—say to their London houses to set against shipments being made from London to Japan. Obviously this method also can only be adopted by large firms.

"With regard to the export trade, the methods of financing shipments to other countries may be put under four headings:—

"1. For the shipper to obtain bank credits under which he draws a draft direct on the issuing bank, with full shipping documents attached, these drafts being accepted by the issuing bank on behalf of the consignees and the documents delivered on acceptance. Such credits generally call for drafts to be drawn at either three, four, or six months' sight (*i.e.*, payable three, four, or six months after acceptance.)

"2. Documentary letters of authorisation issued by the consignees, enabling the shippers to draw direct on them, documents being delivered on payment of drafts only. Drafts under these letters of authorisation are usually drawn at from 30 days' to four months' sight.

"3. For the shipper to draw documentary drafts on the consignees, documents being delivered on acceptance or payment, as the means and standing of drawees warrant. The usance of these drafts being generally the same as in the case of letters of authorisation.

"4. For the shippers to draw clean drafts on their customers and handle the documents themselves, such drafts being drawn at varying usances from sight to six months.

"In connection with the first method, it might be mentioned that many of the bank credits on London cover shipments to America, one set of documents going direct to the issuing bank in America, and the remaining documents being attached to the draft drawn on the accepting bank in London.

"It is usual for drafts to be drawn in the currency of the country to which the goods are shipped, with the exception of shipments to America under bank credits on London, which in the majority of instances call for drafts to be drawn on a London bank in sterling.

"The rate of exchange for converting the currency of a draft from yen varies in all cases with the usance of the draft, and the face value is collected at due date.

"With regard to the customary terms and conditions in the various lines of business, it is difficult to be precise, as the terms naturally vary considerably according to the standing of the parties concerned, but as a general rule it may be stated that the German firms made a practice of giving longer credits than British firms, and the chief distinction between import and export business is that in the case of the former credit from 30 to 90 days or more has to be allowed, while in the case of the latter cash has nearly always to be paid, and in some instances even an advance has to be made to dealers.

"No discount is allowed for cash in paying for exports.

"It will be noticed that payment in the import trade is generally made with promissory notes, due in 30, 60 or 90 days. The promissory notes can be discounted with Japanese banks, but they are the source of much trouble and litigation, and a demand is frequently made for their renewal.

Promissory notes can very rarely be discounted without recourse. In these cases a higher rate has to be paid and the firm has to be of the best standing.

"The great bulk of the import trade is done against orders. It is only in the case of low qualities of Indian cotton that goods are sent on a large scale to be sold on consignment in this market."

"*Machinery.*—The conditions with regard to machinery vary perhaps more than in the case of any other imports. The first distinction is between Government, municipal and private orders. The Imperial Government railways have their own inspectors abroad, and on the presentation of their certificate of inspection, payment is made on delivery of the goods after a further inspection in Japan on arrival, chiefly with regard to measurement. With Admiralty and War Office orders to the value of under about £25,000, inspection is made within 15 days of delivery at destination, and payment within 15 days from inspection. With large orders such as for warships, payment is spread over the course of construction into about five to ten amounts. The Admiralty generally place their important orders through inspectors in London, but the negotiations are carried on through agents in Japan. In such cases payment is made f.o.b. British ports, and freight is arranged by the naval inspectors with the Japanese steamship companies. In the case of the larger municipalities prompt payment is made after delivery and local inspection, or when erection of the machinery is also undertaken, after completion of the tests.

"With private companies of the best standing each contract is generally negotiated for separately, but, roughly, the rule is that about 70 per cent. of the money is paid on delivery, 20 per cent. is paid after the lapse of another three months, and 10 per cent. remains unpaid for a year or more as part of the guarantee for fulfilment of obligations. It is, however, customary that about 10 per cent. should be deposited as bargain money at time of placing the order.

"In Government business the reverse is the case, and the importer has to put up a deposit of 10 per cent., which he is liable to forfeit if he cannot implement his contract.

"With small companies payment is very much delayed, often over years. A recent case which came to my notice is a good example of what sometimes happens. A British firm secured an order for machinery and turbines on the following terms:—60 per cent. payable on arrival, and 40 per cent. on completion of erection and tests. The company's plans were altered and the final erection will not be completed for more than two years after arrival, during which time, under the contract, 40 per cent. of the money due is withheld. British firms rarely take payment in shares, but German firms frequently arranged to do so, and they thus acquired a sufficiently big interest in the company to insure their getting paid a high enough price to compensate them for the risk they ran.

"In the case of big contracts, prices for machinery are generally quoted delivered to purchaser's site, but for Imperial Government Railway orders the customs duty is not included in the price. Delivery is generally to one of the railway compounds.

"Sales of machine tools are often made out of stock for cash. This also applies to many lines of a nature where stocks have to be carried, such, for instance, as files, saws, locks, etc. With gas engines and some other goods, although stocks have to be carried, credit has to be given."

(To be continued.)

SOME DIFFICULTIES OF DESIGN OF HIGH-SPEED GENERATORS.

By PROF. A. B. FIELD, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *November*, 1915.)

(*Continued from page* 734)

Coil-retaining Rings.—As regards the part of the rotor windings external to the core, we have a very serious problem to meet in supporting this free copper. Of the methods so far used or proposed, the most satisfactory, for machines of the size considered here, is the use of a weldless chrome-nickel steel ring proportioned to carry its own load and that of the copper underneath it without any radial support from the rotor. The severe conditions to be met here may be inferred when it is recollected that this steel ring would have, due to its own weight only, and without any of the copper load which it has to support, a stress of 17,000 lb. per square inch when running at normal speed. The best properties obtainable are required for this ring, although we cannot, of course, expect to get as good characteristics in the steel of a ring of this size as we could in a small bolt. However, we can depend on getting properties as least as good as the following:—

Ultimate strength	120,000 lb. per sq. in.
Yield point	100,000 lb. per sq. in.
Elongation	18 per cent. in 2 in.
Reduction of area	50 per cent.

The fractures are always silky, and in most cases beautifully symmetrical cup fractures.

The importance of inspecting and testing in the case of these rings is very great, and at least four test-bars should be taken from each ring. As it is also important to obtain the most favourable forging conditions possible, the width of the ring should preferably be such that it can be accommodated in a tire-mill, the uncertainties introduced by forging on a mandrel being thus avoided.

The rings must be positively driven by means of a key, and this is best located in the rotor body rather than in the outside end disk. In considering these details we have to provide for possible short-circuit conditions involving a considerable retardation shock to the rotor. For these reasons we make provision for driving forces of the various parts which would otherwise appear to be unnecessary.

Steel is used for the retaining rings, in spite of the electrical and magnetic difficulties which it introduces because in such matters the mechanical considerations must take precedence over everything else. It will, however, be noticed that the rings tend to form a magnetic short-circuit from pole to pole, and in fact they do account for a large leakage. The design of the tip of the ring, and its connection with the rotor body, are arranged to reduce this evil as far as possible, and a comparatively slight variation in this respect can make a large difference in the leakage in the case of a 4-pole rotor. The 2-pole machines of large size saturate their ring cross-section almost necessarily, and in this case the end disk which centres the ring at its outer end, is made of manganese bronze to obviate further leakage. In the 4-pole machine this disk is made of steel, without appreciably affecting the leakage.

Some of the more obvious ways of diminishing leakage, and at the same time obtaining ventilation of the copper supported by the rings, are of a nature which seriously affects the strength of the ring, and are therefore undesirable. Any slotting of the tip of the ring which breaks the continuous circle results in so much extra dead load being put upon the ring material immediately behind the slotting; further, in the case of this alloy steel it is of the greatest importance to have fillets everywhere, and entirely to avoid any sharp corners or notches. The key-way which necessarily cuts through the tip of the ring is made as shallow as possible and is provided with good fillets. It has been the practice of some companies to use for these rings either 25 per cent. nickel steel, or a manganese bronze. While both these materials have the great advantage of being non-magnetic, they also have some mechanical disadvantages, but they are feasible for small machines. For the machines under discussion there can be no question as to the advisability of using the best material from the mechanical point of view, and neutralising the effects which are injurious from the electrical standpoint.

So long as the load on the generator is a nearly balanced 3-phase (or 2-phase) load, the objection to a magnetic end-ring is chiefly on account of the extra flux with which it burdens the rotor. It is true that the projecting stator coils to some extent overhang the steel ring, and that the leakage flux from these penetrates the ring and is increased by the presence of magnetic material there, but this flux sufficiently approximates to a rotating field of constant magnitude for comparatively small losses to appear in the rings on its account. Occasionally, however, the system of distribution from the power house is such that a balanced condition of phases cannot be obtained; in this case the leakage flux from the stator coils is no longer a simple rotating field, and very large losses would occur in the magnetic steel end-ring in consequence.

While this matter had been recognised by us for many years, it first became necessary to tackle it seriously when the problem arose of building several 4-pole, 60-period generators of nearly 20,000-K.V.A. rating which would be required to operate upon a considerably unbalanced 3-phase load. Such preliminary investigations as could be made upon a similar existing distribution system indicated that we ought to provide for unbalanced conditions equivalent to a 3-phase load of half the rated kilovolt-amperes, upon which was superposed a single-phase load of the same number of amperes. A little investigation shows that a comparatively thin sheet of drawn copper outside the ring would carry sufficient current to protect the magnetic material below it from this stray flux. The sheet, however, would require an increased cross-section at the outer end of the ring and again at the end near the rotor body, unless the sheet could be effectively connected electrically to the slot wedges of the rotor. The difficulty of safely providing such a protective shield would be quite considerable, not to mention the liability of having trouble from it in operation. For the machines above referred to, for unbalanced-load conditions, the difficulty was overcome by dividing this sheet into a number of hard-drawn copper strips about 3/16 in. thick, which were driven and caulked into axial dovetailed grooves upon the surface of the ring, thus covering about 80 per cent. of the entire perimeter with copper and maintaining a thoroughly substantial construction. In order to provide the copper for the circumferential path of the protecting current, dovetail grooves were turned in the chrome-nickel steel ring near its outer end; into such a groove was fitted a pair of heavy copper strips of rectangular section side by side, and by means of hydraulic pressure these strips were pressed in and made to expand and fill the dovetail section of the groove. For mechanical reasons this copper was distributed in two grooves instead of one. As it was not feasible to depend entirely upon the electrical connection of the ring with the rotor body, it was necessary to provide similarly a circumferential path at the other end of the ring, and for this purpose a short section of ring was made of manganese-bronze and securely united to the chrome-nickel steel ring. In making the axial dovetail grooves to carry the copper strips, all these conducting rings were cut through at the same time as the steel, and good electrical connections obtained between the strips and the conducting rings by caulking. While the short length of manganese-bronze rings could if necessary be carried as a load by the steel ring, it was desirable to make this, so far as possible, self-supporting and to obtain the very best properties in this material. A number of experiments were required before we were able, by applying a certain amount of cold forging to the cast-bronze ring, to obtain results which might almost be considered remarkable in a cast ring of such dimensions. The following figures indicate the results of tests on bars taken out of these bronze rings:—

Ultimate strength	75 to 86,000 lb. per sq. in.
Yield point	60 to 73,000 lb. per sq. in.
Elongation	12 to 15 per cent. in 2 in.
Reduction of area	20 to 30 per cent.

It will be noticed that in addition to this bronze ring being necessary owing to electrical considerations, we gain the magnetic advantages of having a separator between the steel ring and the rotor body. In fig. 6 can be clearly traced the axial bars and circumferential copper rings referred to here. Some of the other features of construction already described are also evident; in particular the ventilating grooves located at the plate interfaces.

It is hardly necessary to point out that the unbalanced load affects the flux conditions in the main body of the rotor also, and must be provided for by heavy longitudinal dampers. In the slotted region of the circumference, the slotwedge is used for this purpose, being made in continuous lengths and of hard-drawn copper; elsewhere special dampers are inserted. These dampers complete their electrical circuit by means of all the circumferential copper and bronze of the end-rings; and the design of the bronze section of the ring is such as to ensure the electrical connection being improved rather than the reverse by the stresses arising upon rotation. The adequacy of this rotor protection is best illustrated by test figures. Single-phase and 3-phase short-circuit runs were made upon these machines, the power absorbed being measured, less that due to friction and windage. This was found to be only 10 per cent. greater when the machine was delivering rated current on a single-phase short-circuit than for the same current on a 3-phase short-circuit, thus indicating only a very small additional loss due to the unbalanced single-phase effect. In similar machines without this balancing device the extra power absorbed on a single-phase short-circuit is very high indeed. Perhaps it may be well to mention here that in the case of turbo-generators the total loss on a short-circuit test is very great in comparison with the product of the square of the currents flowing and the resistances of the stator windings. Hence the fact that in the single-phase run only two-thirds of the winding is involved does not vitiate the excellent nature of the single-phase short-circuit results given above.

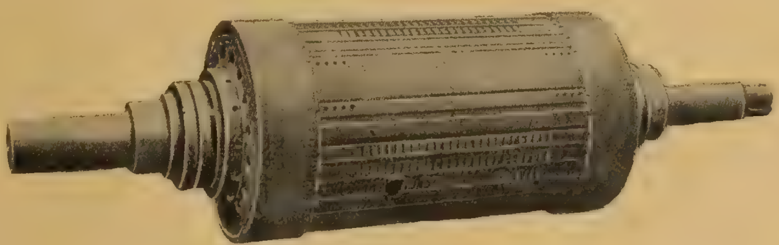

Fig. 6.

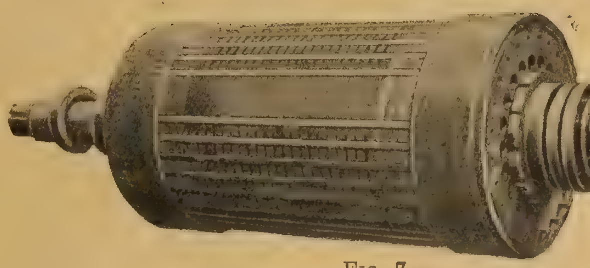

Fig. 7.

Several large 2-pole, 25-period, single-phase turbo-alternators have been constructed upon somewhat similar lines. Fig. 7 shows such a rotor for a machine of a little over 11,000 K.V.A.

single-phase rating; the stators of these machines were insulated for a one-minute puncture test of 30,000 volts. The Westinghouse Co. advised that they are now building 2-pole single-phase machines of a rating 25 per cent. greater than the above.

Rotor Coil Bracing.—The necessity of a positive key-drive for the rotor end-rings has been indicated. In a similar way the problem of the circumferential bracing of that part of the rotor winding which is external to the core must be faced. In the case of 4-pole machines having only three heavy coils per pole of less than 90 deg. pitch, no very special means are needed. In the case, however, of 2-pole machines where the coil-span is twice as great, and where we have of necessity more coils per pole, involving a greater length of straight extension from the slot, it is important effectively to brace the windings. A number of considerations enter into this matter, such as a possible very slight change of position of the end-windings between the stationary and full-speed conditions; also the necessity of thoroughly anchoring any blocking device used, and the desirability of avoiding extra centrifugal load upon the end-rings by reason of these accessory parts. In view of the nature of the effects to be guarded against, mere blocking from coil to coil will be ineffective, and we require some driving device rigidly attached to the metal of the rotor itself. Fig. 8 illustrates the system of blocking adopted for a 21,000-K.V.A., 2-pole machine in which a light built-up steel driving-horn is located on the interpole centre line of the rotor, being firmly attached to the shaft by heavy chrome-nickel steel bolts. The shaft diameter at this place is but little smaller than the inside diameter of the coils, so that a very effective stay is obtained. With this provision made for the coils of largest span, it merely becomes necessary to block the succeeding coils from these and from one another. This is effected without departing from the principles enunciated above, by the use of a metal block carried by a radial chrome-nickel steel stud having some degree of flexibility and acting merely as a tie and anchor. Substantial insulating shoes separate the coil from the block.

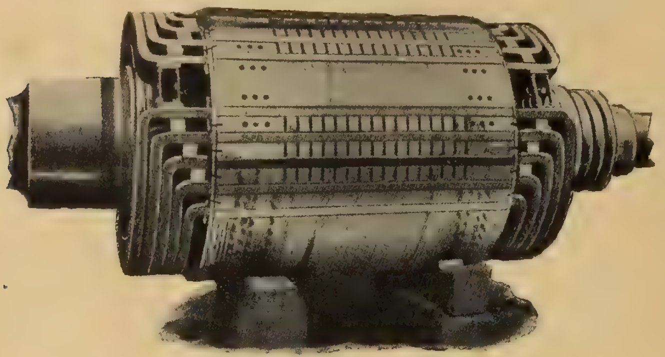

Fig. 8.

(*To be continued.*)

Discussion at Birmingham.

The paper was read and discussed at a meeting of the Birmingham Local Section on November 24th.

Mr. F. W. Carter (Rugby) wrote that Prof. Field's paper was one for experts, and those whose work lay in other directions could hardly discuss the main topic. He asked whether Prof. Field had met with trouble from end thrust in the type of generator considered. With the usual flexible coupling between turbine and generator there was a tendency for the rotor to be pushed with considerable force towards one end; the tendency could be balanced against a magnetic centring force, but this sometimes led to local heating from the undue crowding of flux in some of the end punchings of the stator. He believed the proper remedy to lie in attention to the correct design of the coupling, which was undoubtedly the source of the end thrust. Prof. Field had referred to a formula of Mr. Carter's giving the pole-face losses, and appeared in doubt as to what it represented. It was the result of a direct calculation starting with Maxwell's equations and carried through on orthodox lines. It represented very closely the actual loss under the assumed conditions, and he would himself trust it in preference to any empirical formula, for experiments designed to separate out such a loss as this were by no means easy, and were not likely to yield very consistent or reliable results.

Mr. T. H. Hurst (Loughborough) spoke as to the desirability of a new specification being issued by engineers regarding the temperature rise permissible in large generators. He pointed out that the present restrictions unnecessarily limited the development of these machines.

Mr. F. H. Clough (Rugby) stated that the crux of the whole question of the design of large generators was, in the author's view, associated with critical speed. In his opinion, the author had laid too much stress upon critical speed, and if he had regarded this factor less he could have produced a simpler design and smaller cost. Machines were built to run satisfactorily through and above their critical speed. He could not approve of the author's three-part wedge, as the coils could be pressed and held in position without wedges. He also thought that a fan on the rotor was preferable to a separate fan.

Mr. R. J. Kaula (Rugby) said there was a great deal to be said in favour of a separate fan system for the cooling of rotors as against the arrangement of the fan on the rotor; he also stated that solid couplings had been provided with satisfactory results on large machines for connecting the generator to the turbine.

Mr. B. A. B. Boyce (Loughborough) commented upon the title of the paper, and remarked that it related to high-speed generators. Seeing that there was no mention in the paper of D.C. generators, he wanted to know if these were now completely out of date.

Mr. E. Kilburn Scott (Birmingham) asked for information as to the limit of size possible in machines of the type described by the author. In his view, the limit would possibly determine the question as to whether or not the British chemical industry could compete with Continental concerns deriving their power from hydroelectric systems. The latter were able to provide cheaper current than the present common steam-driven plants. If the generating units of the latter could be so increased as to bring down the cost of energy to a figure comparable to that of a water-driven plant, then it would be possible for important industries to be established in this country.

Mr. H. W. Taylor (Rugby) also mentioned that there was no need to limit the speed of high-speed generators below the critical speed, as satisfactory running above that speed was obtained in practice.

Mr. A. M. Taylor (Birmingham), commenting upon the author's statement that these large machines should be so built as to stand a dead short-circuit at their terminals, said that it rather supported the contention which he had previously put forward, viz., that a certain amount of external reactance was desirable between the machine and the bus-bars in those cases where the bus-bars were connected with a large number of other alternators. The argument for the external reactance was, briefly, that there was a possibility of a short-circuit occurring in the end windings of the stator in such a position as to cut out a large proportion of the reactance of the stator; consequently, if connected directly with bus-bars to which many other machines were connected, the flow of current from these bus-bars into the short-circuit would be many times that which would flow into a short-circuit at the machine terminals if fed merely by the machine itself. Hence a short-circuit test of the machine made after erection, which could only be tried under the latter conditions, would be no criterion as to what would happen under the former conditions; in this case such forces might be set up in a part of the winding of the alternator as to wreck the end connections. Probably the best combination of internal and external reactance was that which permitted the machine to be short-circuited on itself when on test, without its reactance; the (external) reactance being so designed as to pass only the same current from the bus-bars, in the event of a short-circuit occurring in the machine and near the terminals of the machine, as the machine had been previously tested with when tested without the reactance. It was undoubtedly easier to insulate the turns of the reactance, where they were not cramped for room, than the end coils of the stator, where they were both cramped for room and were forced to be bent and twisted about in addition.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Contractor's Complaint.

A letter appearing in your issue of November 12th last, under the above heading, and signed "J.S.L.," causes me to write calling your correspondent's attention to the fact that there are a number of associations of electrical contractors in the country at the present time endeavouring to carry out the objects he suggests, viz.: To protect the rights and interests of electrical contractors.

The Association of which I am secretary has a very strong and influential electrical contractors' section, which is working most strenuously in this matter, and I have reason to believe that similar branches of the Building Trades' Federation throughout the country are organised and acting in a like manner, and steps are about to be taken to link up these various organisations through our national bodies for one united effort in the hope of attaining the object in view.

I can only, therefore, advise your correspondent, and all other electrical contractors in the country, either to become affiliated to the Building Trades' Association of his district and form strong electrical contractors' branches, or to become affiliated to the nearest branch of the Electrical Contractors' Association, and so organise themselves in a united body, and thus be able to place their rightful demands before the proper quarters.

In my opinion, it is no use complaining against manufacturers supplying their wares to anybody, irrespective of whether they be tradesmen or otherwise, unless some joint mutual arrangement can be made with them, and their interests protected, and, of course, as this cannot be done by each firm individually, it must be accomplished through a united organisation, and the stronger that organisation the better hope we have of attaining success.

James Denver, *Secretary*,
Manchester, Salford, & District Building Trades' Employers' Association.

Manchester, *December 2nd*, 1915.

The A.E.G. Meeting.

I should like to draw the attention of your readers who are interested in the correspondence appearing under the above heading to a most illuminating article in this month's *National Review*, entitled "The Germans in England, 1915," from the pen of Mr. Ian Colvin.

Mr. Colvin investigates at considerable length the ramifications of the Allgemeine Elektricitäts Gesellschaft, both in this country and elsewhere.

E. P. Allam.

Romford, *December 3rd*, 1915.

The Institution and Alien Enemy Members.

Having learnt from the correspondence that has arisen out of my first communication that there exists a strong feeling in respect of this question, I desire to trespass again on your valuable space to summarise the position as it appears to me.

Although we have been at war for practically 18 months, the Council of the Institution have in no way considered the personal feelings of those members who do not desire to meet or come in contact with members of alien origin; consequently, no steps have been taken to call upon such members to resign, and as it is now stated that they have no legal authority, nor have they taken any steps to obtain it, it can be correctly assumed that they are in sympathy with such members and view them as being more desirable than those who claim the discontinuance of membership and privileges to those of alien enemy origin.

One seeks to find the reason, either from the members' or the Council's point of view, why they should continue their membership, and can only judge it to be one of the following:—

Scientific, Social, or Commercial.

Scientific.—If this, and it is assumed that the furtherance of electrical science would be hindered, give the exclusion a trial, and if the Institution finds it cannot proceed with scientific research, ask these members to put themselves forward for re-election.

Social.—The writer has intimate personal knowledge of alien enemy acquaintances (not business, therefore not now referred to), and he has lost nothing by refusing to have any further intercourse with people of a race that has to its credit such noble deeds as the outrage on Belgium, the sinking of the *Lusitania*, the shelling of drowning women and children of the *Ancona*, Zeppelin outrages, and the brutal treatment of war prisoners, and he fails to see where the loss from the social side would arise.

Commercial.—The Institution prides itself that it is not interested in the commercial side, but, having regard to its treatment of this question, one wonders whether the objects of the Institution have been modified.

That there is no stone being left unturned to prevent the exclusion of members of alien enemy origin taking effect is evident by the campaign now being carried on amongst central station engineers and others to kill further agitation, and, having regard to the fact that members in commercial undertakings dare not express their views, I think the only solution lies in the following:—

1. That all the Associations who have petitioned the Institution shall continue to agitate, irrespective of what attempts may be made to stop such agitation.
2. That all subscribers will avail themselves (as suggested by another correspondent) of clause 37 of the Articles of Association, namely, "that no subscription will be paid until December, 1917."

If this is done, I am certain that the Council of the Institution, whilst not having seen it necessary to call a general meeting under clause 80 of the Articles of Association, "to consider what steps should be taken to exclude members of alien enemy origin from the Institution," may find it in the near future to be in their interest to call a general meeting so as to amend clause 37, as the effect of the economic conditions would become probably quite apparent to the Institution, and it might then not be prepared to sacrifice financial stability, though by not caring to offend a few influential subscribers they failed to call such a meeting for the purpose of excluding members of alien enemy origin.

In conclusion, it seems to me that this step is one which can be safely taken by all subscribers to the Institution without any fear of its being construed as taking any active propaganda in respect to this matter, and, consequently, prejudicing their professional appointments.

Station Engineer.

December 6th, 1915.

Swiss or German?

With reference to the letter of "A.M.H." in our last issue, and our reply thereto, we may now quote the following paragraph from an article on "The Germans in England—1915," by Ian D. Colvin in the current *National Review*:—

"In Switzerland the A.E.G. aims at obtaining complete control, no doubt regarding Switzerland as the power-house of Europe. The Electro Bank of Zurich is practically a branch of the A.E.G., and is devoted to the financing of enterprises which are tied to the A.E.G. for life and are bound to use only A.E.G. machinery."

Under such circumstances, we confess to being deeply touched by "A.M.H.'s" solicitude for the interests of British manufacturers and their future part in international electrical undertakings The "voice of Jacob"?—Eds. Elec. Rev.

WAR ITEMS.

Recruiting Notes.—Before the introduction of the Derby Scheme the St. James' and Pall Mall Electric Light Co., Ltd., had 56 men with the Forces out of a total of 198 men employed in all departments. The remainder of the eligible ones, 44 in number, have now been attested. The Central Electric Supply Co. before Lord Derby got to work with the present scheme had 39 men with the Forces out of a total of 239. The remainder of those who are eligible (52 in number) have now been enrolled.

Some hundreds of employés from the Westinghouse Works at Trafford Park attended in a body for attestation under the group scheme in Manchester last week-end.

Out of a regular staff of about 56, the South Shields Corporation Electricity Supply Department has 11 now with the Forces, one has returned unfit for service, and one was drowned when H.M.S. "Hawke" was sunk early in the war. The present staff numbers only 44, which is considered to be an irreducible minimum if the work of the department is to be carried on. Of the present staff there are 18 males of recruitable age, seven of whom have been certified unfit for military service. Including Mr. H. S. Ellis, the borough electrical engineer, the remainder have enlisted under Lord Derby's scheme, Class B, although the majority of them are already starred men. All men of recruitable age still wear the Admiralty badge which was obtained for them several months ago, and all men above recruitable age now wear the Ministry of Munitions badge. It will be left to the local tribunal to decide as to which of the remaining men will be called up for military service.

Already a large number of men of the Burnley Corporation Electricity Department have enlisted, and on December 3rd 25 out of 26 eligibles, including the electrical engineer, Mr. J. E. Starkie, attested under Lord Derby's scheme. Being badge men they cannot be called on for immediate service. The department is now working at higher pressure than ever before, the consumption a fortnight ago being 30 per cent. more than last year.

The Bristol Corporation Electricity Department has 77 members of its staff and employés with the Forces. These are from the management and clerical staff, power and substations, "outside" men, and storekeepers and motor-men. In addition, 61 have volunteered for the Derby Reserves "B," and six are in the Naval Reserve. Fifty have been rejected, making the total offering from the department 194. The remainder of the staff consists of 70 men who are over age, 16 who are under age, three who are physically unfit, and 13 ladies. There are also two men of military age badged and three not badged, bringing up the total staff to 301, 38 of whom have been appointed since the outbreak of war. Of the men who are serving with the Forces, 25 are married and 52 single; of those in the Derby Reserves "B," 46 are married and 15 single; of the rejected, 30 are married and 20 single. All the over-age men save four are married, and all the ladies are single.

The whole of the officers and employés of the Islington Electricity Department, technical, engineering and clerical, were attested on Monday under Lord Derby's scheme. The department already has 36 employés (both officers and staff) in the fighting forces.

Tramway Supplies in War Time.—The "Journal" of the Tramways and Light Railways Association states that in October the following communication was sent to members of the Association:—"The Sub-Committee appointed by the Council to deal with the question of future supplies recently interviewed the manufacturers' representatives, with a view to ascertaining what steps could be taken to ensure a sufficiency of tires being obtained for our members during the war, when it was unanimously agreed that the supply of tires would be facilitated by—(a) The adoption of a standard section, especially so far as the profile of the tread and the width are concerned, both in regard to driving and pony tires, as this would enable the manufacturers to (1) increase their output, (2) do away with the delay and expense which is necessarily incurred by changing rolls, and (3) maintain stocks. (b) The preparation of a list showing the actual requirements of each undertaking and the name of the supplier." The circular enclosed a blue print of the suggested standard section and a list of questions. After receipt of the replies the Sub-Committee proposed to again approach the manufacturers on November 24th. No member was to be committed to the purchase of tires without his consent.

American Electrical Apparatus for Russia.—The last number of the New York "Electrical World" to hand contains the following:—"With the conclusion of the war in Europe electrical apparatus of American manufacture will be greatly in demand in Russia, according to a statement made by Nicolai Fedotoff, electrical engineer for the Petrograd branch of the Siemens-Schuckert company, to a representative of the "Electrical World." Mr. Fedotoff has just arrived in the United States from Petrograd and expects to make a study of the manufacture of telephone material with the intention of placing here a large order. Electricity is now widely used in Russia, he stated, and when the war is over the necessity for the rehabilitation of the empire's industries and the large demand that will be made on them for the reconstruction of the war-swept areas will create a tremendous demand for generators, motors, line equipment, and all of the other electrical equipment which is needed for industrial installations. A further point brought out by Mr. Fedotoff in this connection was that American and English technical men of sound training would be needed by Russia. The war has taken many of her engineers, and when the period of reconstruction begins their ranks will be found to be seriously depleted. For this reason Russia will offer a brilliant opportunity to engineers who have received their training in England or the United States."

German-Owned Companies.—In the House of Commons on Monday a member asked what steps it was proposed to take to deal with the registered companies under the cloak of which Germans and other enemies were enabled to continue their business and connections in this country, whether the shares were nominally held by British investors or not. According to the "Standard," Mr. Pretyman (Secretary, Board of Trade) replied that practical steps were taken by the Board of Trade to prevent any trading with the enemy by such companies as were referred to in the question. Consideration was being given to the question whether any steps should be taken after the war to prevent the registration of companies, the majority of whose shares were under foreign control.

The Earl of Halsbury has introduced in the House of Lords a Bill to amend the law relating to enemy companies registered as British companies. The Bill was read a first time last week.

From the Front.—A correspondent with the British Expeditionary Force writes:—"Very many thanks for the copies of the Electrical Review. They are reaching me quite all right, and receive a very warm welcome, bringing, as they do, just the news one is anxious to hear, besides the technical articles, which profitably fill up otherwise idle moments. We have been having some real wintry weather just recently—heavy falls of snow, hard frosts, and, of course, plenty of rain, the days when one's thoughts turn to peak loads. Power consumption at the present time must be fairly heavy. It is only in rare instances one meets people one knows out here, then it is a mere coincidence. Once only have I happened across a friend in this way. The cold days sometimes make me wish I could get my back against a nice warm turbo set, although I must say that, as regards clothing, we are well equipped."

Russian Electricity Students and the War.—At a recent meeting of the students of the Petrograd Electro-Technical Institute, a proposition was unanimously adopted that at the present time the students, as a body, should devote their whole strength to the defence of the country, and a sub-committee was appointed to organise the students of the Electro-Technical Institute. Already this committee has found it possible to address the factories working on the preparation of military materials and propose to them to use the students of the Institute, who are completely equipped to take the place of instructors. The Committee of Mobilisation of the Students' Energy is ready to place 300 student-instructors at the disposition of the factories requiring them.

Russia.—The new Board of Control of the 1886 Electric Lighting Co. (Moscow) has stopped credit to its clients. It requires immediate payment of all debts, threatening to stop delivery of current. This request it explains by the extraordinarily high price of fuel, immense difficulties in obtaining machinery, and the very onerous conditions of the money market.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

16,443. "Methods of and apparatus for producing and distributing electric current waves." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). November 22nd.

16,452. "Electric soldering irons." J. G. Clemens. November 22nd. (Convention date, November 21st, 1914, U.S.A.) (Complete.)

16,464. "Dynamo-electric machinery." A. C. Eborall (Akt. Ges. Brown, Boveri et Cie, Switzerland.) November 22nd. (Complete.)

16,466. "Electric contact thermometers." R. P. Costello. November 22nd.

16,469. "Portable electric and other lamps." C. H. Hefford. November 22nd.

16,471. "Method for producing durable galvanic battery cells with zinc anodes and alkaline electrolyte." J. N. Bronsted and H. Enke and V. Ludvigsen. November 22nd. (Complete.)

16,474. "Magnetos." J. L. Didier. November 22nd. (Convention date, September 3rd, 1915, France.) (Complete.)

16,475. "Magneto-ignition systems." Etablissements de Dion-Bouton Soc. Anon. November 22nd. (Addition to 16,408/15. Convention date, October 28th, 1915, France.) (Complete.)

16,476. "Alternating-current motors." A. H. Neuland. November 22nd. (Complete.)

16,479. "Loaded telephone line system." Western Electric Co., Ltd. (Western Electric Co., U.S.A.). November 22nd. (Addition to 12,434/15.) (Complete.)

16,492. "Metal and carbon filament electric incandescent globe and like illuminators." M. Steele. November 23rd.

16,495. "Ignition and electric lighting apparatus for automobiles." Wright and Bull, Ltd. (trading as St. Martin's Motor Works) and A. Moulin. November 23rd.

16,502. "Electric switch appliances." Mavor & Coulson, Ltd., and W. Lawrence. November 23rd.

16,508. "Insulation system for cells and batteries." K. O. Leon. November 23rd.

16,516. "Electric batteries." F. J. Beaumont. November 23rd.

16,534. "Centrifugal pumping apparatus." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). November 23rd.

16,540. "Electric batteries." E. C. R. Marks (Interstate Electric Novelty Co., U.S.A.). November 23rd. (Complete.)

16,550. "Telegraph or telephone line insulator." J. B. Alexander. November 23rd.

16,565. "Clamps or supports for coils or windings when used on electric circuits." P. W. Scholefield. November 24th.

16,569. "Electric lampholders." E. Dewhurst. November 24th.

16,591. "Systems of radio communication." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). November 24th.

16,602. "Electric furnaces." F. Cochlovius. November 24th. (Convention date, November 24th, 1914, Switzerland.) (Complete.)

16,614. "Magneto-electric generators." Etablissements de Dion-Bouton Soc. Anon. November 24th. (Convention date, June 17th, 1915, France.) (Complete.)

16,640. "Dynamo-electric machinery." Electromotors, Ltd., & E. Greenhalgh. November 25th. (Complete.)

16,643. "Electrolytic cells." H. C. Jenkins & C. I. Syndicate, Ltd. November 25th.

16,647. "Electrical connection." H. G. Cockrell. November 25th.

16,671. "Electro-dynamic brakes for use in connection with printing machines." H. V. James. November 25th. (Addition to 596/15.) (Complete.)

16,692. "Winding drums for electric wires, cables, and the like." H. F. Smithson and Callender's Cable & Construction Co., Ltd. November 26th.

16,694. "Electric arc lamps." A. H. Railing & A. E. Angold. November ber 26th.

16,695. "Electric arc lamps." A. H. Railing & A. E. Angold. November 26th.

16,721. "Vehicles." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). November 26th.

16,730. "Apparatus for the electrolytic production of zinc, copper, or other metals." M. Perreur-Lloyd. November 26th. (Addition to 4,681/15.) (Complete.)

16,731. "Portable battery lamps." C. A. Vandervell. November 26th.

16,753. "Galvanic batteries." T. H. M. Harvey. November 27th.

16,754. "Apparatus for manufacturing the elements of electric batteries and performing like operations." T. H. M. Harvey. November 27th.

16,765. "System of, and apparatus for, electrically lighting railway and other vehicles." G. D. Peters & Co., Ltd., F. C. Hibberd, and W. King. November 27th.

PUBLISHED SPECIFICATIONS.

1914.

3,583. Contact Breaker for Electro-magnetic Vibrating Members. A. H. Maitre and V. H. G. Martin. February 11th. (February 20th, 1913.)

21,536. Water-tight Electric Bells and the like. J. Bein. October 26th. (March 23rd, 1915.)

22,057. Manufacture of Tungsten Filaments for Electric Incandescent Lamps. F. R. Grote and J. W. H. Reynolds. November 5th.

22,131. Direct-current Dynamo-electric Machines. British Thomson-Houston Co. (General Electric Co., U.S.A.). November 6th.

22,265. Telegraphy. Muirhead & Co. and G. O. Squier. November 9th.

22,383. Dynamo-electric Machines. J. A. Kuyser. November 11th.

22,549. Intercommunication Telephone Systems. C. B. Kersting. November 14th.

22,868. Electrical Relays. H. G. Barwell, W. Judd, and Eastern Telegraph Co. November 21st.

1915.

1,892. Electrically-heated Fluid-pressure Boiler. G. E. A. Holdsworth. February 6th. (Patent of addition not granted.)

2,036. Portable Dry Battery Electric Torches. M. H. Goldstone. February 9th. (May 4th, 1915.)

2,289. Gripping of Electric Cables and the like. W. T. Henley's Telegraph Works Co. and H. Savage. February 12th.

2,349. Method of Establishing a Voltaic Arc between Electrodes not in Contact. F. C. Ucar. February 13th.

3,326. Secondary Electric Batteries or Accumulators. W. S. Naylor. March 2nd.

3,837. Electro-magnetic Switches. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). March 10th.

4,561. Pressure-operated Electric Switches. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). March 23rd.

5,001. Electric Motor Controllers. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). March 31st.

6,098. Electric Generating Set. A. Collet. April 23rd. (April 30th, 1914.)

9,411. Electrically-operated Bells. E. Kilner. June 28th.

10,130. Electrically-controlled Electric Circuit Breakers. British Westinghouse Electric & Manufacturing Co. July 12th. (July 11th, 1914.)

10,131. Arrangement for supplying Electrical Energy to Direct-current Electric Motors. British Westinghouse Electric & Manufacturing Co. July 12th. (July 11th, 1914.)

10,604. Electrolytic Cells. H. R. Nelson. July 21st. (August 17th, 1914.)

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Vol. LXXVII.] CONTENTS: December 17, 1915. [No. 1,986.

Page
Science and the Nation 769
Copper 770
Importing Machine Tools... 770
Nationalisation of Electricity Supply in Germany 771
The Decimal System 771
A New Zealand Hydro-Electric Scheme (*illus.*) 772
British Industry after the War 773
Multicore Cables, by "Commercial" 774
Corrosion of Steel Smoke-Stacks, by R. I. Elkin 774
Electrical Development in Germany after the War 775
Domestic Electric Heating 775
Correspondence—
    The Consular Service Again... 776
    More News from Ruhleben 776
    Decimal Coinage and the Metric System 777
    The Institution and Alien Enemy Members 778
    Finchley Breakdown 778
    The A.E.G. Meeting 778
War Items 778
New Electrical Devices, Fittings and Plant (*illus.*) 779
Legal... 781
Business Notes 782
Trade Questions with Russia 786
Notes 787
City Notes 789
Stocks and Shares 791
Electric Tramway and Railway Traffic Returns 792
Share List of Electrical Companies 792
Electrical Accidents in 1914 (*concluded*) 793
Our Trading Opportunities throughout the World (*continued*) 794
Reviews 795
Some Difficulties of Design of High-Speed Generators, by Prof. A. B. Field, (*illus.*) (*concluded*) 797
New Patents Applied for, 1915 800
Abstracts of Published Specifications 800
Contractors' Column ... ... Advertisement page xx

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SCIENCE AND THE NATION.

NOTHING in our social organisation is more incomprehensible to the man of scientific training and pursuits than the indifference which is manifested towards the nature, potentialities, and purposes of scientific culture by the great mass of the people of this country. Having himself tasted the delights of the search for truth and the endeavour to promote the progress of mankind, be it in the humblest capacity, he sees the world with different eyes, from a new point of view; and not as a contemptuous Pharisee, but as the brother of all humanity he wishes all to share in the riches which he has discovered. But it is given to few to cast their knowledge in a form attractive to the public; Faraday, Tyndall, Huxley, Ball, and some others were able to do so, but the gift is rarely met with nowadays, and partly in consequence of this the people display even less interest in science to-day than they did 20 or 30 years ago. We do not blame the modern teachers for their inability to emulate the genius of the great men of the past; if they have not the gift of popular exposition, they are undoubtedly well able to enthrall the minds of those who come to their lectures properly prepared to assimilate their teaching, and fired with the desire to learn; it is not the want of teachers that we suffer from, but the lack of learners.

No one who has observed the popular tendencies during the past quarter of a century will deny that there has been plainly manifest a craving for amusement and frivolity, for slothful ease and sensual pleasures, a drifting away from the spiritual towards the material. A similar phenomenon marked the days of the decline of the Roman Empire, when the populace demanded "Bread and games," and cared for nought but the gratification of their various appetites, while destruction crept upon them. Not that we anticipate a similar fate for this gracious realm—*absit omen!*—but we see in this tendency to unrestrained enjoyment the symptoms of decay, which, if not arrested, would undoubtedly destroy the nation.

From this point of view, we may be thankful for the war—the knife which, clumsily and brutally applied by a jealous rival in the hope of achieving our destruction, bids fair to accomplish our salvation by awakening us to our danger and ending the too easy prosperity which was lulling us to slumber. It is a sharp medicine, as King Charles said of the axe—but desperate diseases need desperate remedies.

Now, there are many reasons which induce us to hope that one of the greatest benefits that we shall derive from the war will be the adoption of a new attitude towards science by the nation. Hitherto there has been a tendency to look upon a man engaged in scientific pursuits as unpractical, absent-minded, and aloof from the world of affairs; but those who harbour this unjust impression are gravely in error. We are fortunate in having amongst us many men in the front rank of scientific progress—whose work has attained a world-wide reputation amongst those who are in a position to appreciate its worth, and who are full of vigour and eagerness to serve their country. They recognise that in the present crisis of our fortunes their special qualifications for research may and should be utilised to the utmost, and they are anxious to seize the opportunity of promoting the welfare of the nation. Many of them have, in fact, devoted their talents to the national service from the commencement of the war, and the Government, after long delay, has realised the necessity of mobilising our scientific forces with a view to making up for lost time and engaging our enemies upon their own ground. While the Germans are pre-eminent in the application of scientific method to the needs of industry, they are by no means noted for initiative or creative ability, of which we have no lack; they are, in fact, but uninspired plodders, and if we utilise our resources with sound judgment and efficiency, we need not fear defeat.

Unfortunately, we are governed by a coterie of lawyers, whose whole training has been utterly divorced from science, and who are inherently incapable of appraising the merits of a scientific discovery or the capabilities of scientific men. Only by the most strenuous efforts of such men as Sir William Ramsay was the importance of withholding cotton from Germany brought home to the nation, and their efforts would have been of no avail without the powerful assistance of the Press. But a few weeks ago a prominent member of the Government announced as *a new discovery* the fact that glycerine was derived from oils and fats. Labouring under their life-long prejudice against all physical science, a prejudice that was implanted in their minds at public schools controlled by literary men to whom science was anathema, and hugging the delusion that science is unpractical—whereas it is essentially the most practical form of knowledge—our rulers organise an Advisory Council and place it under the control of executive officers who, with the best will in the world, are nevertheless hopelessly unable to administer a scientific department with any approach to efficiency. With sublime assurance, however, the politicians consider themselves qualified to take charge of any Department of State without previous training, and flit from the Board of Trade to the Exchequer, from the War Office to the Woolsack, or from the Post Office to the Department of Agriculture, with equal ease and incompetence. Surely it is high time that our methods of Government were drastically reformed. At the present moment we have a Labour representative at the head of the Board of Education—which, like the Board of Trade. and the Local Government Board, is an unreal body that never meets.

Whether in the absence of a complete change of system in the appointment of our governing body it will ever be possible to bring about that fundamental reform in the utilisation of science for the benefit of the nation that is so urgently necessary, we do not know; but we are sure that the mere appointment of advisory councils, inventions committees, etc., will never take us very far in the desired direction. What is required is a change of attitude on the part of the nation as a whole. Our "leaders" unblushingly declare that they only follow public opinion; it is the latter, therefore, that must be first reformed, and in effecting this object the Press can render invaluable assistance. In an interesting address delivered in October last, Prof. Fleming drew attention to the question, and pointed out that we had still made scarcely any progress towards the creation of a disciplined army of scientific workers, and urged the formation of committees of scientific specialists to guide and instigate research, the reading and discussion of papers on problems of the moment by our engineering and other societies, and generally the promotion of a higher efficiency in all our operations. "We have said good-bye now and for ever to those easy-going amateur British methods which have held us in the past." Let this be our watchword—let us be strenuous and unwearied in furthering the scientific education of the nation; let us think less of our individual interests and more of the immense power of co-operation and mutual aid.

Copper. There has been some irregularity in the tone of the standard copper market owing to the gloomy outside conditions, and to the fact that an anxiety to realise paper profits manifested itself. The downward movement in prices in the speculative medium naturally affected the position of consumers, who, as soon as they thought they could detect growing weakness in the position, abstained from buying. Consequently, there has been less new business booked on this side, although consumption is proceeding at a remarkable rate. A new feature which has developed has been the refusal of the authorities to permit any shipments of standard copper abroad. The reason for this is to be found in the substantial reduction which has been effected in the holdings of rough metal here during the last few months. So long as there was a sufficiency of standard copper to provide for the reasonable requirements of consumers in this country the authorities were not unwilling to allow exports from here to America on an undertaking being given that the refined material should be brought back to this country, but this is no longer regarded as good policy owing to the smallness of the stocks now available here.

There is no change in the position of the leading producers, who, in fact, show remarkable firmness all round. There is a tendency to believe that American production is barely equal to the huge war demands combined with the growing domestic consumption across the Atlantic for general purposes, but the latter is bound to be affected sooner or later by the excessively high prices ruling, though the same consideration does not apply in so far as war requirements are concerned. Producers are very well sold, and, indeed some of them have nothing to dispose of now for the next two or three months except possible odd parcels. The tone has been a shade easier, perhaps, so far as refined copper is concerned, but this appears to be due to nothing more serious than a disposition on the part of second hands to realise a portion of their holdings which shows them very substantial profits.

Buying lately has been of a less aggressive character, consumers on both sides of the Atlantic appearing rather to have satisfied their needs for the time being, and to be disposed to hold their hands pending some fresh development in the general situation. There has been some interruption in the supply of rough copper to the American refineries, and this would appear to have been the foundation for the spurt in prices which lifted electro in New York to 20 c. per lb. f.o.b., and in this country to £99 a ton c.i.f.

There was rather a nasty labour outbreak at one of the largest refineries there which caused an entire suspension of operations for about a couple of weeks, and this completely frightened buyers, while the supplies of material available for treatment at the refineries were likewise cut down owing to fresh trouble in Mexico, and to the continued strike in Arizona which closed down practically the entire copper production of that State. Important modifications have, however, now occurred in Arizona and Mexico, while the strike at the refinery alluded to proved of comparatively short duration. Work is proceeding at full tilt in all directions of the American copper trade.

Importing Machine Tools. Users of machine tools have been somewhat mystified by the recent Royal Proclamation prohibiting the importation of these appliances into the United Kingdom, except under licence from the Board of Trade, as from December 21st next. At first glance it is difficult to reconcile this restriction with the extraordinarily heavy demand for machine tools from firms engaged upon munition work, and the avowed difficulty of sellers in coping with this demand. An investigation of the causes which led to the step, however, discloses a remarkable state of affairs. Throughout the country many small firms, which were formerly unknown in the tool trade, have suddenly come into existence, and have been importing second-hand machine tools and selling them at inflated prices. The tools in question have invariably proved faulty, and such inconvenience was caused by this as to attract the attention of the authorities, with the result that the Proclamation now issued restricts the importation of machine tools, except under licence from the Board of Trade.

These licences will only be granted to firms which were established in this country not less than two years before the outbreak of the war, and whose turnover amounts at least to £10,000 per annum. Imports licences will be granted to firms satisfying these requirements subject to the condition that the tools shall not be sold to users at a profit exceeding 18½ per cent., or in the case of transactions between one merchant and another, at a profit exceeding 10 per cent. The effect of this arrangement will be to eliminate the small and irresponsible trader, and to limit the business to reputable and experienced firms. The sale of second-hand machine tools is likely to be affected very considerably by the restriction, but, on the other hand, it is expected that business in new tools will be stimulated. The prohibition does not apply to hand tools.

Nationalisation of Electricity Supply in Germany.

THE question of the establishment of a Government monopoly of the supply of electricity in Germany was raised incidentally on November 24th at a meeting of the Berlin Electricity Works Co., when Dr. Walter Rathenau, criticising certain figures adduced on behalf of a minority of the shareholders with a view to showing the great future prospects of the undertaking in its new sphere of activity, stated that the estimates had no foundation, especially having regard to the monopoly endeavours of the Government. Apparently this reference applied to the Imperial Government, or rather to that of Prussia, as at least two of the Federal States propose to act independently on their own account, one being an entirely new scheme, and the other the development of a project which has been under consideration for a long time past. The former relates to the kingdom of Saxony, and information concerning it is contained in the Address from the Throne at the opening of the Saxony Parliament on November 11th. It was therein stated that the supply of electricity in the kingdom urgently needed to be consolidated and unified, and the Government had therefore decided itself to take in hand an undertaking of such great importance to the whole national economy, and the impending introduction of a Bill for this purpose was foreshadowed. The second instance refers to Bavaria, where the Ministry of State placed before the Finance Committee of Parliament on November 23rd a detailed report on the position of the work for the establishment of the Walchen Lake works for the supply of electricity to the whole of Bavaria. The report is based upon the information furnished by Imperial Councillor Muller, and the Ministry endorses the suggestion that the most appropriate site for an embankment installation is near Krünn. It is proposed to form a special company under the title of the Bavaria Works, to carry out the project, which also provides for a combination of the large power works in Rhenish Bavaria. The overland and large power stations already existing in Bavaria, together with the electricity works in towns and communal supply districts, come into consideration as customers for the new works. It is estimated that the Bavaria Works, which will have a feeder network at 100,000 volts, will have to expend £1,550,000 on the network and accessory plant, of which one-half will be raised by a loan bearing a fixed rate of interest, whilst the other half will form the company's working capital. The proprietors will be the State, the overland central stations, the towns—which will be able to participate at least for the amount of the capital expenditure which they will not have to incur for extensions of their own generating stations—and the firms entrusted with the establishment of the network, who will be interested to the extent of a portion of the constructional expenses devolving upon them. It is calculated that with a total annual consumption of 530,000,000 KW.-hours, which will be reached in the next 10 years, a yearly saving of £210,000 will be effected by the consolidation of interests in the Bavaria Works," as compared with individual supply from independent generating stations. The interest of the Government in the scheme is of a twofold character. In the first place, it is hoped by its successful completion to afford important advantages, through a cheap supply of light and power, to industries and agriculture, which are expected to develop after the war; and, secondly, it is calculated that the hydro-electric works, of which the Gustav Works now in progress at Dettingen is a preliminary example, will also be available in connection with the conversion of the Bavarian State railways to electric traction. It is intended, if sanctioned by Parliament, to begin the undertaking immediately on the conclusion of peace, as negotiations are already proceeding for this purpose.

The Decimal System.

IN our "Correspondence" columns to-day Mr. C. Turnbull raises a point of considerable importance with regard to the teaching of the metric system in our elementary schools. Impressions gained in childhood are apt to endure throughout life, and nothing could be more detrimental to the popularity of the metric system than to have it made the subject of abstruse and puzzling problems by misguided teachers. Rarely indeed would anyone require to convert from one system to the other; and when conversion was absolutely necessary, it would be effected with ease by means of the admirable tables which are available. We can quite imagine that if "teaching the metric system" is taken to mean arithmetical gymnastics, irreparable harm will be done to the opinions of the rising generation. As a matter of fact, the true teaching of the system would involve not more than a morning's work—there is so little to learn.

With regard to M. Planchon's letter, while we appreciate the ingenuity of his proposal, we maintain our view that the English sovereign must on no account be interfered with. It has been for centuries our standard coin, and is known throughout the world, while all our statistics have been recorded in terms of it; we must not touch the pound! We do not agree that with the pound and shilling we can form a decimal system; the retention of any multiplier other than 10 is absolutely fatal to the simplicity of the system. In our view the pound, florin, and mil (or modified farthing) are the essential coins, and all the gold and silver coins now in circulation would be entirely unaffected in value.

We may add that just as the French centime and the German pfennig are coins too small in value to be of practical use, so the $\frac{1}{100}$th of a shilling would be a merely nominal coin, whereas the mil, being practically equivalent to the present farthing, would probably enter into circulation on its own merits, as at present.

Our contemporary the *Contract Journal*, in further commenting on our recent articles, whilst adopting a complimentary tone which we cordially appreciate, is unfortunately unable to agree that the adoption of metric measures and decimal coinage in this country has much bearing on our foreign trade. But, in order to prevail in the stress of modern competition, we must neglect nothing that will strengthen our arms or reduce our costs, and there is no doubt whatever—*pace* our contemporary—that under our present system of £ s. d. a vast amount of clerical labour is absolutely wasted. *We cannot afford to waste it.* But our manufacturers cannot cut loose from it unless everyone else does too. And as regards the metric system, here again we cannot use both; efficiency can only be attained by the employment of a single universal system.

The essence of economical manufacture on the great scale is to be sure of your home market first, and send your surplus abroad; and if the surplus must be metric, the *whole* must be. In short, the adoption of the metric system at home is the necessary preliminary to its adoption for export, and we entirely dissent from the view that its advantages "can be obtained by individual effort."

A NEW ZEALAND HYDRO-ELECTRIC SCHEME.

It is not usual to read of a power scheme over 2,000 ft. above sea-level, but there is such a one on the main trunk line in New Zealand, at a rising borough called Ohakune, which a few years ago was only a bush settlement. Ohakune, like many other towns in New Zealand, is situated close to a river, the Mangawbero, which, it was discovered, had enough fall for producing a sufficient supply of electricity for lighting and power purposes to meet the requirements of the town for some years to come.

A low rubble dam was thrown across the river, and the water diverted through a screened regulating gate into the flume, which conveys it to the power station, less than half a mile distant. The flume has a fall of 1 in 1,200 throughout its length, and is constructed principally of concrete. Where the flume crosses under the roads it has been roofed over with ferro-concrete, and where it is carried over creeks or on artificial fillings timber fluming has been used.

Power Station and Pipe Lines, Ohakune.

At the extreme end of the fluming the water enters the forebay; this is designed with a long spillway capable of taking all the water the flume can carry—viz., the equivalent of 250 h.p. When the turbines are not in use, the water discharges over the spillway into the underground tail-race leading into the river. The forebay is fitted with a sludge valve, which can be used for discharging into the tail-race any silt which comes down the flume. Screens are also provided for holding back any *débris* which might injure the turbines. From the forebay two penstocks of riveted steel, each 27 in. in diameter, convey the water to the turbines in the power house below, and provision has been made for the installation at a later date of a stand-by unit.

Forebay Screens, Spillway and Power Station.

The present plant consists of two reaction Francis-type turbines, made by Messrs. Boving & Co., each capable of giving 100 b.h.p. under a total head of 40 ft. with a normal speed of 600 r.p.m., and each is controlled by a Boving patent automatic oil-pressure governor guaranteed to control the turbines with a momentary variation of speed not exceeding 3 per cent. with 25 per cent. change of load, 6 per cent. with 50 per cent. change of load, and 15 per cent. speed variation with full load thrown on or off. The fly-wheels are of cast steel, proportioned to prevent a pressure rise in the pipe-line exceeding 40 per cent. of the normal, when full load is suddenly thrown off the turbines.

Concrete Flume with Truck Rails Inside.

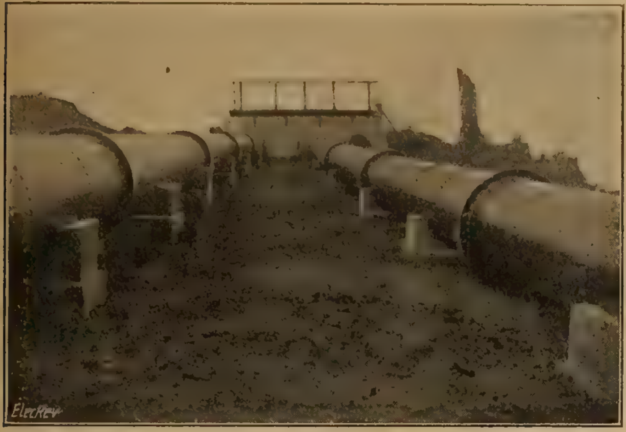
Each turbine is coupled through a flexible coupling to a 60-k.v.a., three-phase, revolving-field alternator, generating at 2,400 volts and 50 periods. These alternators are star-connected, with the neutral terminal earthed. An exciter is direct-coupled to each shaft. The alternators, as well as the switchgear and instruments, were manufactured by the British Westinghouse Co.

The switchboard is fitted with all necessary instruments for indicating the current supply, and the machinery is effectively protected by Westinghouse lightning-arresters placed on the wall behind the switchboard; isolating switches are also fitted to the outgoing feeders.

An ideal natural storage of water is available with the expenditure of very little capital. This consists of diverting the Mangawbero into an extinct crater (for Ohakune is surrounded by mountainous country) situated a few hundred yards upstream from the intake.

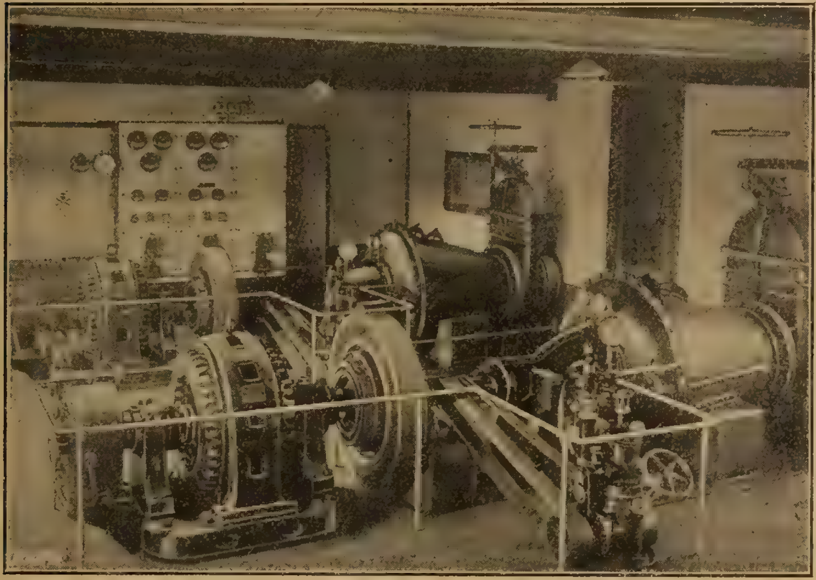
The power-house building is about 50 ft. long by 24 ft. wide. The foundation walls are in concrete raised 2 ft. 6 in. above the ground-level, and the superstructure consists of a timber framing lined inside and outside with Poilite.

The main streets of the town have been reticulated for private and street lighting. The poles used throughout are of natural round Australian ironbark, the cross-arms being of best North Island Rata. The reticulation system is fed at 230 volts for lighting and at 400 volts for power, from one 20-KW., two 10-KW., and a 5 KW. transformer, mounted on poles at different parts of the town. A large number of street lamps, each of 50 C.P., have been provided. The brackets used are of very neat design, with special reflectors.



Pipe Lines and Forebay.

The Borough Council is assisting ratepayers who are not in good financial circumstances to install their premises on a monthly time-payment system; the Council raised a loan of £9,000 for the purpose of installing the plant. On account of the height at which it is situated, and other unique features, the scheme has attracted considerable attention. It was designed and supervised by a well-known firm of New Zealand electrical engineers, Messrs. Turnbull and Jones, whose representative in the scheme was Mr. S. Blackley.



Interior of Power Station, Ohakune, New Zealand.

BRITISH INDUSTRY AFTER THE WAR.

In his Presidential address to the North-East Coast Institution of Engineers and Shipbuilders, Mr. H. B. Rowell, after discussing some of the engineering features of the war, referred to the industrial situation, and remarked that the position would be very serious at the conclusion of the war.

The ignorance in which the country had been kept, the courtier-like deference of the Government to labour, the high rates of wages, defiance by labour of supervision, demoralisation caused by unmoral methods of payment, excessive overtime, night and Sunday work with their accompanying abuses, had all combined to produce a condition of affairs which could not possibly continue.

Taking the most favourable assumption that victory came to us and our Allies, the relative position of this country and her competitors after the conclusion of peace would not necessarily be to our advantage. We should go into the commercial arena with labour costs much higher than at any time in our history, and probably at a great disadvantage from the point of view of delivery and internal industrial troubles; while Belgium, Germany, and Austria, in the throes of industrial starvation, and with favourable labour conditions from the point of view of competition, would set to work more methodically and resolutely than ever to recover their positions in the markets of the world.

For a number of years workmen had been encouraged to believe that, as regards production, their interest was divergent from that of their employers, and that the former could best be served by limiting the amount of work done in a given time. Since the war began loyal efforts had been made, especially by those of the men's leaders who had visited the fighting line, to suspend the influence of this teaching, but the success attending these efforts had been far from complete. It had never yet, apparently, occurred to these men that the amount of money a man could receive in wages could only be a proportion of the value of the work he turned out, and that it was not likely to be increased in the long run by limiting the output of the individual workman.

With the value of the annual output per man in American works about two to three times that in this country, and the use of machinery per head showing a similar ratio, it seemed that increase of output indicated the direction in which we must look for the salvation of our industries and the increased welfare of our men.

It was absolutely essential that the men should be brought to see that their first interest was the fostering of the industry by which they lived, and that the limitation of output was a fallacy which had done more than foreign bounties and Protection to foster shipbuilding abroad. Increase of output and economy of production reacted on each other, and the interest of employer and employé in both was inseparable.

However the war might end, it would have one outstanding result—a marked change in the attitude of all departments and sections of the Government towards the trade and manufactures of this country, and towards education as bearing on these; it was quite comprehensible that the political representative of this country might consider that he could not properly assist a particular British subject to secure an order, but it was wrong that he should not realise that it was of first importance that the country he represented should secure it.

The work which was being done by the new Ministry of Munitions, aided, as it was, by business men, had served, apart from its own functions, to draw attention to the urgent need of the establishment of a Ministry of Commerce, which would protect and encourage both home and foreign trade. If the organisation were carried on by business men on business lines, the advantage would be incalculable.

He advocated very strongly that greater effort should be made in the direction of providing for a more prolonged general education, specially avoiding the serious error of discarding the study of all subjects which did not appear to have essential connection with the profession in view. To build high it was necessary to start with a broad as well as a deep base, and while such a method placed the student at a disadvantage in his early twenties, it should, other things being equal, enable him later to out-distance rapidly those competitors whose field of knowledge was less broad.

The complete absence of any consideration of the cost of production both in technical colleges and technical institutions, and its insufficient consideration in works except by the more highly placed officials and a special staff, were circumstances which required prompt rectification, in the interests of our national industries. An accurate appreciation of cost came one day to most men who occupied leading positions in works, but it should be ensured at a much earlier stage in the career by education and early training in business, because it was only by the man of technical and scientific attainment that the most efficient use could be made of it.

Speaking as a technical man, and with a full appreciation of the high aims and achievements of technical men, he unhesitatingly advocated that not only should our technical colleges deal in their curricula with such questions as the relation of design to cost, and of cost to production, but that all technical institutions should, subject to proper control, open their doors to the reading of papers dealing with these subjects.

Good News from Mexico.—An American Consular agent reports better conditions on the Mexican border. He says:—"The situation in the Piedras Negras Consular district is much improved; in fact, fighting has become a thing of the past. The passenger, freight and other trains of the Mexican National Railroad are operating daily to and from southern points without molestation. Many Americans and other foreigners are crossing the International Bridge daily (date of writing November 6th) *en route* to their homes in the interior with a view to again settling down to work and rebuilding their businesses. Those coming out say conditions are becoming better each day."

MULTICORE CABLES.

By "COMMERCIAL."

In the construction of multicore electric cables of one type or another, it is often desirable to employ some means of easily distinguishing core from core, or pair from pair. The most general methods are by the use of coloured cotton lappings, and coloured tapes of paper or cotton. Cotton lappings are mainly used on telephone cables, in which unvulcanised rubber, silk and cotton form the insulation. The number of cores in such cables may run into hundreds, and it would be scarcely possible to make the cores distinguishable without the use of coloured cotton, in single or "self" colours, in double, or in triple-colour combinations. In the case of "pair" cables one colour is used throughout on one core of each pair, and combinations of two or three colours on the other core. Occasionally also, in lieu of coloured tapes, cotton lapping is used on the cores of small vulcanised rubber multicores, over the grey tape. Generally, however, coloured proof tapes are used on vulcanised rubber multicores for distinguishing purposes, and usually on bitumen cables, though some makers omit tape from the cores of the latter class. If the single colours available are insufficient two are put on in parallel, each half the width of the ordinary single colour tape, thus producing a spiral striped effect.

The use of coloured papers is confined to paper insulated power cables, and dry cores; in the latter case, sometimes accompanied by a whipping of cotton. The range of colours is necessarily more restricted than in the case of cotton, and the number of combinations of colours is correspondingly less. Also where two colours are used, they are put on in succeeding layers, and not in parallel strips as in the case of cotton tapes.

In this connection it may be interesting to ascertain, when given a number of colours, how many two-or-three-colour combinations may be obtained from them. It is found that the number of cores which can be coloured with single and two-colour combinations is equal to the sum of the numbers of the colours. That is, where three colours are used, (1 + 2 + 3) cores can be coloured; or where N is the number of colours used, $\frac{1}{2}N(N+1)$ cores may be coloured by the use of N single colours, and all possible combinations of two colours obtainable therefrom. Thus, 8 colours will give 4 (8 + 1) or 36 cores, made up of 8 cores with one colour, and 28 cores with two-colour combinations.

The numbers of combinations made by the use of three colours are rather more difficult to find by formula. On working out several examples, however, it is found that they are expressed in an irregular progression of the terms: 1; 1 + (1 + 2); 1 + (1 + 2) + (1 + 2 + 3); &c., *i.e.*, for 3 colours: 1 triple.

„ 4 „ 1 + (1 + 2) triples.
„ 5 „ 1 + (1 + 2) + (1 + 2 + 3) triples.
„ 6 „ 1 + (1 + 2) + (1 + 2 + 3) + (1 + 2 + 3 + 4) triples.
„ 7 „ 1 + (1 + 2) + (1 + 2 + 3) + (1 + 2 + 3 + 4) + (1 + 2 + 3 + 4 + 5) triples.

So that with the self colours singly, and the triple combinations, in all, 3 colours will serve 4 cores, 4 colours, 8; 5 colours, 15. Tabulating the results gives the following figures:—

No. of colours.	Self colours + 2-colour combinations.	Self-colours + 8 colour combinations.	Self-colours + 2 colours + 3 colours.
2	3	—	3
3	6	4	7
4	10	8	14
5	15	15	25
6	21	26	41
7	28	42	63
8	36	64	92
9	45	93	129
10	55	130	175
11	66	176	231
12	78	232	298
13	91	299	377
14	105	378	469
15	120	470	575

In making out a list of colours and combinations, the self colours must first be placed in a definite order and numbered, and such order must be strictly adhered to in working out the combinations. All possible two or three-colour combinations of No. 1 are then found, and so on, care being taken always to work forwards and not refer to a back or earlier colour. This precaution is necessary to avoid duplication of any set of colours. Following on after the numbers allotted to the single colours the combinations should also be numbered, as this will simplify the use of the list in practice.

The table shows how large a number of cores can be made distinguishable by means of a few colours, and it can be further extended if necessary by using different shades of some of the colours.

CORROSION OF STEEL SMOKESTACKS.

By R. I. ELKIN.

The discovery that a number of steel smokestacks throughout the country are corroding at an alarming rate has aroused much interest among central-station companies, insurance interests and others. A superficial inspection of the exterior of many of these stacks indicates that they are apparently in a satisfactory condition, but when scrutinised on the inside it is found that disintegration in many cases is proceeding rapidly. Of the stacks examined a few were lined, and these were free from attack. Those without any lining whatever were, however, deteriorating in practically every case.

A steel stack will corrode on the inside and on the outside, but this fact appears to have been overlooked in many instances, for protection has been given the exterior while the interior has been ignored, although internal corrosion is by far the more serious of the two. Corrosion of the outside of a stack is due in part to the elements and in part to acids and sulphur fumes, which attack steel quite rapidly in the presence of moisture. An inexpensive way to prevent corrosion is to paint the steel with a suitable pigment. The conditions affecting a smokestack are similar to, but much more severe than, those existing round other steel work, bridges, &c., on account of the atmospheric conditions and the rather high temperatures—a combination most favourable to corrosive action. The painting should be thorough, and not less than two coats should be applied, otherwise the pinhole abrasions in the paint and uneven coating may give a covering which is not completely protecting. To obtain the benefits of painting it should be done regularly, the frequency depending upon local conditions. About every two years suffices in average cases.

It is a less simple matter to prevent corrosion in the interior of a stack, and one which will cost more than outside protection, because the hot flue gases direct from the fires must be contended against. These gases are extremely corrosive, and will cause rapid disintegration of the steel if preventive means are not taken. The corrosion is due almost wholly to the flue gases containing moisture, which condenses against the comparatively cool walls of the metal stack. The condensate thus precipitated consists largely of sulphurous acid, while there are always present the deleterious effects of carbon-dioxide gas, which attacks steel in the presence of moisture. The remedy for corrosion on the interior of a stack is to protect the metallic wall from the acids and gases by lining it with firebrick. This lining should be carefully laid, care being taken that no air gap exists between the lining and the metallic wall, otherwise the corrosion will take place as fast as, if not faster than, when no lining is used. The intervening space between metal and brick should be filled in completely by grouting with cement. The lining should go the full height of the stack, because with unlined stacks it has been found that the upper rings corrode faster than the lower, owing, no doubt, to the greater condensation at the top of the stack.

One of the things most conducive to corrosion is to take an unlined stack out of service from time to time, even for short periods. Experience, however, seems to indicate that allowing a stack which is properly lined to stand idle has little effect upon corrosion. This is a great advantage to steam plants operating in connection with hydro-electric plants where the water supply is erratic or insufficient at all periods of the year. A further advantage of lining a stack, besides that of protecting it and thereby prolonging its life, is that the radiating losses through the metallic walls are very materially reduced, thus improving the draught.—*Electrical World.*

The German Cable Makers' Syndicate.—It is reported that this syndicate, which would nominally expire with the current year, has been prolonged until April 1st, 1916. The syndicate has been provisionally extended several times since the outbreak of the war, and it is not intended definitely to renew it during the continuance of hostilities.

ELECTRICAL DEVELOPMENT IN GERMANY AFTER THE WAR.

The magnitude of the prevision which has characterised Germany's preparations in almost every direction for the conduct of the present war is to be emulated on a smaller scale during the course of this world-conflict by the exercise of foresight regarding the supply of electricity after the conclusion of peace. It is contended that electricity will then play an important part in a double sense in connection with the reorganisation of the economic conditions in that country. In the first place, it will have to be substituted for other lighting agencies and forms of power in industries and agriculture to a far greater extent than hitherto, and the larger extension of the use of electrical energy will, it is held, represent the supersession of foreign materials and an economy in the national sources of energy. The second point is that the State, according to former and recent indications, intends to utilise this source of power for national purposes, and from this standpoint Gustav Siegel discussed the subject a few months ago in the *Preussische Jahrbucher*. The opinions expressed by the author are not only of importance and interest, both from a general point of view and from that of the competitive capability of Germany in the future, but they gain increased value from the fact that the fundamental idea underlying them was approved by Dr. Emil Rathenau (now deceased), in a preface attached to a reprint of the article from the journal in question.

The development of electricity in Germany has so far been divided into three stages. The first, which extended to 1890, was that of technical and economic experiment; the second, which ended with 1900, was the period during which local works were erected and electric motors were introduced into minor industries; and the third has been characterised by the expansion of overland central stations so that lighting and electric power are becoming general in industries and agriculture. In addition to the participation of local authorities, provinces, and States in the supply of electricity from overland stations, chiefly for the purpose of supervision, the co-determination of conditions of supply and the adoption of guiding principles for dealing with distant districts, the States of Prussia, Bavaria, and Baden have included within the scope of their activity the utilisation of water powers, the erection of main transmission lines, and the operation of these works. As to the further intervention of the State, the author considers that this is necessary so as to secure wayleaves in order to be able to install networks at comparatively low cost by overriding the arbitrary demands of individuals, and also for the establishment on a grand scale of generating stations directly on the site of the production of coal, and the location of water powers and peat moors, and the interconnection of these stations on a uniform plan by the erection of a high-tension network over the whole of the empire. This, then, is the principle of the scheme, which naturally raises various questions in connection with the extent of the present and the prospective supply of electricity.

The total capacity of the generating stations engaged on furnishing electrical energy to the public is stated to have amounted to 2,000,000 kw. in 1913, and that of the private and individual installations with their own generating plant was 8,000,000 kw., whilst the total consumption for lighting and power purposes throughout Germany is estimated to have been 30,000,000,000 kw.-hours, to which has to be added a further 10,000,000,000 kw.-hours used for railway purposes. Although these figures are enormous, it is calculated that they would be doubled in the course of ten years, and that one-half of the quantity then consumed—40,000,000,000 kw.-hours—would be able to be delivered by the generating stations which serve the general public. At present the area supplied by the latter has a population of 45,000,000 persons, and it would be possible to include the remainder of the empire by the enactment of an expropriation or wayleaves law. As, however, the prospects of passing such a law are deemed to be infinitesimal, the author discusses the question of the imposition of a tax on the consumption of electricity, as has been suggested for the period after the war is over. Such a proposal is considered to have opposed to it still greater objections than were raised against the similar plan which was abandoned in 1908 in favour of a tax on illuminating appliances, which has hitherto yielded one-third less than was expected by the Government, as a high tax when peace again prevails would be fatal to industries. It would hamper the export trade and increase the cost of supply in the inland market, especially as the industrial products to a preponderating extent are not for direct consumption, but serve for the manufacture of other articles.

The question of the State expropriation of the undertakings which supply general consumers is argued to be a much less satisfactory proposal for the nation than that of the adoption of a general scheme of development of huge stations with a vast network of feeders to transformer stations in different parts of the country. As to the financial effects of the former, the author states that the gross surplus realised by all electricity works in Germany in 1913 was, approximately, £11,250,000, and after providing for depreciation at the rate of 3½ per cent., there remained net profits of £7,350,000. If this sum is capitalised at 5 per cent., the price of purchase to the State would be £147,000,000, and if the depreciation provision made by the State were reduced to 2 per cent., and the purchase price were raised by means of a 4½ per cent. loan, the surplus available to the State for free disposal would be only £1,850,000. This comparatively small sum would represent the whole proceeds of the monopoly, which would, however, by no means counterbalance the disadvantages of the monopoly. Under these circumstances, the author contends that the duty of the State should lie rather in the exercise of a regulating and promoting influence upon the supply of electricity than to paralyse capital and labour through the institution of a monopoly, and in the former instance a prominent opportunity is afforded for also securing a considerable revenue to the State.

The definite proposal made in this connection, as previously mentioned, is that it would be advantageous for the State to erect and work huge generating stations at coal mines, at suitable water powers, and adjoining extensive deposits of peat on the moors, the stations to be interconnected with each other by means of high-tension mains, from which electrical energy would be transmitted to specified transformer stations of large dimensions. This idea is essentially a development of the pit bank practice of one or two stations of the Westphalian Electricity Works in the district of Dortmund, of the present utilisation of certain lignite deposits at Bitterfeld, and of the contemplated extensive use of other lignite mines in that district indirectly for electrochemical industries; and of the existing use of certain peat moors in East Friesland. But, naturally, the inclusion of large transformer stations carries the scheme much further. It is suggested, for instance, that the limits of the State action should be fixed at the transformer stations, and the distribution then undertaken by the present owners of electricity supply works. In other words, the State would become a supplier in bulk. It is assumed that by the establishment of the generating stations at the source of power, and the installation of huge units, it would be possible for the State to deliver so cheaply that it would be of advantage to most of the existing works to procure a supply by means of the State transmission lines, whilst, conversely, the latter works would be under the obligation to afford a supply to the State in so far as the technical conditions would permit and the prices were equal to those of the State. It is calculated that an initial expenditure of £20,000,000 on the works and lines, and an estimated sale of 6,000,000,000 kw.-hours per annum, would yield a net surplus of £3,000,000 per annum, or twice as much as would be derived from a tax on the consumption of electricity under present conditions, and still more than would be obtained from a State monopoly of the supply works with over seven times the amount of capital investment; whilst a further extension of the stations and a turnover increased to 12,000,000,000 kw.-hours would raise the net revenue to £4,500,000, even if the bulk price were reduced. The approval given to the general idea by Dr. Emil Rathenau, as already referred to, was accompanied by the statement that the suggested Imperial Electricity Union would receive all the revenue, and, after indemnifying the individual Federal States for the expenditure incurred by them in associating themselves with the scheme, and securing to them a share in the profits, the balance remaining would devolve upon the Imperial Treasury for the general benefit of the country.

DOMESTIC ELECTRIC HEATING.

Lecturing at University College, London, on Friday last, Prof. A. H. **Barker** dealt with the application of electrical heating methods to domestic requirements. He regarded electric heating as the system of the future *par excellence*, in spite of the obstacles which at present hindered its development—chief of which was its high cost, in comparison with older methods. The requirements to be met in connection with domestic heating were extremely complex; the reading of a thermometer was utterly misleading, and there was a great divergence between the real problem and conventional ideas on the subject.

The orthodox view was that the thermometer indicated the "temperature of the room," as if the room were full of liquid; but it really indicated only its *own* temperature, the resultant of radiation and convection.

It was usual to assume that heat was conducted out through the wall at a rate proportional to the difference between the internal and external temperatures, and to the area of the walls; the ventilation requirements were based on the supposed permissible limits of the CO_2 content of the air, and it was taken that the incoming air must be heated up to 60 deg. F., whilst the external temperature was 30 deg. F. These considerations led to the conclusion that to provide for maintaining the room temperature and for heating the necessary volume of fresh air an allowance of about twice as many B.TH.U. per hour as the volume of the room in cubic feet was necessary. An ordinary hot-water radiator at a temperature of 160 deg. gave off about 140 heat units per square foot per hour. These data were the basis of the heating engineer's calculations, and on these lines, taking a concrete example, it was estimated that about one watt per cubic foot should suffice to heat a certain apartment; but in practice it was found that two watts were required, and it was necessary to discover the fallacy.

Taking the walls to be at 30 deg. F. to commence with, on a still day, on starting the radiators the internal surface of the wall would rise in temperature and a temperature gradient would be established in the wall, which would ultimately acquire a mean temperature about half-way between the inside and outside temperatures; an immense amount of heat would be absorbed by the walls in attaining this state, and, in fact, if no heat were lost from the outside, it would take about 19 hours to warm the walls alone, with all the radiators full on, in the case under consideration.

It would clearly be out of the question to carry this out with electric heaters; their function should be to heat little-used rooms occasionally for a few hours, without attempting to heat up the walls. The question, then, arose: What were the conditions which constituted comfort? The human body was constantly parting with heat by radiation, convection, and evaporation, and in order that a man might not "feel cold," an excessive demand must not be made upon his body for heat; the chief function of the electrical heater was to reduce the call upon the body below the limit at which discomfort was felt, and for this purpose the luminous radiator was the appropriate means.

It was necessary to produce a feeling of warmth without a feeling of oppression; the purity of the air had little to do with this, in spite of the popular notions. A person had been experimentally enclosed in a cabinet until the atmosphere within it became foul and gave him a feeling of oppression and discomfort; he was then allowed to breathe the outer air through a tube, but felt no better. When, however, he was taken out of the cabinet and allowed to breathe the foul air within the cabinet by means of a tube, he felt fresh and comfortable. Evidently the cause of the oppression must be sought elsewhere than in the impurity of the air. It was, in fact, possible to warm a room and fill it with fresh pure air, and yet to experience great discomfort when occupying it. Hence it was important to discover the true conditions which gave rise to comfort and discomfort; and it was because electrical heating could be made to respond to any desired conditions that it was so valuable. The oppression due to heat was the worst factor—though one might at the same time feel cold.

Extended investigations had been carried out at University College on the subject. It was necessary to take into account the true temperature of the air apart from the effect of radiation, which is totally independent of the former, and the lecturer had devised special thermometers for ascertaining these quantities, with the result that he claimed to have proved that "stuffiness" was due largely to the fact that the air temperature was too high and the radiant temperature too low. The open fire was very popular, having a high radiant temperature without heating the air excessively, whilst it also drew in fresh *cool* air, which at the same time was at a lower absolute humidity. The intermixture of the streams of cool air entering through crevices, etc., with the warmer air in the room produced a "streakiness" which made it feel fresh; this could be artificially imitated without admitting fresh air. One feature of the open fire was that the temperature was not uniform all over the room—an advantage, not a defect. To warm the incoming air as it entered a room was an utterly mistaken plan; the coldness and dryness of the fresh air were essential qualities.

The necessary radiant heat must be supplied in the proper quantity and direction. Some would be reflected from the walls, some absorbed in the walls and by the air, some radiated through the windows; much of it was, therefore, quickly lost, and the radiators should be constructed so as to *direct* the radiant energy upon the persons in the room. Dr. Leonard Hill and the author had investigated complaints of the defective ventilation at the House of Commons, and found that immense volumes of fresh air were poured into it, yet the atmosphere produced lassitude; this feeling was found to be due to the feet of the members being cooled more than their heads, which was precisely the wrong effect to be aimed at. In the open air the contrary was the case. Hence they must make sure that a good proportion of radiant energy would be projected downwards in a room. Electric carpets were admirable heaters.

On the invitation of the General Electric Co., Ltd., he had carried out an extended series of experiments on their electric radiators, and had devised methods of separately testing the radiation and convection from them; by means of a thermopile and a device for holding the radiator in various positions he had obtained polar curves showing the distribution of the radiation in all directions. All electrical radiators had an efficiency of 100 per cent. in converting electrical into heat energy; but the proportion of radiant to total energy varied with the construction of the apparatus. The best he had found was 69.4 per cent. He had also determined the proportion of the total radiation which was directed on a zone 4 ft. high and 5 ft. from the radiator, this being the part that would fall upon a person sitting in a chair at that radius. In the course of his experiments he had ascertained that a person could feel comfortable whilst sitting still, in air at a temperature of 50 deg. F., if the radiant heat falling upon him from one side was at least 2.5 watts per sq. ft. of normal surface. When the air temperature was below 48 deg. F., he could not feel warm no matter what the radiation from one side only, but if radiant heat were supplied from both sides, a flow of 1.7 watts per sq. ft. on each side enabled him to feel comfortable in air at a temperature of 40 deg. F.

A hot coal fire in a cold room might scorch one without removing the feeling of chill, and the manufacturers of electric radiators should avoid the mistake of providing too intense a radiation.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Consular Service Again.

I am sure that most of your readers will agree with the remarks on the Consular Service in your issue of September 10th. The whole question of the part to be played by the Government in promoting British trade should be considered *now* by those most interested, viz., the manufacturers themselves. Now is the time for manufacturers to put constructive proposals before the departments concerned—the Board of Trade and the Foreign Office. As you point out, Consuls cannot be expected to do what manufacturers themselves ought to do. Our big manufacturers have their own channels for obtaining reliable information as to opportunities for trade, and as regards the supply of this, the services of the official trade scout will, to a large extent, only be in demand by the smaller firms. It will, therefore, be in the direction of giving official support to representations to foreign Governments in connection with public works, tariff difficulties, and the like, that the British official can render most useful assistance. He should, of course, also report on such opportunities for British trade as come under his notice.

The United States Government, whose reports you rightly commend, has lately made a new departure in regard to its efforts to foment foreign trade by appointing a number of commercial attachés, who are in no way controlled by the State Department, which corresponds to our Foreign Office, but are under the direction of the Department of Commerce, which corresponds to our Board of Trade. In other words, the American Government has applied to foreign countries our practice as regards the self-governing Dominions, where the Trade Commissioners are appointed by the Board of Trade. The American Government has, apparently, recognised that its representation in commercial matters needed strengthening, not only as regards the number of its representatives, but also that the official whose duty it is to study trade matters should not have his attention diverted by the hundred-and-one things a Consul has to do. The British Commercial Attachés appointed by the Foreign Office at present are eight in number, confining their attention to the principal European countries, China, and Japan. Outside of our Consuls, we have no officers expressly charged with the duty of investigating trade matters in the United States or in the growing markets of Latin America, where such an immense amount of British capital is invested, and where our imports represent a vast sum. It certainly seems somewhat of an anomaly that while Commissioners of the Board of Trade have been appointed to the self-governing Dominions where racial sentiment and tariff preferences all favour the British manufacturer, the presumably less effective representation by Consuls has been considered sufficient in important foreign markets, where the British manufacturer has neither the tariff preference nor the sentiment mentioned to assist him. If Mr. E. W. Stevenson, of Brooklyn, who writes in your issue of September 10th, will consult official figures, he will see that instead of our Colonies taking, as he supposes, about 75 per cent. of our foreign exports, they took about 37 per cent. of these in 1913. In other words, nearly two-thirds of our export trade is outside the Empire. Now, while we are all anxious to see increased trade within the Empire, we cannot afford to neglect that with foreign countries, and just in proportion as this latter is the more difficult to hold, so it ought to be supported and fomented by the Foreign Office and the Board of Trade if, as I believe, official efforts to promote trade are of real use to manufacturers.

I hope the Chambers of Commerce and such like bodies will get busy and press the matter of reform in trade representation on the Government without waiting for the end of the war.

Viator.

Melbourne, *November 1st*, 1915.

More News from Ruhleben.

It has occurred to us that a short report of the lot of engineers interned here at Ruhleben will be interesting and acceptable to our colleagues at home. We have, therefore, pleasure in addressing you the following notes relative to the activities of engineers here, and to the conditions under which their labours are being carried on.

As may well be imagined, there are a large number of engineers in the camp, and all branches of engineering are represented. The majority were either employed in Germany prior to August 4th, 1914, or were engineers on ships which were moored in German ports on that date; the remainder were either detained in Germany when travelling through home from other countries (chiefly those of the Near East), or were on holiday here when war was declared.

During the first few months of our internment, the engineers were completely inactive. The mental depression incidental to exile, the inconveniences incidental to internment, and the vain, but importunate, hope that liberty was nigh, prevented utterly all serious work and study. Gradually, however, it was realised that a long internment was inevitable, and so, with traditional national adaptability, we set to work. A movement was set afoot to ascertain the number and needs of engineers in the camp. It was found that besides the large number of marine engineers, who had already formed an excellent local branch of the M.E.A., there were about 60 other engineers. To enable the latter to get an opportunity of interchanging ideas, an engineering society, called "The Technical Circle," was formed. A chairman, secretary, and committee were appointed, and weekly meetings were arranged, the general procedure at the meetings being similar to that adopted by our Engineering Institutions at home.

The first meeting of "The Technical Circle" was held on August 5th, 1915. [Some particulars of the proceedings of this Circle appeared in a letter from another correspondent published in the ELECTRICAL REVIEW for November 19th, p. 657.—EDS. E.R.]

In addition to these activities, practically every engineer here is taking advantage of the opportunity of learning European languages. Ruhleben Camp, although officially an English camp, is really very cosmopolitan. Several men may be found here who have lived many years in any European country that one chooses to think of, and the majority of these willingly give instruction in languages in which they are proficient. As a large number of these men are engineers, the value to us of instruction from them is obvious. Our studies, however, are by no means limited to languages.

A valuable feature of technical intercourse here is the fact that we have amongst our circle members, men who, as already indicated, are acquainted with the engineering conditions in all parts of the world. The importance of that cannot be exaggerated, as it offers a source of reliable information as to the engineering possibilities of existing and future markets; an engineer destined for the development of future foreign markets, in fact, can do much here to extend his knowledge. Incidentally, the number of engineers interned here and the diversity of their activities is proof of the ubiquity of the British engineer.

These few notes will, we hope, be of interest to our colleagues at home. When considering our aforementioned activities, the disadvantageous conditions under which we labour should be borne in mind. The prolonged internment and the continuous isolation from all external society have proved a serious handicap. A great disability is gradually being removed by the inauguration of a scientific and literary reference library, for which we receive from time to time generous gifts from individuals and societies at home. Finally, we have had to contend all along with the galling thought of not being able to do anything for the Motherland in the hour of need. This is the most distressing feature of our captivity.

We gladly take this opportunity of wishing our colleagues at home as happy a Christmas and as prosperous a New Year as the gravity of the times will allow.

Wm. Eric Swale,
Hon. Sec. to the Committee of
"The Technical Circle."

Ruhleben, Berlin, *December 4th*, 1915.

Decimal Coinage and the Metric System.

Your very interesting articles on the decimal system suggest the question, why has the metric system not made more progress? Probably one reason is that schoolmasters have been in the habit of getting pupils to do puzzling problems in the conversion of the metric system to the British and *vice versa*, and the pupils have got the idea that if the metric system were introduced it would be necessary to spend their time in converting kilograms to pounds and metres to feet and inches. After such a course of instruction, most pupils leave school with an aversion to the decimal system which no argument can shake.

The following examination paper, with answers, may serve to show how an intelligent pupil might be permitted to answer the examiner's posers. If answers like these procured the passing of the examination, we might expect the metric system to make rapid progress in the near future:—

Question 1.—A lady desires to buy a yard and a-half of tape. What will she ask for in the metric system, given one yard equal .9144 m.?

Answer.—She would ask for a metre and a-half.

Question 2.—A surveyor measures a piece of land and finds that it contains 4 acres 2 roods 10 perches. How will he express it in the metric system?

Answer.—He would measure it in the metric system, and so would not require conversion. Where it was necessary to do conversions like this the work would be carried out by tables.

Question 3.—A loaf of bread weighs 4 lb. 4 oz. 3 dr. What will be its weight in the metric system, given 1 oz. equal 28.34954 grams?

Answer.—The loaf will weigh about 2 kilograms.

Question 4.—A man desires a gill of lemonade. What would he ask for in the metric system, given that one pint equals .02005 cubic foot and one cubic inch equals .00001638 cubic metres?

Answer.—He would ask for a glass of lemonade, and if that did not satisfy him he would have another.

C. Turnbull.

Tynemouth Electricity Works,
December 6th, 1915.

I have read with interest some of your articles on the metric system and on decimal coinage. Though a Frenchman, I have had a good deal to do with the English systems, because I have been connected for quite a long time with English and American firms. I remember I had to check several estimates where a certain amount of metres of cable was quoted at so much £ s. d. per mile. It was no joke, and I have often thought that it would not be impossible for the English Government to adopt, at least, the decimal coinage. In fact, so far as pounds sterling and shillings, and down to the sixpence coin are concerned, the present system is almost decimal; after the sixpence coin it is not.

Let us assume, now, that the Government should decide to do away with the copper coins and to replace them by nickel coins; it would be possible to divide the shilling into 100 cents and to adopt nickel coins of, say, 25, 10, and 5 cents, similar to those used in Belgium and to those which will be used in France after the war.

The following table shows the corresponding values of cents and pence, the pence being expressed in decimal values:— .

Cents.	Pence.	Cents.	Pence.	Cents.	Pence.	Cents.	Pence.
5	.6	30	3.6	55	6.6	80	9.6
10	1.2	35	4.2	60	7.2	85	10.2
15	1.8	40	4.8	65	7.8	90	10.8
20	2.4	45	5.4	70	8.4	95	11.4
25	3	50	6	75	9	100	12

Let us suppose that the English Government made compulsory the quoting of all merchandise in shillings and cents instead of £ s. d. For the period of transition during which the copper pennies and halfpennies would be collected away, it would perhaps be necessary to mark on labels both quotations, say, for instance, 44.95s. = £2 4s. 11.4d.

On the table it can be seen that the decimals of the pennies corresponding to 5, 10, 15, etc., cents are always .6, .2, .8, .4. In order to make the exact change, it would be necessary to make two small copper coins, one of .1 of a penny and the other of .3 of a penny, which, by the way, could be marked as 2.5 cents, because with the halfpenny being equal to .5 of a penny, all the decimals of a penny shown on the table can be made: .2 = 2 coins of .1d.; .4 = 1 coin of .3d. + 1 coin of .1d., or 1 halfpenny—1 coin of .1d.; .6 = 2 coins of .3d.; .8 = 1 halfpenny + 1 coin of .3d.; other combinations are also possible.

When all the copper pennies were withdrawn from circulation, it would also be possible to withdraw the .1d. coin, which is necessary only for the period of transition; but the .3d., or 2.5 cents, could be kept as useful to quote merchandise or small value, for instance, an article sold at, say, .175 cent the lb. (* See note.)

I advocate the above decimalising of the money because English money is used only in England, and does not circulate in other countries; but I would never suggest to decimalise the English system of weights and measures, because the metric system is the only one which is easy, logical, and of almost universal use, and its adoption would help the English people and foreigners to understand each other better on all English exportation business.

* NOTE.—The making of .1d. and .3d. coins is necessary if the change must be exact. In order to avoid this double creation, another solution could be considered.

It could be decided that the farthing should be equal to .2d., instead of .25d., as at present; it can be seen from the table that it will then be possible to exchange any amount of cents for copper pence, halfpence, and farthings without making new copper coins.

This, of course, would be detrimental to the holder of farthings; but it could also be decided that, after the withdrawal of all pennies and halfpennies, the value of the farthing should be 2.5 cents, which would be a compensation.

The inconvenience of this scheme would be that the holders of farthings would keep them during the transition period in order to make a profit afterwards. That is why it will be necessary to make .25 cents new copper coins, to avoid the rarity of small coins during that period.

H. Planchon.

France, *December 4th*, 1915.

[We are very much indebted to our correspondent for his interesting letter, which explains an ingenious method of effecting the change from pence to cents. We refer to the matter in our leading columns to-day.—EDS. ELEC. REV.]

The Institution and Alien Enemy Members.

The letters regarding the above matter appearing in this valuable journal, by "Station Engineer" and "Another Station Engineer," should act as a stimulus to those members of our Institution who, apparently, do not appreciate the situation. One has only to refer to page 64 of No. 251, Vol. 54, of the *Journal*, and surely the names of those members emblazoned on the roll of honour should stir their hearts to some action. The *Journal* is read, I take it, by alien members, and it seems an insult to the memory of those members who have given their lives to be recorded in the *Journal* under such conditions.

Surely the Council realise the facts; why have they not moved in the matter long ago? One observes several military members amongst eminent men whose names are recorded on the opening pages of the "list of officers and members"; cannot they do anything to stir the life-blood of the Council to some action?

It is unnecessary to quote the feeling of members on active service in war areas, but they can be realised; and it is quite time action in some direction was taken. Cannot this question be thoroughly ventilated at the next meeting, please?

A.M.I.E.E.

B.E.F., France.

Finchley Breakdown.

In connection with your report, in last week's publication, of the interruption to the electricity supply of the Finchley Council, I beg to draw your attention to the fact that your statement of the supply being interrupted "till 8 a.m. Monday morning" is not quite complete.

The particular section from which the writer receives his supply was still interrupted on the Wednesday following, and no definite statement was then obtainable as to when supply would be resumed. As a matter of fact, the supply was resumed at 9 p.m. on the Wednesday following the breakdown of Sunday, but, in view of the great inconvenience caused to consumers, it seems desirable that some official statement should be forthcoming as to the cause of breakdown, with the object of avoiding its repetition. The average person is under the impression that modern electricity supply is reasonably reliable, assuming good design and maintenance, but this does not seem to obtain in the present case.

Consumer.

The A.E.G. Meeting.

In response to the courteous invitation of the Secretary of the Electrical Contractors' Association, I waited on him at his office. As he is a personal friend of long standing, I did not find it difficult to convince him of my *bona-fides* or the point of view from which my remarks should be taken.

As there does not now appear to be any difference of opinion as to the main question of dealing with, or buying goods from, firms of questionable standing from the enemy standpoint, the whole matter resolves itself into a very narrow compass.

The E.C.A. offers to circularise its members, and claims that by the result it would be able to refute one of my charges. Now this is entirely unnecessary, and would serve no useful or other purpose. From a list of its members I was able to see that at least 75 per cent. are well known to me. Many are old personal friends, and I do not doubt, nor have I ever doubted, that 100 per cent. of the members would give a satisfactory reply to such a question. But for a body of 10 per cent. of men, however high-standing, to claim to speak for the whole of a particular trade or industry is fatuous presumption. I have the highest respect and regard for the members of the E.C.A. as such, but it does not blind me to the obvious. I repeat that there are as nearly as possible 5,000 men or firms who do electrical contracting work in the United Kingdom. Some may do it as a separate or entire business, whilst others do it in combination with another business. But all of these are electrical contractors, and until the E.C.A. can stop these others from doing this electrical work, they will class themselves and be classed as electrical contractors.

There are quite simple means of tackling the matter in a satisfactory manner, such as would at the same time put an end to the scandal I have written you on, and some others which I could also mention, and if, as I hope and believe, the E.C.A. and the B.E.A.M.A. will put their heads together in an intelligent and trustful way, they will soon find the solution.

I admit that, even after the means are found, the task is not an easy one, and will need tact and patience, but if the general body of the E.C.A. possess these qualities to the same extent as their worthy Secretary, I have no fear of the ultimate success.

Mr. Tate will, I believe, be able to report to his Committee that my experience not only has *not* been gained amongst the "cheap and nasty" type, but, strange to say, amongst the general body of the members of the E.C.A.

Some of your correspondents have adopted the tone of "Mind your own business," or "Don't cry stinking fish." My own view is that a person who, having certain knowledge, keeps it to himself is acting selfishly to his confrères.

For some years previous to this present state, I had been warning my friends as to what, in my opinion, was coming. I was laughed at or jeered at, and many of my friends dubbed me "German mad." I am sorry to see I was right.

During the last ten years I have travelled all over the European Continent. I am well acquainted, from actual experience, with the business methods and habits of all of the countries. Without exception, the general opinion in those countries is that, during the last few years, the electrical industry in this country and her Colonies has been in the hands of the Germans, or under their influence. One does not hear opinions voiced in such widely different parts or by men of such divergent lines of thought without being deeply affected, that is, of course, if one is possessed of any love of country, people, or profession. In the last few remarks, dear Mr. Editor, I disclose to you the reasons which have impelled me to write you. I sincerely trust that in a few years I shall be able to think I was as wrong in my fears on this subject as I was right as to this present war.

I thank you for the patience with which you have borne with me, and in future I will devote my surplus energies on this subject to worrying or, perhaps, assisting the worthy Secretary of the E.C.A.

If I required any self-advertisement I should not still sign myself

Anti-Humbug.

December 9th, 1915.

With reference to the correspondence that has appeared in your journal, I wish to complete my previous letter by informing you that I have met the writer of the letters signed "Anti-Humbug," and was pleased to find that he is a gentleman extremely well known in the trade, and one who has been a personal friend of mine for over 20 years. During our conversation we found that our aims were identical, and I am pleased to say that he entirely approved of the methods under which my Executive had acted with regard to the matters under discussion. I am also pleased to state that he fully convinced me of his reasons for not at the present moment disclosing his personality, and I can only state that, should he desire to do so, the whole of the British portion of the electrical industry would agree that his position is such that his opinions would be worthy of their best consideration.

Leonard G. Tate, *Secretary,*
Electrical Contractors' Association.

London, E.C., *December 13th*, 1915.

WAR ITEMS.

Trading with the Enemy.—A Reuter dispatch from Cape Town states that the Trading with the Enemy Bill, which has now been published there, imposes seven years' imprisonment, with or without a fine, for offences committed since the beginning of the war, and provides for the inspection of the books of enemy firms. Dividends accruing to the enemy are to be paid to the Treasury, which may appoint a receiver to control any business undertaking. Enemy property and holdings of shares have to be notified to the authorities.

A Reuter dispatch from Melbourne says that a proclamation has been gazetted tightening up the provisions excluding enemy goods from Australia, both by direct and indirect importation. It is stated that drastic action is contemplated.

On December 8th, in the House of Commons, replying to a question of Sir J. Lonsdale, the Attorney-General said he thought that the decision in the Continental Tyre case, whether technically correct or not, left the law in an unsatisfactory condition. The case was being carried to the House of Lords, and a decision on the matter there would settle whether further legislation was necessary.

In the House of Commons, on December 10th, Lord Robert Cecil introduced the Trading with the Enemy (Extension) Bill, which (according to the "Financial Times") provides that His Majesty may by Proclamation prohibit all persons resident, carrying on business, or being, in the United Kingdom, from trading with any persons or bodies of persons resident or carrying on business in enemy territory, or in territory in the occupation of the enemy, wherever, by reason of the enemy nationality or enemy association of such persons or bodies of persons, it appears to His Majesty expedient so to do, and if any person acts in contravention of any such Proclamation, he shall be guilty of a misdemeanour, triable and punishable in like manner as the offence of trading with the enemy. For the purposes of the Act, a person shall be deemed to have traded with a person or body of persons to whom a Proclamation issued under the Act applies if he enters into any transaction or does any act with, to, on behalf of, or for the benefit of, such a person or body of persons, which, if entered into or done with, to, on behalf of, or for the benefit of, an enemy, would be trading with the enemy.

In the House of Lords, on 9th inst., Lord Halsbury moved the second reading of the Companies of Enemy Character Bill. This Bill provides that where it shall appear to the Attorney-General that any company registered in the United Kingdom is, owing to the character of its directors or of its shareholders, or to any other cause, of a predominantly enemy character, he shall present a petition praying that such company be declared of enemy character. His lordship said that he had introduced the Bill to check what he believed to be a gross abuse of the law, assuming the decision of the Court of Appeal in the Continental Tyre case to represent the law. He had received an extraordinary number of requests to proceed with the Bill, and undoubtedly the matter was one of great national importance. The Judicial Committee of the Privy Council should decide whether a company was of a predominantly enemy character. The Lord Chancellor, in reply, referred to the Continental Tyre case which had been the subject of consideration for upwards of twelve months, and no step had been taken until recently to bring it before the House. He agreed with Lord Halsbury that there was no reason why he should postpone any longer bringing forward a Bill to deal with that decision as it stood, but the case would now be brought before the House and every opportunity would be given for the hearing to be expedited. It was desirable to settle the law by the highest authority before any attempt was made to alter it, and in such circumstances it would be impossible for the Government to undertake to proceed with the Bill or to give it facilities in another place, but he saw no reason why it should not be read a second time. Under the present law the collection of outstanding debts by these companies was not prevented. They had the protection of the Courts, and could recover their debts, but having recovered them they could not dispose of them to any enemy alien, so that the danger they had to guard against was not imminent or grave. The position was, however, startling and undesirable, and he saw no reason why it should not be altered. Though he had no desire to oppose the second reading, and though the principle was one to which general assent might readily be accorded, he feared that there was little prospect of it becoming law, and possibly, in the circumstances, Lord Halsbury might not desire to go beyond the second reading. Lord Halsbury wished the Bill to go forward to Committee, and it was read a second time.

In the House of Commons on Monday, December 13th, Lord R. Cecil moved the second reading of the Trading with the Enemy (Extension) Bill. Lord Cecil said that the object of the Bill was to impede, if not to stop, enemy trading in neutral countries. As the law now stood it was not an offence for a British subject to treat with a German firm in a neutral country, nor was it an offence for ships to carry his goods, or for banks to manage his business. In some neutral countries, particularly in South America, German firms were doing a good trade and directly assisting the enemy, and even now, though we had swept the seas of German ships, the money which the Germans had amassed was being used to assist the belligerent purposes of the enemy. Lord Cecil said that the intricacies of modern trade were so great that we had to be extremely careful lest a blow aimed at German trade should react on British trade. The French plan was to say that birth should be the only guide as to the belligerent character of a person or firm in neutral countries, but it was doubtful whether that would be effective in the present case. A German firm could employ a neutral firm or person as its agent in a neutral country. There were some districts, however, where trade was so entirely in German hands that to cut off their trade would be to cripple British trade there. In the view of the Government the best results would ensue if they formed a black list of traders in neutral countries who were substantially enemy firms who could be cut off from British intercourse without interfering seriously with British trade. They must bear in mind the enormous importance of preserving British export. Under the Bill, which he regarded as one likely to diminish the resources of the enemy, and one which was urgently required, it was provided for the publication by Proclamation of the names of firms with which British firms ought not to deal, and the list would be added to from time to time on the advice of the people in the district and of those who understood the trade of this country. After some discussion, the Bill was read a second time. The Solicitor-General said that the Bill had been so framed that it would apply to firms in this country, but he was not sure that that was the best way of dealing with this important subject—he hoped we should find something better than that. This was not the only specific of the Government for dealing with enemy firms in this country.

After the War Problems.—In the House of Commons, on Monday, Sir E. Cornwall asked the Prime Minister whether he would appoint two or three committees of the House to consider and report on the problems which would arise after the war, more especially affecting the re-instatement of the men who had given up their positions and prospects to enlist, trade within the Empire, and trade development generally by this country and our Allies. Mr. Asquith, in reply, said that the Government were fully alive to the great importance of the economic, social, commercial, and financial problems that would arise after the war, and he was strongly of opinion that not even our preoccupation with the immediate and paramount task of ensuring victory ought to prevent us from taking measures to ensure that these problems should be carefully explored by skilled experts in advance. A great deal of preparatory investigation was already taking place, but much of it was naturally unsuited for public discussion at present. He doubted if the precise machinery suggested in the question was best suited for the purpose.

One of the most important debates that has yet taken place on after the war problems was that which was opened in the House of Lords on Tuesday by Lord Parker. The Marquess of Crewe replied showing what the Government views were, and other speakers were Lord Haldane, Lord Lansdowne, and Lord Bryce. The speeches show that our leaders and some of the existing Government Departments are fully alive to the seriousness of the questions involved, and that early action is needed. We shall refer to the matter in our next issue.

Enemy Businesses in Russia.—H.M. Commercial Attaché at Petrograd (Mr. H. Cooke) has transmitted a list of enemy companies or firms in Russia which are under compulsory liquidation in accordance with the Laws of 11th/24th January and 10th/23rd May, 1915. The former Law refers, in this connection, to commercial undertakings belonging to subjects of enemy countries, or partnerships to which enemy subjects belong, or branches of enemy companies, authorised to carry on operations in Russia. The supplementary Law of 10th/23rd May excluded from the operation of these enactments companies, etc., in which enemy subjects participated as partners, if the latter left the concern before 1st/14th April, 1915. The list of enemy companies, etc., which also contains the dates of the separate official notifications concerning claims and the address of the Board of Liquidation appointed in respect of each concern, may be consulted by British firms interested at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C. H.M. Commercial Attaché has also forwarded the names of certain enemy companies, etc., from whom authorisations to carry on operations in Russia have been withdrawn, and these names may be obtained on application to the Commercial Intelligence Branch at the above address.

Artificial Limbs for German Workers.—We have already referred to the various steps that are being taken in Germany in order to fit men injured in the war for industrial work when the great struggle of nations is over. The latest announcement in this connection is that the German Workers' Welfare Association, of Charlottenburg, Berlin, is organising an exhibition of specially-designed artificial limbs and body attachments that will enable men, although they may have lost a limb in the war, to follow their old employment in the engineering shop, the cotton mill, or as the case may be.

Recruiting Notes.—The whole of the eligibles on the staff of the Minehead Electric Supply Co., Ltd., including Mr. F. Swarbrick, the engineer and manager, have enlisted under Lord Derby's scheme.

No fewer than 24 members of the Torquay Corporation electrical staff have joined the Forces, and as only five eligible men are left, two of whom spend their spare time on munition work, the T.C. has decided to represent to the Recruiting Appeal Committee that the five men in question are indispensable for the carrying on of the undertaking.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

New CO_2 Moore Vacuum-Tube Lamp.

At a joint meeting of the American Electrochemical Society and the Illuminating Engineering Society, held at New York on November 11th, Mr. D. McF. Moore demonstrated his new carbon-dioxide vacuum-tube lamp, which employs a new principle for automatically replenishing the supply of gas within the tube as this gas is used up during the operation of the lamp.

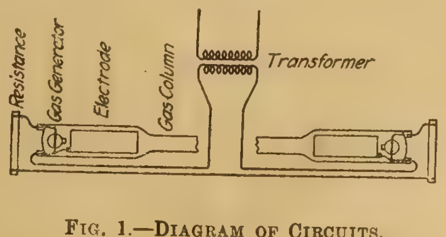


Fig. 1.—Diagram of Circuits.

This new straight-tube lamp is contained in an elongated sheet-metal case, which is provided with a screw base similar to that used on the larger sizes of incandescent lamps. Instead of the lamp being fed with CO_2 gas by means of an auto-magnetic feed valve, the gas is generated automatically within the tube itself. Near each electrode is placed a small bulb about an inch long, containing calcium carbonate, from which emanates the carbon-dioxide, CO_2, when the resistance wires embedded in it become heated to the proper degree by reason of their being connected in shunt to the gas column, as shown in the accompanying circuit

diagram. The gas column measures ⅞ in. in diameter and 1 ft. in length, and appears as a solid bar of light with an appearance of intense whiteness.

The foot-candles available near the tube total more than 200, making the apparatus suitable for the very closest colour discriminations. The degree of vacuum is automatically held within 0·001 mm. of mercury column, and the apparatus will stand wide line-voltage fluctuations without becoming disarranged in any way.

This new lamp has been found suitable for making absolutely correct colour determination, and, while it is applicable to a very wide field, it is particularly useful in enabling the dye shops of the great textile industry to run night shifts.

The Couch Autophone System.

An interesting development of automatic telephony has been brought to our notice by the Private Telephone and Electrical Co., Ltd., of 28, Great Queen Street, Kingsway, W.C., which has secured the rights for this country of the Couch Autophone system. This is an automatic telephone exchange suitable for a maximum of 100 stations, and is intended to take the place of the usual manually operated private exchange. It embodies certain features of the larger automatic telephone systems, such as the dial calling device manipulated by the user, a switchboard equipped with automatic line selectors, automatic ringing and engaged signals, &c., and the central battery, but aims to reduce the installation to its simplest terms. Thus a separate selector is provided for each line, which by one operation finds the desired line and puts the caller through, or warns him that the line is busy. Fig. 2 shows the selector with its 100 line contacts, as well as three additional points for special purposes; fig. 4 shows it without the contact ring, which is easily wired, and remains fixed in the switchboard, whilst the mechanism can be readily removed and replaced; and fig. 3 is a view from the other side, showing the relays, step-by-step pawl and ratchet mechanism, &c. The switchboards are standardised for 15, 30, 50 and 100 lines, but any less number can be supplied, and selectors can afterwards be added as desired until the full capacity of the board is reached. The selectors are mounted on vertical racks in a neat dust-proof cabinet, which also contains the battery, &c. Each station is connected to the board by three wires, and the instruments are made in desk and wall patterns; fig. 5 shows the desk type, fig. 6 the wall type, and fig. 7 the latter with the dial opened showing the simple internal mechanism.

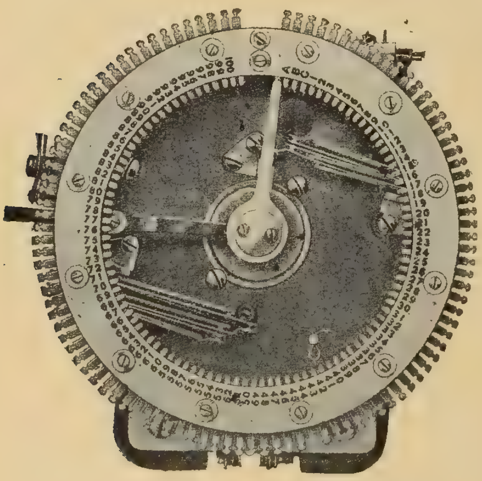


Fig. 2.—Couch Automatic Line Selector, complete

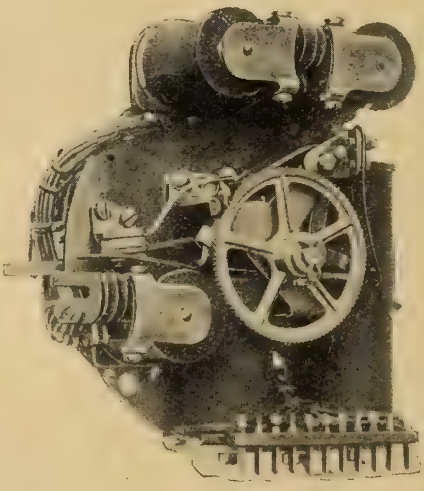


Fig. 3.—Ratchet Mechanism of Selector.

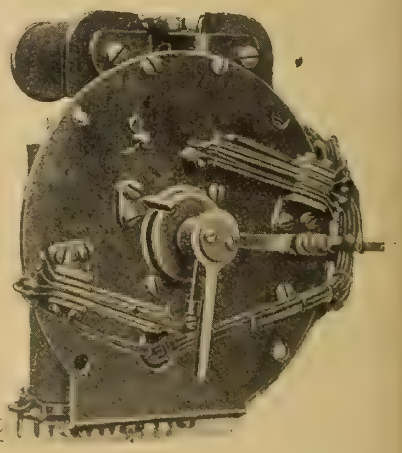


Fig. 4.—Selector removed from Wired Contact Ring

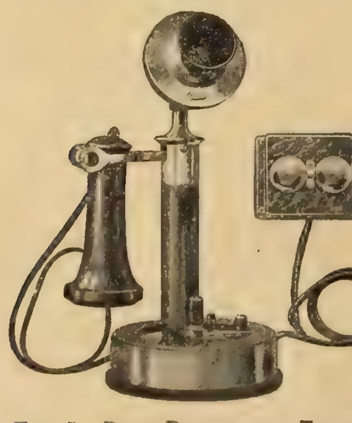
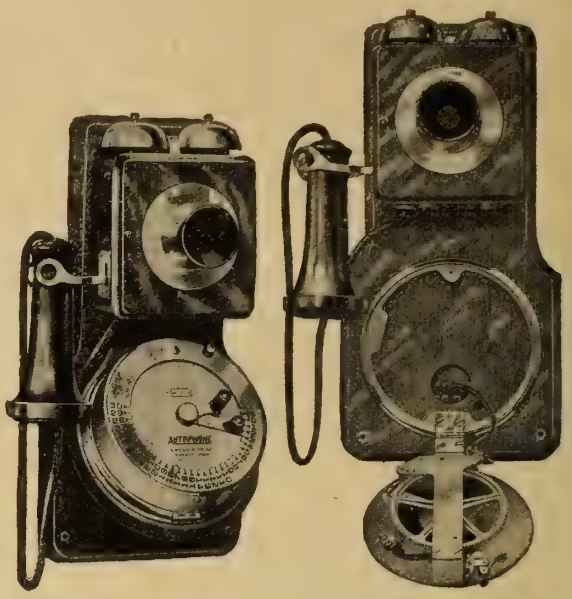


Fig. 5.—Desk Pattern of Telephone.

As compared with the manual exchange, the Couch system possesses the advantage of perfect secrecy; the moment a connection is put through, the circuit is detached from the system, and no third party can call either of the two stations concerned. There is, of course, no operator to "listen in," and no other person can overhear or interrupt the conversation. On the other hand, the person who has been called can call a third party, who will then be in direct communication with both stations, the third can call a fourth, and so on; thus a conference can be held between heads of departments, or other persons to any desired number. Another advantage is that the service is available not only during the usual working hours, but throughout the 24 hours of the day. One of the special points can be utilised to send a "general call," which is effected by means of bells situated in all the workshops, offices, &c., the ringing of which demands the attendance of the nearest official or other person at the adjoining telephone; by this means the manager for instance, whilst on a tour of the shops, can always be located and informed of urgent matters requiring his immediate attention.


Figs. 6 and 7.—Wall Pattern, Closed and Open.

The cost of the installation is necessarily greater than that of a manual exchange, but on the other hand the services of an attendant are dispensed with, secrecy is secured, a 24-hours' service is given, and there is no delay in effecting a connection; moreover there is no limit to the number of persons who may simultaneously use the system, save the full number of stations connected, and in this respect the system is superior to the ordinary automatic exchanges. The working parts being interchangeable and the operations simple, maintenance costs little and can be effected by any telephone electrician without special knowledge; the system is not experimental, having been in use in the United States for some years. We have had an opportunity of inspecting the system, and found its working all that could be desired for an intercommunication system.

Half-Watt Lanterns.

Messrs. Townshends, Ltd., of Ernest Street, Holloway Head, Birmingham, have recently introduced a number of new patterns of outdoor and indoor fittings suitable for use with half-watt lamps, of which we illustrate a couple. The reflectors are made in extensive, intensive, and focusing shapes, and the fittings are hard stove enamelled on steel or copper. Fig. 8 shows an open intensive type, and fig. 9 a type with the lamp enclosed.

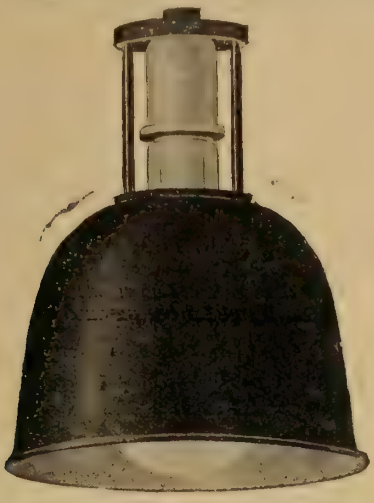


Fig. 8.—Townshend Open-Type Fitting.

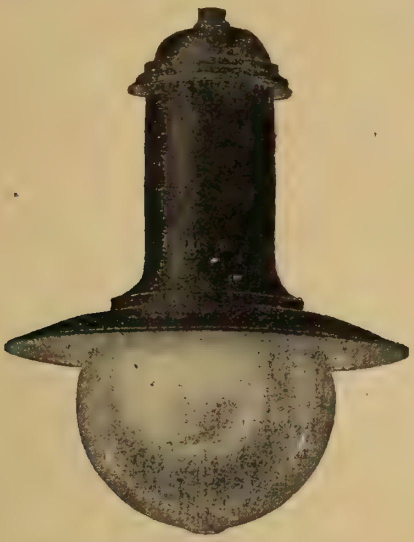


Fig. 9.—Enclosed-Type Fitting.

LEGAL.

Tramway Accident Claims.

A settlement has been effected in the Court of Session, Edinburgh, in an action in which the wife of a Glasgow engineer sued the Corporation of Glasgow for £500 damages in respect of personal injuries received on a tramcar. Payment of £100 and expenses has been made to the pursuer.

An action by a Greenock riveter, who claimed £300 damages for injuries to his child, from the Greenock and Port Glasgow Tramways Co., has also been settled, the pursuer receiving £30 and expenses.

The Mayor, &c., of West Ham, v. Hart Accumulator Co., Ltd.

In the King's Bench Division on December 9th, Mr. Justice Bailhache, sitting to take cases in the special paper, had this matter before him.

Mr. Williamson said that he appeared for the respondents, and he understood that certain terms had been agreed between the parties. The matter was one between the company and the West Ham Corporation with reference to terminals, and there had been an arbitration. He now asked his Lordship to allow the appeal with costs, and set aside the award that had been made on the terms agreed between the parties.

His Lordship said he was willing to do this if there was general agreement, but he could not very well set aside an award without knowing what it was.

Mr. Stephen Lynch, on behalf of the Corporation, said that by the new arrangement that had been made there would be no object in arguing the appeal against the arbitration award. The matter was very complicated, involving intricate points of law. A new agreement had now been arrived at. The appeal was set down a year ago, and it would be purely academic if argued now, and it would be a very long case. He asked the Court to allow the award to be set aside by consent. There had been a good deal of evidence submitted at the arbitration which was objected to.

His Lordship, by consent, set the award aside, without costs.

British Electric Traction Co., Ltd.

(Concluded from page 748.)

Mr Justice Astbury in the Chancery Division, on December 8th, decided the question which arose on a scheme of arrangement, including a reduction of capital.

His Lordship said no option was given to the holders of income certificates to receive cash or shares, the scheme involving a compulsory exchange of certificates for shares. Upon the question whether there was a real reserve fund, it appeared that the company had transferred sums amounting to £818,000 representing premiums received on shares and debentures, discount on cancelled stock, and sums transferred out of assets. Of this fund the company had written off ascertained losses on investments amounting to £336 552, and it was proposed to allocate another £124,000 towards estimated loss on capital ascertained to have taken place. There thus remained to the credit of the account the sum of £482,162. He was satisfied that this reserve fund had never been written off against investments, or the whole of it permanently applied to cover realised or estimated loss, and there was a non-capitalised fund in the company's books to that amount; but the stock market had estimated the loss at a much higher figure than ascertained by the directors because of the marked depreciation in the company's stocks. They all knew that there were many reasons to cause fluctuations on the Stock Exchange. Having gone into the evidence he was unable to come to the conclusion that the available reserve, which unquestionably had been built up out of profits, had so depreciated that the sum of £93,000 was not now available. It was a domestic matter for the directors, acting fairly and honestly by the company and having regard to its commercial interests, to allocate £93,000 of that reserve towards the capital depreciation account. The scheme, if sanctioned, would be binding on the company because the Court came to the conclusion that there was a reserve fund and that the shares would be fully paid up. He therefore sanctioned the scheme.

Upon the application of Mr. Clauson he granted the opponents of the scheme their costs.

Electrolytic Zinc for Government Supply.

A process for the production of pure zinc by electricity to meet the spelter difficulty was discussed in the Patent Courts on the 10th inst., when the Refractory Zinc Ore Treatment Co., of Devonshire Chambers, Bishopsgate, London, and New York, applied for a licence to use Patent No. 605 of 1909, belonging to Messrs. Siemens Bros., of Berlin, for a process for making anodes of massive manganese peroxide to be used in saline solutions with electricity for securing a pure form of zinc.

The application was heard by the Controller of Patents, Mr. Temple Franks, and the Deputy Controller, Sir Cornelius Dalton.

It has been found that crystalline manganese peroxide conducts the current well, and possesses the great advantage that any reduction which occurs entails only the passage of manganese ions into the solution, and these have no injurious effect on the deposition of the metal at the cathode. Under the patent, crystalline manganese peroxide, obtainable by heating manganese nitrate, is capable of being secured in massive form as a cake, and this in electrolysis is oxidised to higher stages of oxidation only very inconsiderably.

Mr. Edward Evans, for the applicants, explained that zinc ore was difficult to handle, and the applicants had in view the promotion of an undertaking (for which they would require this patent) for obtaining pure zinc by passing an electric current through a solution containing zinc ore in solution. With zinc in such urgent demand as at present, for Government and other purposes, there were considerable commercial possibilities before the scheme. It was not so long since that the Zink Gesellschaft, a powerful syndicate, cornered the ore supply in America. The price of zinc had risen since the war began from, roughly, £20 a ton to £100, and with its reduced supply, in a commercial form, owing to the lack of imports from Germany and Belgium, it was in greater demand than ever to-day for cartridge cases, shells, &c. The President of the Board of Trade and the Colonial Secretary had appointed a Special Committee to arrange an immediate scheme which should guarantee a continuous British supply, and the applicants were ready to place the results of their experiments at the disposal of that Committee. They had made experiments, in association with Messrs. Siemens, for the production of zinc by electrolysis. This electric method would be of great assistance in meeting the spelter difficulty.

Evidence was given by the applicants' technical director, Dr. P. C. C. Isherwood, chief chemist to Messrs. W. J. Bush and Co., manufacturing chemists, Hackney, who stated that Germany had made half a million tons of zinc annually from ore imported from Australia. Applicants were ready to pay 5 per cent. on the anodes manufactured. They preferred to pay the royalty in that form rather than on the zinc recovery. An anode might last a twelvemonth, and 20 000 would be required for a fairly large electrolytic installation.

Mr. Burton, for the opponents, insisted that as an anode might vary in size from a rod as small as a lead pencil to a plate as big as a blackboard, that was not the fair way of estimating royalty. The royalty should be upon the output—on what the patented process enabled them to obtain.

Dr Isherwood said the firm proposed to begin with a unit yielding 10 tons a day. As the need arose they could increase the units. They were entitled to have taken into account the experimental work they had conducted in order to apply the process to zinc. Messrs. Siemens recognised its value, and had offered to make them an equivalent reward. An anode cost, perhaps, 8s. or

9s., and if the royalty was to appear as a permanent and substantial tax on the undertaking, it would jeopardise at the outset the promotion of the company. It would be necessary to have a separate factory for making anodes, possibly under a subsidiary company. The initial step was to secure the Board of Trade's licence. Other lincenses had yet to be asked for—2,767 of 1915, and 15,128 of 1911. One of the patents taken out was the result of witness's own experiments. They received some time ago a licence from Messrs. Siemens for experimental purposes, and conducted these experiments at works at Mitcham, in Surrey. That investigation was done on an undertaking that they should supply the results to Messrs. Siemens, and with that condition they had complied. That arrangement with Messrs. Siemens came to an end before the war.

The Controller asked whether there was any obstacle in the freights from Australia, whence the ore must come.

Dr. Isherwood replied that with the ore at £80 a ton the freights were not prohibitive, and Germany had, of course, imported from Australia. Every ounce of zinc made in England came from imported ore. The demand at the moment was great. It would lie with the Government Committee to say whether they desired the applicants to obtain zinc by this method; it would not be possible now to promote a company to manufacture zinc without Treasury sanction. The applicants were the only people who knew how to make these anodes; they had actually done more work upon them than Messrs. Siemens had. The initial plant, if the Committee favoured the project, would be very expensive, and they would not be able to get to work for six months. It should be remembered, when the question of royalty was considered, that the process was mainly electrical, and the patent applied only to the anode, which was produced from the nitrate in a pan at baking heat. Applicants already had antecedent processes for treating the ore. They had a plant running for 12 months in America, but the price of zinc was not particularly good, and there was the trouble of the ore supply because of the Zink Gesellschaft's corner. Dr. Isherwood added that the zinc made electrolytically by his process was particularly suitable for all the present demands, as it came out absolutely pure. When they experimented at Mitcham they paid Messrs. Siemens a royalty of 4 marks per ton of electrolytic zinc obtained. They had the option of compounding the royalties by a lump sum, to be estimated on five years' output of 300 working days, without deducting the ton royalties already paid. Their relations with Messrs. Siemens came to an end while they were discussing the joint use of the witness's and Siemens's processes. Applicants preferred to manufacture in this country, because of the zinc shortage here.

The Controller said zinc was badly needed in England, and he should recommend that a licence be granted by the Board of Trade to the applicants, to get to work on the production of zinc at the earliest possible moment.

Vandervell *v.* A. P. Lundberg & Sons.

Judgment was delivered on Friday, December 4th, by Mr. Justice Younger, in the Chancery Division, in this action, the trial of which was reported in our issue of December 3rd.

His Lordship said the defendants had put up three defences to the plaintiff's claim. First, they said that the design was not new or original; secondly, that the numbers of the registered design had been used by the plaintiff upon switch boxes which were not covered by the protection afforded by the registration, and, therefore, the plaintiff had forfeited any right to obtain protection for the design at the hands of the Court; and the defendants lastly said that, in any case, they had not infringed the design. At the time of this registration the rules did not require, and the plaintiff, in fact, did not specify, the particulars in which his design was new and original, beyond the statement that they were switch boxes for use in electric installations, and were particularly adapted for motor-cars. The design showed a base with a particular sloping top surrounded by a beading, but it also dealt with the representation of push plugs between rows of switches, six in number, set in a plate of metal or some other substance. Two dials were also shown, and the plugs for attaching the electric connection were shown at the bottom right-hand side of the box. The plaintiff's contention with regard to the design was that it was a design for the whole structure, and not for any separate property. So far this claim that the design was novel and original was strongly supported, but looked at in that way the defendants' design was not an infringement of it. It did not resemble the plaintiff's design in that sense. But the plaintiff said the defendants had taken novel features in their design. The defendants had, as the plaintiff had, their switches arranged in a row, and six in number. Then the two dials were arranged in the sloping top of the box, which was said to be very essential to switch-boxes for motor-cars. But the registered design was not limited to switch-boxes for motor-cars. Now he thought the law was quite clear, and unless the plaintiff could get novelty and originality by taking the design as a whole, their claim failed. It was admitted that similar shaped boxes had been made and used before, and there was no novelty in, or infringement of, the design as a whole in respect of shape. He could not hold that there was anything novel or original in the number of switches so as to entitle the plaintiff to protection on that ground. With regard to the position of the switches, he could not hold that there was such a modicum of novelty and originality as would by itself justify a claim for protection, nor would it justify a claim for a combination, everything else of which was old, just because of this one novelty. He did not think, therefore, the plaintiff could justify a claim for originality at all and, on the whole, he must hold that there was not sufficient novelty and originality in this design to entitle it to be registered. To his mind there was a much broader ground on which the claim of the plaintiff ought to be rejected. As he had pointed out, this was a design for a switch-box not for a switchboard inside the box. No claim was made for the design of the switchboard, or its arrangement. He found in the plaintiff's 1910 catalogue that this was a switchboard which contained many novel features, and had been made the subject of a patent. That patent was taken out in 1909 before the switch-box was registered as a design. The design was for the box and not for the switchboard already patented. The box was designed for the board and not the board for the box. The plaintiff now claimed as part of the design of the box, a feature which was part of the board. The plaintiff was endeavouring to obtain for the switch-box an implied protection which he, as patentee, was entitled to for the switchboard. To his mind it would be a most dangerous thing to extend the scope of the Designs Act to such a claim, and if there was no other defence the objection would be fatal. Having regard to his decision on the first point, he did not think it necessary to express any opinion on the questions of forfeiture or infringement. The action would be dismissed with costs.

Wynstanley *v.* Macartney, McElroy & Co., Ltd.

Before Mr. Justice Scrutton, in the King's Bench Division, on Monday, plaintiff, May Octavia Wynstanley, claimed damages for wrongful dismissal from the post of secretary of the company; she also claimed declarations that she was the holder of 30 fully-paid £10 shares in the company, and was still secretary of the company. An injunction and damages were claimed. According to Counsel's statement, she was engaged in 1912 by the chairman of the company, Mr. J. F. Macartney, as a typist, and to teach him English grammar, spelling, &c. Mr. Macartney died in 1913, and his two sons, aged 16 and 12 respectively, were appointed directors. She was appointed a director in the month following Mr. Macartney's death, and by resolutions passed in 1915 by the two directors mentioned above, she was, she said, ousted from her position. The defendant company made a counterclaim, alleging misfeasance on the part of the plaintiff, by wrongfully converting to her own use shares which belonged to the company, and they claimed the repayment of the moneys and the transfer of the shares. They said that she was dismissed on account of grave breaches of duty, including the wrongful obtaining of certain moneys and the conversion to her own use of shares in the Malta Tramways Co., Ltd. The plaintiff said that sums of money were voted to herself and one of the directors at 5 per cent. until the proving of the will of the late Mr. Macartney, and the moneys referred to by the defendants were part of these amounts.

The hearing was adjourned until yesterday.

Osram Lamp Works, Ltd., *v.* Pope's Electric Lamp Co., Ltd.

Judgment was delivered on Wednesday, December 15th, in the plaintiffs' appeal in this action, when the appeal was dismissed.

BUSINESS NOTES.

Bankruptcy Proceedings. — J. W. Dewhurst, electrical engineer, late of 52, Northend Road, Fulham.—The public examination was held on December 8th, before Mr. Registrar Hope, at the London Bankruptcy Court. The accounts showed liabilities £152, and assets valued at £24. The debtor stated that prior to August, 1912, he was employed by his father in the above business, but then took it over and paid him £38 by monthly instalments of £1 each for the stock, tools and fixtures. He continued the business until the end of October, and then having no work in hand and no funds he closed it. Witness attributed his failure to a decline in the business since the outbreak of the war. The examination was concluded.

G. J. T. J. Parfitt, consulting electrical engineer, Keynsham, near Bristol.—A first and final dividend of 6½d. in the £ is payable on December 13th.

J. P. K. Clark (lately trading as G. Driver & Son), electrical and mechanical engineer, Hythe Road, Willesden Junction.—Application for debtor's discharge is to be heard on January 12th, at Carey Street, W.C.

Herbert Page (trading as Smeeton & Page), electrical engineer, 63, Queen Victoria Street, E.C.—Application for debtor's discharge is to be heard on January 11th, at Carey Street, W.C.

C. H. Pearson (Pearson & Co., and B.O.A. Engineering Co.), electrical, &c., engineer, Manchester.—Second and final dividend of 1s. 2d. in the £, payable December 21st, at 27, Brazennose Street, Manchester.

New Lamp Factories in Spain.—In Madrid two new factories for the manufacture of tungsten lamps are about to be started. One, apparently a German undertaking, is associated with the names of Maximos Schultz and Paul Kissted. Twenty-eight electromotors, of a total capacity of 99 H.P., are comprised in the machinery equipment. The other factory is to be established by the Franciso Perez e Lijos Sociedad en Commandita.

At Valencia is to be set up the manufacture of electric lamp bulbs by Olegario Masset, the concern, like the two above-named, being started under the protection of the Ministerio de Hacienda and the new scheme for stimulating the development of the national industries.

Dissolutions and Liquidations.—The Renew Electric Lamp Co., Ltd.—This company is winding up voluntarily with Mr. J. E. Percival, 6, Old Jewry, E.C., as liquidator. A meeting of creditors is being held to-day at the address stated.

Allan & Co., electric lighting and power engineers, 27, Endell Street, Long Acre, London.—Messrs. F. Niemeyer and T. W. Allan have dissolved partnership. Mr. Allan attends to debts, &c., and will continue the business as Allan & Co.

Wm. Sanders & Co., electrical engineers, Ridding Lane, Wednesbury.—Messrs. W. Sanders (who died on February 16th, 1915) W. Preston, and E. J. Selby, have dissolved partnership. Mr. Selby now retires. Mr. Preston attends to debts, and will continue the business under the same name.

Trade Announcements.—The Manchester Engineering Supplies Co., 45a, Market Street, Manchester, want up-to-date catalogues and price lists from manufacturers.

Messrs. Henry Faija & Co., Portland Cement Testing Works and Chemical Laboratories are removing on December 25th to 6, Earl Street, Westminster, S.W., where they have taken larger laboratories, the lease of their old premises (occupied by them for 35 years) having expired.

The Electrical Supplies Co. have moved to 233, Tottenham Court Road, London, W.C. New telephone numbers: "Museum 2516-2517." Telegraphic address: "Elecsplico, Ox. London."

Messrs. Ship Carbons, Ltd., have removed to 5, Chancery Lane, London, W.C. Telephone: Holborn 2367.

The British Trade Outlook.—We have received a pamphlet entitled "The New Outlook in Britannic Affairs," by Ben. H. Morgan, the contents being a reprint of an address delivered by the author on December 6th, before the Bristol Branch of the Royal Colonial Institute. The necessity for stimulating our export trade is referred to, the writer suggesting that one of the first things that the Government should do is to organise and stimulate production for that purpose. He says that the business of manufacturing exporters to-day is in a chaotic condition, and cites the case of a firm employing 12,000 hands which has on its books between £300,000 and £400,000 worth of export orders which it cannot execute, because its entire resources are devoted to turning out munitions. All the leading export manufacturing firms, he suggests, could be Government controlled, as in the case of munitions firms, and excess profits could be appropriated for war purposes. The question of preference in overseas purchases is discussed, and a Britannic Commercial Union is suggested. Mr. Morgan advocates a Government policy of requiring that all our Government and public departments shall place their orders with British firms, excepting where it is "inconsistent with the public good," a wide term which opens the door to many expressions of opinion. Transportation problems are briefly referred to, as is also the need for a British Empire mark of origin. In conclusion, Mr, Morgan expresses the view that in our export commerce in future great combinations will have to be met by great combinations of our own. "Manufacturers will have to syndicate their goods, and banking houses must take a broader view of their functions, and support the enterprises of manufacturers and traders." He says that the prejudice that exists in this country against large combinations or "trusts" will not diminish unless we are guided by a strong national policy, having for its object "not only the promotion of Empire industry and trade, but the maintenance of safeguards against the improper use of the great forces which we seek to create."

Book Notices.—"How to Make Low-Pressure Transformers." By Prof. F. E. Austin. Price in U.S.A., $1.10. "Directions for Designing, Making and Operating High-Pressure Transformers." By Prof. F. E. Austin. Hanover, N.H., U.S.A.: From the Author. Price in U.S.A., $2.

"The Central." Vol. XII. September, 1915. No. 37. London: The Central Technical College. Price 1s. 6d.

"*Mechanical World* Pocket Diary and Year Book for 1916." Manchester: Emmott & Co., Ltd. Price 6d. net.

For Sale.—The liquidator of "The Checkogram" is offering for sale the patents and stock, &c., of the business. Manchester Corporation is inviting tenders for the purchase of one 2,500-H.P. Yates & Thom engine and 1,500-kw. three-phase alternator, now at work at Stuart Street. Information will be found in our advertisement pages to-day.

Catalogues and Lists.—Messrs. David Rowell & Co., Ltd., 33, Old Queen Street, S.W.—Twenty-four-page illustrated price list of wire and other fencing, staircases and landings, principals for roof work, iron and timber buildings, factory buildings and workshops, and so forth.

The *Chemical Trade Journal* has issued its usual wall calendar, with monthly sheets for next year.

The Foster Engineering Co., Ltd., Wimbledon.—Circular No. 140 gives prices of Foster wire-drawn lamps for from 20 to 260 volts, and from 4 to 270 C.P.

Messrs. James McMillan & Co., Clun House, Surrey Street, Strand, London, W.C.—Sixteen-page catalogue, giving brief descriptive information, excellent illustrations, and, in some cases, prices, of portable military and rifle-range telephones, including portable magneto telephones, portable battery telephones, rifle-range telephones, and accessories.

The Bastian Electric Heating Syndicate, of 185, Wardour Street, W., has prepared a handy celluloid measure (English and metric), which can be used either as a book-marker or as a paper-knife, and which, by means of a revolving disk arrangement, gives a calendar for from 1907 to 1927.

Fire.—As reports have been circulated that the fire at the Edison & Swan Co.'s works at Ponder's End was very serious, we have pleasure in stating the actual facts. On Saturday last a fire broke out in the joiners' shop, an extensive building of two floors, employing nearly 90 hands. The fire did not spread, but was confined entirely to that department. The self-contained nature of the Ediswan works enabled things to be set going by Monday morning when work was resumed.

Electric Cooking Installation.—The Jackson Electric Stove Co., Ltd., has obtained an order for fitting up an electric cooking installation at the new Phœnix Assurance Buildings in King William Street, E.C. It will consist of large ovens, boiling pans, hotplates, fish boilers and fryers, hot cupboard, grills, &c.

LIGHTING AND POWER NOTES.

Aberdeen.—New Plant.—Mr. Bell, the city electrical engineer, recently submitted a proposal, which was adopted by the Electricity Committee, for extending the generating plant, at a cost of £21,175. In his report Mr. Bell pointed out that the plant consisted of 4,000 kw. of A.C. and 4,380 kw. of D.C. machinery, which in view of the increasing demand was insufficient. In particular this referred to the A.C. supply which depended on the 3,000-kw. set not being rendered inoperative for any time in the winter months. This set Mr. Bell reported had up to a recent date generated 19 million units; in 20 months it had saved after paying all capital charges, £2,490, and would with the present coal prices, pay for itself in another 18 months. He recommended that a 5,000-kw. turbo-alternator, with condensing plant, switchgear, &c., and a 1,000-kw. motor-converter with switchgear, be obtained. The recommendation of the Committee was, however, rejected by the T.C. at its meeting on December 6th, by 17 votes to 14.

Ashton-under-Lyne.—The electrical engineer having reported difficulty in maintaining supplies, a Sub-Committee is to consider the desirability of using a railway siding near the works, the erection of a conveyor, and the purchase of a motor wagon. It has been decided that power accounts of £10 per month and over be collected monthly instead of quarterly.

Atherton.—Price Increase.—The South Lancashire Tramways Co. has notified the U.D.C. that in consequence of the increased cost of coal, the price charged to the Council for electricity supplied during the year commencing January 1st, 1916, will be increased ·1d. per unit.

Australia.—The Melbourne City Council has concluded an agreement with the Melbourne, Brunswick and Coburg Tramway Trust for the supply of electric current for a period of five years; the price to be paid by the Trust is £5 per annum for each kw. of demand and 0·65d. per unit for current supply.

The city electrical engineer is to visit Sydney in connection with the formulation by the Federal Council of the Electrical Association of Australia, of a uniform set of conditions of contract for public tender.

The Shire Council of Upper Yarra (Vic.) has applied for an Order-in-Council to supply electricity to the townships of Warburton, Millgrove, West Warburton, and Yarra Junction.—*Tenders.*

Bolton.—Proposed Loan.—Sanction is to be asked by the T.C. to the borrowing of £2,215 for mains and transforming plant.

Burton-on-Trent.—Proposed Loan.—The T.C. has decided to apply for sanction to borrow £3,500 for cables, in accordance with the recommendation of the Electricity Committee.

Continental.—Russia.—A group of contractors has submitted to the T.C. of Rostoff on the Don a proposition to erect a third electrical station on a concession basis, including the Council as a shareholder. A committee of the town engineers is examining the proposition.

The Tabreez Government has approved the project of an electrical station to be erected in Alupka, besides a system of electrical distribution for Alupka, Sara, Mischora and Simeisa.

The Belgian Company, of Simferopol, in agreement with the management of the Simferopol Railway Station, is negotiating with a view to introducing electric current for lighting the station, and at the same time, the Gorodetz Factory.

As the Chabarovsk electricity station is over-loaded, and can only deliver current to the garrison buildings, &c., for limited periods in the evening, it is proposed to install a separate electric station for the use of the military department.

The Mozyr (Minsk Government) Council proposes to grant a concession to Messrs. Mikulitzky & Smolyansky for the installation of an electric lighting system in the town.

The Government of the town of Vitebsk has received notice from the Minister of the Interior, of the approval of the decision of the Vitebsk T.C. to establish as a share company, the "Vitebsk Tramways" concession for the construction and exploitation in the town of Vitebsk of electric light, and of the conditions attached thereto as approved by the Vitebsk T.C. for the concession.

Chesterfield.—Plant Extensions.—The T.C. is recommended to couple a 400-kw. d.c. generator, which is being displaced by an alternator, to an a c. motor, in order to give additional plant capacity, at an estimated cost of £1,800. It is also proposed to equip four additional boilers with coke-breeze burning apparatus, at a cost of £219.

Darlington.—Loan Sanction.—The Corporation has received the sanction of the L G.B. to the borrowing of £15,600 for new plant. Of this amount, £12,800 is required for a turbo-generator, condensing plant, &c., switchboard and cables, and £2,800 for a mechanical coal-handling plant. The tender of Messrs. Fraser and Chalmers for a 3,000-kw. turbo-alternator has been accepted.

Dover.—A loan of £157,519 to the Corporation Electricity Committee by the Trustees of Greenwich Hospital, is due for repayment next May, and the Committee has been informed that the Trustees have been recommended not to renew the loan at 4 per cent. Negotiations for the renewal are proceeding.

Downham Market.—E.L. Scheme.—The U.D.C. has offered to discuss with Mr. C. H. Best, of Bradford, a scheme of E.L. for the town, on the distinct understanding that the Council will not incur any pecuniary liability.

Ellesmere Port.—Prov. Order.—The B. of T. has informed the U.D C. that it is not prepared to grant the Council a prov. order for E.L. unless some urgent reasons are adduced.

Fakenham.—E L. Scheme.—The P.C. has decided not to consider the question of electric lighting during the war.

Folkestone.—Street Lighting.—Owing to the lighting restrictions, the Electricity Co. has made a further reduction in the Corporation street lighting account at the rate of £72 per quarter in addition to the rebate of £112 per quarter allowed when the lighting was first reduced. This has been accepted by the T.C.

Gillingham (Kent).—Price Increase.—The T.C. has decided, owing to the increased cost of fuel, &c., to add to each account for current 10 per cent., and to ask the other consumers having contracts whether they are prepared to pay the increase.

Hertford.—New showroom premises in the town have been opened by the North Metropolitan Electric Power Distribution Co., Ltd.

Heywood.—Price Increase.—The charges for electrical energy are to be increased as from January 1st, 1916, by 5 per cent. for lighting purposes, and 10 per cent. for power purposes.

Keighley.—Water Pumping.—The Corporation has decided to put down plant, including a motor to cost about £100, for pumping water from a well belonging to Fleece Mills Co., into Black Hill reservoir.

Kilmarnock.—Year's Working.—During the year ended May 15th last, the Council's electrical undertaking sold 2,681,607 units, being a small increase on the previous year. The net profit on the undertaking was £3 726 against £3 825 in the previous year. The generating plant capacity now amounts to 3,030 kw.; 800 kw. of rotary sub-station plant and 1,315 k.v.a. of transformer sub-stations are supplied, and 18½ miles of 11,000-volt overhead lines are in use. In the Kilmarnock area 2,558 h.p. of motors, and in the outer area 1,570 h.p. of motors—a total of 4,128 h.p.—are supplied. The total working costs amounted to ·512d. per unit sold, coal costing ·157d. per unit, with coal at 4s. 2d. per ton.

Kingston-on-Thames.—L.G.B. Inquiry.—An inquiry was to be held during the week into the application by the T.C. for sanction to a loan of £16,792 for the electricity undertaking.

Llanelly.—Street Lighting.—The Council has decided, by 9 votes to 3, to substitute small lamps for street arcs during the period of the war.

London.—School Lighting.—In July, 1914, the London Education Committee accepted the tender of Messrs. Turnham & Co., at £1,050, for installing electric light, bells and telephones in the Furzedown Training College and Hostels, Wandsworth. The contractors have now submitted a claim for £38 13s. in respect of the increased cost of the work, which the Committee has agreed to pay. A three-story building for boys, girls and infants and a separate boys' school have been erected in Vallance Road, Whitechapel, and the wiring has been completed. As a result of negotiations, the Stepney B.C. is now prepared to lay the services, on the understanding that the cost is borne in the first instance by the Council, to be refunded on the termination of the war.

It was reported at last week's meeting of the Lambeth B.C. that the South London Electric Supply Corporation, Ltd., had given notice to its consumers that an addition of 9 per cent. will be made to the charges for current supplied, as from the date of the December meter readings.

The Metropolitan Water Board proposes to enter into an agreement with the Battersea B.C. for the supply to the Battersea station of current at 1d. per unit for power and 3½d. per unit for lighting, plus a temporary increase of 10 per cent.

Islington.—The L.C.C. has sanctioned the borrowing by the B.C. of an amount not exceeding £5,455 for electricity mains within the borough.

Hospital Lighting.—As the result of negotiations the Metropolitan Asylums Board proposes to enter into a new agreement with the South London Electric Supply Corporation, for the supply of electricity to the South-Western Hospital and Ambulance Station. The agreement is to be for a period of seven years from October 1st last, and at the following scale of charges:—For the first 12,500 units per annum 4½d. per unit, in excess 2d. per unit, the Board undertaking to take at least 20,000 units for lighting each year. For power, heating, and cooking a flat rate of 1½d. per unit.

St. Pancras.—The Finance Committee has had under consideration a letter received from the Comptroller of the L.C.C., relative to the sanction asked to the borrowing of £13,000 in connection with the King's Road electricity extension. While it appears the L C.C. Finance Sub-Committee is under the impression that the first two boilers cannot be obtained owing to the war, and, therefore, it would be unnecessary to proceed with the buildings to accommodate them, the British Niclausse Boiler Co. offers delivery of the boilers by autumn, next year. In view of this it is proposed to renew the application to the L.C.C., and to inform the Boiler Co. as to the course of events, with a view to installing the boilers by the specified dates. The Ecclesiastical Commissioners have agreed to advance the loan required for the boilers, the option expiring on March 25th next.

Hampstead.—A small fire occurred at the Council's generating station on Wednesday night, resulting in damage to machinery and switchgear, and a 20 minutes' failure in the supply.

Loftus-in-Cleveland.—Street Lighting.—The Council has decided to make a grant to Messrs. Pease & Partners, Ltd., who were responsible for the electric lighting in the district, on account of the reduced revenue consequent upon the lighting restrictions. Taking a basis of £200 for the full year, the firm will be apportioned a sum according to the number of times the lamps have not been lighted.

Loughborough.—Half-Year's Accounts.—Ald. Bumpus, in reviewing the work of the electricity department for the half-year, mentioned that there was a large increase in output of energy, mostly for power purposes. The lighting receipts were slightly decreased, but the gross profit was £878, as compared with £517 a year ago.

Manchester.—New Plant.—Owing to the increasing demand for electricity and the impossibility of completing any part of the new Barton power station in the required time, the Electricity Committee proposes to temporarily install one of the 15,000-kw. generating sets intended for the Barton power station, at the existing Stuart Street station, making room therein by removing a generating set of 3,750 kw., which is some 11 or 12 years' old.

Morley.—New Plant Proposals.—The electrical engineer (Mr. J. E. Ellis) has reported to the T.C. that owing to the increase in load on the generating station, the margin of reserve plant is becoming exhausted, and new plant should be obtained, to be in working order by September next. He adds that, from the standpoint of efficiency alone, up-to-date plant could be obtained that would generate current at one-half of the cost of generating with the present plant. The Electricity Committee has, however, decided that it cannot carry out the work, which would probably cost £2,000.

Newcastle (Co. Down).—The manager of the Electric Light Co., in response to the Urban Council's request, states that, owing to the high cost of materials, it is impossible for the company to install electricity in workmen's houses in the town at present.

Nuneaton.—The L.G.B. has intimated in reference to the Council's application for sanction to the raising of a loan of £10,000 for electrical extensions, that it would not take exception to the Council entering into contracts for the plant.

Redditch.—Proposed Loan.—The U.D.C. has decided to borrow a further £12,542 in connection with the reconstruction of the electricity undertaking. The original estimate of the cost of the scheme was £28,000, of which £25,000 has already been borrowed. With the present application the total cost is increased to £38,127.

Rotherham.—New Plant.—The T.C. has been authorised to purchase a 5,000-kw. turbo-alternator from the British Westinghouse Co.

Sheffield.—Proposed Loan.—Application is to be made to the L.G.B. for sanction to the borrowing of £137,104 for the provision of an additional turbo-alternator, with necessary boilers and auxiliary plant, at the Neepsend power station.

Stretford.—The U.D.C. is recommended to reappoint Mr. Thos. L. Miller as consulting engineer in connection with the electrical undertaking, for a further period of 12 months, at a fee of 25 guineas.

Torquay.—The T.C. has decided that the Tramway Co. be asked to pay an additional ¼d. per unit for traction current supplied.

West Ham.—The electrical engineer has reported in detail on the existing arrangements for the supply of feed and make-up water at the generating station, and has submitted estimates for extensions and alterations which were provided for in a past loan sanction. This work is estimated to cost £1,350; the unexpended balance of the loan sanctioned is, approximately, £1,100, and the balance of £250 will be defrayed, if necessary, out of current revenue.

Walsall.—In a recent report by the Electricity Committee, attention was drawn to the serious increase in coal consumption at the electricity works. This position had been anticipated, in view of the necessity of bringing into use old and inefficient machinery, owing to the backward condition of the new works, which, it was expected, would be in use this winter.

The Electricity Committee has agreed to reduce by 25 per cent. the charge to the Property Committee for lighting the lamps outside the Council House.

West Bromwich.—Price Increase.—The Electricity Committee recommends the T.C. to increase the price of energy to ordinary power consumers by 15 per cent.

Whitehaven.—A Sub-Committee of the Corporation Lighting Committee has been appointed to go into the question of the general working conditions at the electricity station, and present a report. It is considered that additional plant may be necessary in the near future.

Wigan.—According to the *Wigan Examiner*, a lengthy discussion recently took place on a breakdown at the electricity works, where, on a certain Saturday night, it appears that seven boilers of the eight installed were out of service on account of burst tubes. The boilers in question, mostly old ones, have been forced for some time, and two new Stirling boilers are on order to assist matters; the condition of the boilers is attributed to the indifferent water supply, to improve which water softening plant has been installed, but with poor success owing to the erratic character of the water.

Wolverhampton.—The B. of T. has granted permission to the Corporation to supply energy to the Sewage Outfall Works at Barnhurst.

Worcester.—The borough electrical engineer has been authorised to fix a new switch panel at the Hylton Road station at an estimated cost of £32.

Wrexham.—Prov. Order.—On account of conditions arising out of the war, the T.C. has decided to defer for the present the application for a prov. order extending the area of supply into the rural district.

TRAMWAY and RAILWAY NOTES.

Bingley.—Tramway Extension.—The U.D.C. has applied to the B. of T. for an extension of time from February 7th, 1916, to a year after the termination of the war, for the completion of the new tramway from the terminus at Crossflats to the Council's boundary adjoining the area of the Keighley R.D.C.

Birmingham.—The Tramways Committee has decided, in view of the strenuous traffic conditions prevailing, to shut down the tramway and 'bus services on Christmas day in order to give the employés a rest.

Bournemouth.—Tramway Reconstruction.—The T.C. has decided, subject to the consent of the Treasury, if it be necessary, to borrow temporarily by loan from the bankers, and afterwards by mortgage on the rates, £6,000 for the reconstruction of a portion of the tramway track between the town and Poole at Constitution Hill. The B. of T. has raised no objection to the project.

Continental.—Russia.—At a recent meeting of the Karkoff T.C., a proposition of the General Electrical Co. respecting the sale of land, &c., was accepted. After explaining the terms of the bargain, the notice states that the Russian General Electrical Co. has undertaken to introduce, on account of the town, a tramway line, beginning from the Petinsk line, and running to the recently-acquired property. The cost will be paid off in three years in equal sums; the company is to begin construction at once. The town will supply the company with power at 5¼ farthings per kw.-hour.

Darwen.—The General Purposes Committee has declined an application by tramway employés for an advance in wages.

Lanarkshire.—An arrangement has been made whereby the possibility of the County Council acquiring the tramway system will be kept open till after the war.

Leyton.—Female Conductors.—The U.D.C. has decided to train female conductors for the tramways, preference to be given, except in special circumstances, to single women or widows. During training they will receive 12s. 6d. per week, and afterwards a wage of 7½d. per hour.

London. — Vehicle Battery Maintenance. — The Metropolitan Asylums Board proposes to enter into an agreement with the Tudor Accumulator Co., for the maintenance of the battery of the new 30-cwt. electric vehicle at Queen Mary's Hospital. The agreement is for five years, the amount charged per mile run being 1½d.

Northampton.—Female Conductors.—The T.C. has decided to train some female conductors for the tramcars, and to pay them the same wage as received by men.

Sheffield.—The City Council has confirmed the Tramways Committee's proposal to suspend the tramway service on the Sunday following Christmas Day. Sir William Clegg, the chairman of the Committee, said it recognised that the proposal was somewhat drastic. There were now 400 women in the employment of the department, and the number was rapidly increasing. The number of passengers carried per day was 350,000, and the excess per week, compared with last year, was about the same figure. They were running between 1,100 and 1,200 miles more than in the corresponding period last year. Each evening they had to turn out over 100 part-day or special cars to meet the increased traffic. They anticipated that in the week before Christmas the staff would be overwhelmed, and he was quite sure that unless advantage could be taken of the special circumstances, the time would come when they would break down physically.

TELEGRAPH and TELEPHONE NOTES.

Cable Censorship.—It was announced on Monday last that censorship by the Press Bureau, on behalf of the Foreign Office, would be suspended from December 20th; the responsibility for matter telegraphed abroad would rest with the senders of the telegrams, but the censorship of Press telegrams from one foreign country to another over British cables would remain unaltered. The censorship of naval or military matter will continue as before.

Illicit Wireless. — The wireless apparatus on the German steamer *Bulgaria*, which is interned in the harbour of Baltimore, U.S.A., has been sealed by order of the United States Government, owing to charges that messages have been sent and received by it recently.

Russia.—The chief Department of Posts and Telegraphs has allocated a sum of 100,000 roubles for converting the overhead telephone system of the Saratoff district into an underground one. The work will begin in the spring; in the meantime the necessary material will be prepared.

Until now, between Tomsk and Omsk there has only been one telegraph line, which has proved altogether insufficient; to relieve this line, a supplementary line *viâ* Novo-Nikolaievsk-Omsk has now been installed.

The Poltava Government is asking the Ministry of the Interior for permission to construct a telephone line from Poltava to Kremenchy. The work will be started immediately.

Submarine Detectors.—In the *Scientific American* of October 16th, it was stated that a means had been found for detecting the approach of submarine vessels at a great distance, with the aid of Mr. W. Dubilier, whose name is known in connection with wireless telegraphy. It was not difficult to detect the sound of propellers by means of submerged microphones, but these sounds could not be distinguished from those emitted by the propellers of surface vessels. However, after numerous experiments, a characteristic sound associated only with the propellers of submarine vessels was identified, and eventually methods of filtering out other sounds were developed, while the sensibility of the receiving apparatus was increased by means of the De Forest amplifier, so that it became possible to detect the approach of a submarine at a distance of over 50 miles; the employment of a number of microphones arranged so as to possess maximum sensibility in particular directions enabled the direction of the submarine to be discovered, and a method not disclosed was found of estimating the distance of the submarine.

Wireless Telegraph Relay.—It is reported that Dr. R. E. Hall, at the University of Michigan, has perfected a relay for wireless telegraphy which operates on the principle of tone instead of wave-length tuning, and makes possible the sending and receiving of messages simultaneously on the same antenna; it will automatically relay wireless messages to a wire telegraph line, and records the messages on tape at a high speed.—*Telegraph and Telephone Age.*

Wireless Telephony.—Prof. Pupin in a lecture recently described the device which he has invented for increasing the range of wireless telephony. He states that it eliminates all disturbances and static discharges, and selects only the waves conveying the message.—*Telegraph and Telephone Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Birkenhead.—December 20th. Unwashed rough slack for the Corporation's electricity generating stations, during period ending June 30th, 1916. Mr. G. P. Shallcross, Borough Electrical Engineer, Craven Street.

Australia.—Adelaide.—January 19th. P.M.G. Common-battery switchboard. See "Official Notices" November 19th.*

January 26th. Deputy P.M.G. Twenty tons of galvanised-iron wire, 400 lb. to the mile.*

January 26th. Deputy P.M.G. Telephone instruments, parts and accessories.*

Brisbane.—February 23rd. P.M.G. Wheatstone apparatus. See "Official Notices" to-day.

Sydney.—January 31st. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

February 7th. Metropolitan Board of Water Supply and Sewerage. For No. 1 pumping station at Ultimo. Two centrifugal pumps and electric motors (4,000 gallons per minute each), switchboards, starters, &c. Contract No. 1,301.*

February 28th. Municipal Council. Tenders for induction regulators. Specifications (11s. 6d.) from the Electric Light Department, Town Hall, Sydney.

Nuneaton.—December 24th. Corporation. Supply and erection of an overhead line, for the Electricity Department. See "Official Notices" December 10th.

Redditch.—December 28th. Council. Eighty tons per week, for three months, of D S. nuts or rough slack. See "Official Notices" December 10th.

Salford.—2,000 tons of washed slack for the electricity works, Frederick Road. Chairman of Electricity Committee.

South Africa.—Durban.—January 5th. Corporation Telephone Department. (1) Telephone apparatus and materials; (2) underground cables; (3) 540 c.i. pipes, 9 ft. long, for cables. Messrs. Webster, Steel & Co., 5, East India Avenue, E.C., are the Corporation's London agents.*

Spain.—December 21st. Municipal authorities of Calanas (Province of Huelva). Concession for the electric lighting of the town during a period of ten years.

December 20th. Municipal authorities of Vich (Province of Barcelona). Concession for the electric lighting of the town during a period of three years.

Municipal authorities of Mola del Marques (Province of Valladolid). Concession for the electric lighting of the town.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Aberdeen Line.—This company has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for Wotan, tantalum, and carbon lamps, for the year 1916.

Australia.—The following contracts have been placed:—

Commonwealth Railways.

Portable telephones, £530.—Western Electric Co. (Aust.), Ltd.

Metropolitan Board of Water Supply and Sewerage.

Centrifugal pumps and motors (Richmond pumping station), £1,827.—Zollner, Ltd. (including motors supplied by General Electric Co. of America).

P.M.G.'s Department, Sydney.

Supply of distributing-cable terminals, £1,900.—The Oliver Co.

Metal-filament lamps, £517.—Dick, Kerr & Co.

17 strips metallic circuit-protectors and mounting plates, £935.—Western Electric Co. (Aust.), Ltd.

5,000 ft. glazed earthenware conduit, two ducts; 2,500 ditto, three ducts; 30,000 ditto, four ducts, £2,677.—Sydney Stoneware Pipe Association.

P.M.G.'s Department, Melbourne.

Telephone cords, &c., £335.—Laurence & Hanson Electrical Co., Ltd.

Telephone diaphragms and microphones, £154.—600 common-battery telephones, £1,600.—Western Electric Co. (Aust.), Ltd.

Victorian Railways.

Electrification of Melbourne Suburban Railways, sub-station building at Albion, £13,078.—J. S. G. Wright. —*Aust. Mining Standard.*

Gillingham (Kent).—The T.C. has accepted the following tenders for coal for the electricity works:—

Gill & Son, Ltd.—100 tons of Notts Gedling 1½-in. nutty slack, at £1 4s. 5d. per ton, and 100 tons of Notts Rufford 1½-in. nutty slack, at £1 3s. 10d.

Spencer, Whatley, Ltd.—500 tons of North Staffs 2-in. and ½-in. D.S., at £1 6s. per ton, and 50 tons of Snibson Deep 1¾-in. slack, at £1 1s. per ton.

Glasgow.—The Hyatt Roller Bearing Department of Messrs. Broom & Wade, Ltd., has secured an order from the North British Locomotive Co., Ltd., of Glasgow, for 350 three-inch Hyatt roller bearing drop hangers complete, to be installed in their new works.

London.—The L.C.C. has accepted the tender of the Maxim Lamp Works, Ltd., for an annual supply of electric traction glow-lamps for the Tramways Department.

Morley.—The T.C. has accepted the tender of Messrs. Bedford & Co. for coal for the electricity works.

Newport (Mon.).—The Borough Electrical Engineer has been authorised to order 300 tons of Bedwas navigation coal, at 14s. 6d. per ton, and 300 tons of Crumlin Valleys coal, at 12s. per ton.

Nuneaton.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for pipework for plant extensions at the electricity works, at £330.

Owing to the satisfactory operation of the 750-kw. geared Curtis turbo-generator that was supplied by the British Thomson-Houston Co., Ltd., the Corporation has now placed with the company an order for a duplicate set.

Torquay.—Messrs. E. P. Bovey & Son have written to the T.C. intimating that, in view of the difficulty of delivery of materials, they could not guarantee completion of the electrical work of the new Medical Baths in any definite time, and must therefore let the work pass. The Baths Committee has resolved that, providing Messrs. Bovey will complete the work within four weeks from the date the materials for the job are on the site, their tender be accepted, but failing this, that the next lowest tender be accepted.

Wolverhampton.—The Tramways Committee has accepted the tender of Messrs. Hadfields, Ltd., at £595, for the supply of 14 pairs of points.

Worcester.—The City Council has confirmed the acceptance of the tender of the Pulsometer Engineering Co., Ltd., amounting to £192, for supply of a centrifugal motor-driven pump, with crab, &c., for the detritus well.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, December 17th. At 6 p.m. At 11, Great George Street, Westminster, S.W. Paper on "Engineering Colleges and the War," by Dr. R. M. Walmsley and Mr. C. E. Larard.

Electro-Harmonic Society.—Friday, December 17th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, December 17th. At 7.30 p.m. At Bolbec Hall, Newcastle. General Meeting.

University College, London.—Friday, December 17th. At 5 p.m. Final Lecture on "Electric Heating and Electric Furnaces," by Prof. J. A. Fleming, F.R.S.

Manchester Association of Engineers.—Saturday, December 18th. At Grand Hotel, Aytoun Street, Manchester. Topical Discussion Evening.

Junior Institution of Engineers.—Monday, December 20th. At 7.30 p.m. At the I.E.E., Victoria Embankment, W.C. Paper on "The Modernisation of Power Plant in Factories," by Mr. W. A. Tookey.

Salford Technical and Engineering Association.—Monday, December 27th. At 7 p.m. At the Royal Technical Institute, Peel Park. Annual Social.

FUTURE TRADE WITH RUSSIA.

It may be not without interest to hear what our French friends have to say in regard to the cultivation of commercial relations with Russia, on the principle that it is always advisable to learn something, if possible, from our neighbours, just as the latter seek information from us. That the French are hopeful of securing advantages in Russia after the war is shown by the fact that the Minister of Foreign Affairs appointed a Commission some time ago, under the presidency of M. Méline, to co-ordinate the good wishes scattered about in respect to the promotion of business, and the Commission itself obtained the services of a Consultative Committee, composed mostly of leaders of commerce and industry, to make inquiries in circles interested in trade with Russia, and collect the suggestions for the consideration of the public authorities. The results of the investigation, together with the Committee's recommendations, were recently published in a general report by M. Pierre Arbel, which is divided into two parts, one dealing with the standpoint of German trade with Russia, and the other with that of France with that country. We do not observe anything particularly new in the German part, but it is well not to overlook the statement that, in order to develop the export trade at any cost, the German people, with the Government at the head, have consented to pay in the home market prices which are much higher than the export prices, calculating that the high inland prices were only a displacement of riches without vexatious recoil on the general public, whilst, on the other hand, all the transactions effected abroad would cause an influx of money profitable to the nation. The report states that this was the origin of the export bounties, by means of which the Germans found a practical and efficacious method, not only of favouring their exports, but also of annulling the natural effect of Customs duties, and the Committee remarks that not one of the least preoccupations of the negotiators of the future Peace Treaty should be to provide a remedy for this matter.

The second part of the report, dealing in general with the difficulties which have hampered French exports to Russia in the past, enumerates these as the lack of qualified commercial representatives and travellers knowing the language, the absence of information concerning Russian customers, and the fear of having to grant long credits. It is, however, noted that the French Chamber of Commerce in Paris, the Russian Chamber of Commerce in Paris, and the Russo-French Chamber of Commerce in Petrograd, together with the public authorities, have endeavoured, since the declaration of war, to place the necessary information at the disposal of exporters, including details of business such as concerns goods required or offered in Russia, and of offers of co-operation made by Frenchmen or persons not acquainted with French, living in Russia. The education of young men in commerce and in Russian is being undertaken, so that it will be possible to dispense with German intermediaries in future; whilst in the case of trade credit, it is held that an entirely new organisation has to be created. The French banks and the Bank of France in particular ought to discount long term drafts on other countries. But the report emphasises the necessity for the establishment of an export bank with the co-operation of the State, and states that if such an institution could not be formed at once, it would be possible to include English and Russian capital for the same purpose. A matter of considerable importance is raised in regard to the clearance of goods through the Russian Customs-houses, where the Allied Administration is blamed for causing trouble. It is therefore suggested that in order to provide a remedy Customs-houses as in Russia should be established in Paris and in the principal French seaports to receive declarations, undertake verifications and levy the duties, so that the cases or bales sealed by the Russian officials would be admitted into Russia after a simple confirmation. We do not notice in this connection any reference to the pledge which was recently given, when in Paris, by the Russian Minister of Finance, who promised one of the French ministers that he favoured the opening of such Customs-houses and would endeavour to secure their establishment.

The report also discusses particular cases of Franco-Russian imports and exports. Leaving out of consideration the question of coal, we can associate ourselves with the opinion expressed by the Consulting Committee that France—Great Britain also—should furnish at least a portion of the iron and steel materials intended for works, pledged by loans issued in France or Great Britain, for water, gas and railway concessions, &c., and that a special tariff should be obtained for application to metallurgical products imported into Russia, owing to the inadequacy of the native production. In the case of machinery, France exported only 7,500 tons to Russia in 1911 out of the 300,000 tons imported into that country in that year, and it is admitted that the French can only think of exporting more largely when they have reorganised their mechanical engineering industry. Coming to consider the problem of electrical machinery, we now find a further explanation for the great preponderance of German types in Russia in the past—an explanation which, even where unknown, followed naturally from the fact that Teutonic electrical material previously formed 92 per cent. of the total imports of this class into Russia. Its interpretation is that the Verband Deutscher Elektrotechniker secured the adoption of its constructional regulations in Russia, and now the Consulting Committee contends that it will be possible for French electrical firms easily to compete with Teutonic industry if they can obtain the substitution of the regulations of the Union des Syndicats d'Electricité. By all means let us supersede the Teutonic methods, but let the Allies, if possible, try and arrange a common basis for future work. In conclusion, the report refers to public works in general, and suggests that the French Government could take useful action when foreign loans are proposed in the French market, so that the flotation of such loans should be accompanied by an increase in the activity of French industries, and no longer serve for the assistance of competitors; and that the Russian Government should henceforth grant to French manufacturers a considerable part of the orders for works to be carried out and deliveries to be effected.

We were under the impression that the French Government had for years past made it a constant condition that foreign loans should be accompanied by, or be contingent on, orders, and assume, therefore, that a stricter adherence to this practice is desired in the future. It is precisely a policy of this kind which is urgently needed in Great Britain. A Government alone can make suggestions in the right spirit, and if these are not acted upon, it is possible for a Government to command the attention of banking and other financial institutions concerned. We have sent millions of pounds out of this country which have frequently been used for payment for orders placed with *our* foreign competitors! If public issues can be controlled now, how much more essential will it be for foreign emissions to be regulated for mutual benefit after the war; for reciprocity there must be.

NOTES.

Institution and Lecture Notes.—Royal Institution.—With reference to the list of events announced in our last issue, we have now received the complete programme of arrangements, from which we select the following :—

January 21st.—"Problems in Capillarity," by Sir James Dewar.
February 18th.—"Polarised Light and its Applications to Engineering," by Prof. E. G. Coker.
March 3rd.—"Corona and other Forms of Electric Discharge," by Prof. S. P. Thompson.
April 14th.—"The Genesis and Absorption of X-rays," by Prof. Sir J. J. Thomson.
January 20th and 27th and February 3rd.—Three Lectures on "Utilisation of Energy from Coal," by Prof. W. A. Bone.
March 16th and 23rd.—"Organic Chemistry in War," by Prof. H. E. Armstrong.
March 11th, 18th, 25th, April 1st, 8th, and 15th.—"Radiation from Atoms and Electrons," by Prof. Sir J. J. Thomson.

Institution of Electrical Engineers.—A meeting of the Western Local Section was held at Cardiff on Monday; the attendance was comparatively small. Mr. J. R. Beard read a paper on "The Design of High-Pressure Distribution Systems," and Mr. W A. Chamen, who presided, drew attention to the remarkably large number of sub-stations and generating stations that the Newcastle system now possessed. He said it would be interesting if they could know what would be the effect if some of these sub-generating stations by accident suddenly ceased giving a supply. Were the arrangements such that any one of them could shut down and still allow others to go on without interruption? Mr. Allan, the local secretary, also spoke, and a hearty vote of thanks was accorded to the author.

The Committee of the Manchester Students' Section of the Institution has decided to cancel all meetings this Session.

Institution of Civil Engineers.—On Tuesday last, the "James Forrest" lecture, written by Mr. H. M. Hobart, was read in abstract by Mr. J. A. F. Aspinall. The subject of the lecture was "Electrical Railways," and the paper, as read, appeared to consist almost wholly of working data and statistics relating to recent progress in electric railway operation in the United States. After an introduction outlining the extraordinary reduction in capital cost and improvement in efficiency of electrical plant during the past 20 years, the author described the methods adopted for the application of electrical haulage to the Butte, Anaconda and Pacific Railway, and the Chicago, Milwaukee and St. Paul Railway. From the mass of figures that were given it was clear that as the result of electrification the economies that were effected in comparison with steam were very substantial. On the Chicago railway regenerative operation is being adopted, and is expected to effect a marked reduction in working costs. During the meeting a telegram from the author was read stating that on the Chicago railway a 2,500-ton load, 12 per cent. over the guarantee, was hauled up a 20-mile section including grades up to 2 per cent. by an electric locomotive weighing 250 tons, and descended under regenerative control, returning energy into the 100,000-volt system. The author concluded his lecture with a statement to the effect that direct current was the best for heavy traction, and that high-pressure D.C. supply through overhead conductors had been proved successful.

The railways above referred to were respectively described in the Electrical Review, on March 27th and April 3rd, 1914, and November 5th, 1915.

Volunteer Notes.—Engineering Institutions' Volunteer Engineer Corps.—Orders for fortnight commencing December 20th, 1915.—By Lieut.-Col. C. B. Clay, V.D., Commandant.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

Monday, December 20th.—Sections 1 and 2, Technical; Sections 3 and 4, Squad, Signalling Section and Recruits.

Tuesday, December 21st.—School of Arms with Architects Corps, 6 to 7 p.m.

Thursday, December 23rd, to *Thursday*, December 30th inclusive.—Headquarters closed.

Friday, December 31st.—Social evening, 6.15 to 8.15.

Saturday, January 1st.—Uniform parade.

Officer for the Week: Monday, December 20th, to Saturday, January 1st, Mr. Corbett.

Platoon on Duty.—Monday, December 20th, to Saturday, January 1st.—No. 2 Platoon. Platoon on duty has to provide a piquet for Headquarters of one N.C.O. and three men, and also one N.C.O. for instructing recruits.

Sections for Technical Parade at Headquarters, London Electrical Engineers, 46, Regency Street, S.W. Sections for Shooting Parade at Miniature Ranges. Unless otherwise ordered, all Parades at Chester House.

E. G. Fleming,
Acting Adjutant and Company Commander.

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, December 16th, 1915 :—

Week-end Parades.—Saturday.—The Battalion will parade at Baker Street Station 2.30 p.m. and proceed by train to Neasden Station, detrain, and proceed by march route to Wembley Camp.

Sunday.—7 a.m, Réveillé; 10 a.m., Church Parade; 10.20 a.m., Parade under Company Officers; 2.15 p.m., Parade under Platoon Commanders; 5 p.m., Lecture on Signalling (Maintenance of Communication—use of latest appliances), by Lieut. Reed, Gloucester Regiment (late member of the Corps).

Musketry.—Inter-Platoon Competition.—Acton Range will be open on Saturday next, the 18th inst., for practice in above competition, for those men only who have sent in their names (limited to 20) to the Musketry Staff. Shooting—11 a.m. to 1 p.m. and 2 to 4 p.m. It is hoped that as many men as possible will make it convenient to shoot during the morning.

There will be shooting at Bisley on Saturday next, the 18th inst. Members must report themselves to Sergeant Cotter at the barrier of No. 9 Platform, Waterloo Station, at 12.45 p.m. Names must previously be sent in to Headquarters.

A. G. Joiner, *Major and Adjutant*, O.B.C.

Patents and Alien Enemies.—Application has been made to the Board of Trade in respect of Patents Nos. 26,297/04, 21,750/09, 24,389/10, 19,473/11, 16,165/12, 218/13, 1,179/13, and 25,180/13, granted to Th. Goldschmidt and his associated company, for the welding of rails, by the British Thermit Co., Ltd.

The Board of Trade has published a notice in the *London Gazette* restating and extending the provisions of the Licence, dated November 14th, 1915, with regard to the payment of fees in respect of the Registration of Patents in enemy countries.

London Electrical Engineers, R.E. (Territorial Force).—The Corps of London Electrical Engineers is again open to recruiting. Men of the following professions and trades are specially required :—Mechanical and electrical engineers, electricians, engine drivers, engine erectors, instrument repairers, metal turners, fitters, telephonists and telegraphists, and tinsmiths. There are a limited number of vacancies for carpenters, cabinet makers, pattern makers, draughtsmen, joiners and wood turners. Forms of particulars can be obtained from the Officer Commanding, at 46, Regency Street, Westminster, S.W.

Earnings of Engineers.—The *Daily Chronicle* states that the membership of the Amalgamated Society of Engineers has advanced from 173.629 to 204,162 in 11 months, and the funds have increased by £237,070 in 10 months. It is estimated that, taking into account increases in weekly wages, increase in piece work prices and amount of overtime, the earnings of members must have increased by about 2 million pounds per annum.

Who Will Assist ?—Mr. H. Scholey, writing further with reference to the case of the Belgian mentioned by him in our issue of November 26th, says :—

"I have been interesting myself in the case of a Belgian merchant who, prior to the war, occupied a very important position in the city of Antwerp, but is now practically stranded. He is a man of unusual education, and I felt that there ought to be no difficulty in securing him a temporary position. I obtained an introduction for him to a large firm, who made a half promise that they would find him work, but after the interview which my friend had with this firm, we were both disappointed to find they were unable to do anything for him. You will be interested to observe the conclusions which my friend arrived at, and it constitutes a rather serious criticism of the methods adopted by Relief Committees.

> To me the fact lies somewhat deeper. In fact, the Belgians have been spoilt by you Englishmen. You gave them too much money when the flood of my countrymen reached your hospitable shores. I admit we wanted help, and your pity was aroused. But the members of your War Refugees' Committees, consulting more their generous heart than their head, made morally wrong the good they physically did. Further, I dare say, your upper-middle and working classes are quite strangers to each other, and that is one of the reasons why the members of our War Refugees' Committees were absolutely ignorant how to deal properly with the expatriated Belgians.
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> What was the result ? Money was lavishly spent and given without discretion. Men used to hard work got more money than they ever had in their possession, or had dreamed of. They became very soon sluggards. In this state moral feelings are affected, and every day of laziness wrought more havoc amongst them. And what you Englishmen did in splendid generosity and self-sacrifice was considered by the Belgians as an absolute duty, and now they rely fully on it. Poor countrymen, you gave them too much money, and what they wanted was real true moral food, which they can only find in their own selves as a result of hard work.
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> And still the war is raging, and will last for many months to come, and people here, judging by the facts without looking at the causes, and ignorant also of the psychology of a nation, judge us rather severely now. They think us to be a lazy, indolent folk. The Englishman is tired a bit now of his spoilt child.
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> And I, with some others, who were courageous from the very first day of the war, are drowned in the mass, and, alas ! to my experience, I can assure you that on two occasions lately it was enough for me to mention my nationality in order to see the doors closed to me when I applied for a vacancy.

"I may add that this gentleman has refused any financial help, but up to the present has managed to keep his family of four on a wage of 30s. per week."

Fatalities.—Newcastle-on-Tyne.—An inquest was held on 8th inst. on John Spiller Snell, an electrician, of Heaton, Newcastle-on-Tyne, who had died in the infirmary on November 21st, from injuries caused by an explosion on a vessel in course of construction at a neighbouring shipyard. A fitter named Robert Megson gave evidence as to the explosion, for which he could assign no cause. John Lauder, a fitters' labourer, said Snell, a man called James Nicholson, and others, were engaged on some electric wires at the time of the explosion. After the occurrence he went to look for the men. Nicholson was dead, and Snell was injured. Frederick Alexander Ross, electrical engineer, said he gave instructions for some batteries to be charged. Next morning he found there had been an explosion under the battery hatch, which was blown off. In his opinion the explosion was due to an accumulation of hydrogen gas. There were fans to take away surplus gas, but if there were an accumulation of hydrogen it could be ignited by an electric spark or a light. The most likely explanation was that some one had left off one of the battery tank hatches, and some one had brought means of ignition to the place. Evidence was given that the fans were running shortly before the accident. It was also stated that there might be an accumulation of gas which might have been ignited by a spark due to a loose connection between the cells under the battery cover. A verdict of "Accidental death" was returned, the jury adding that there was no direct evidence as to the cause of the explosion. At the inquest on James Nicholson, an electrician, of Glasgow, a similar verdict was returned, as mentioned by us last week.

METHIL.—It is stated that Alex. Martin, aged 16, an apprentice electrician, was killed on Saturday last in the Leven Colliery of the Fife Coal Co., by his arm coming into contact with a live wire.

Trade Union Alliance.—The *Times* states that the Triple Alliance of the Miners' Federation of Great Britain, the National Union of Railwaymen, and the National Transport Workers' Federation was ratified last week at a joint conference of the Executive Committees of the three Unions. The Alliance constitutes the strongest force for combined action in the history of the labour movement. Of the million and a half workers affected by it, the Miners' Federation contributes about 800,000 and the remainder is divided almost equally between the other two bodies. The Alliance was established by unanimous resolution. The following are the principal features :—Matters submitted are to be of a national character, or, in the opinion of the Executive making the request, necessitating combined action. Before the co-operation of the joint organisation is sought the matter in dispute must receive the endorsement of the National Executive of the organisation primarily concerned. Periodical meetings of the three full Executives shall be held at least half-yearly. A consultative Committee of six to be appointed, composed of two members from the Executive Committee of each of the three bodies. Complete autonomy shall be reserved to any one of the three bodies affiliated to take action on its own behalf. Joint action can only be taken when the question at issue has been before the members of the three organisations, and decided by such methods as the constitution of each organisation provides.

Engineers for the Artists Rifles O.T.C.—The officer commanding the 2nd Battalion of the Artists Rifles Officers Training Corps has decided to form a special company, to consist mainly of professional men whose technical experience renders them qualified for appointment as officers to those units or branches of the Army in which knowledge of construction and civil engineering is especially useful in the conditions obtaining in modern war. A large number of men have already been enrolled, but there are still vacancies for civil, mechanical and mining engineers, architects, public works surveyors, and borough engineers, to receive the military training which is essential if the military authorities are to make full use of their professional skill and experience. Professional men having Colonial experience will be particularly welcome. Application for nomination to the corps should be made to the Headquarters, Artists Rifles O.T.C., 7, Duke's Road, Euston Road, W.C.

Social.—On Wednesday of last week nearly 1,500 persons attended the annual whist drive and dance promoted by the Blackpool Corporation Electricity and Tramway Employés' Institute and held at the Blackpool Tower Ballroom. A military band played for dancing. The proceeds, which should be substantial, are to be divided between the Lancashire Military Convalescent Hospital Gymnasium and Concert Hall and the Tramway Employés' Sick and Benevolent Funds.

Dublin Electrical Workers.—The Electrical Trade Union has intimated to public boards that an increase of ½d. per hour and a war bonus of 6d. has been granted to electricians in the city working under the War Office.

Northampton Polytechnic Institute.—The annual prize distribution takes place to-morrow (Saturday) afternoon, at three o'clock.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The Torquay E.L. Committee has decided to grant the electrical engineer's application for leave of absence in order to join H.M. Forces, on the conditions applying to the enlistment of officers, it being understood that the assistant electrical engineer, Mr. Keenan, will carry out the duties for the present.

Mr. C. E. GARNETT, Darwen's electrical engineer, and Mr. F. J. S. HOSKEN, manager of the Corporation Tramways, enlisted under the group system on December 9th.

The Newport (Mon.) T.C. is recommended to increase the salary of Mr. H. A. FELTON, the electricity works superintendent, from £156 to £166 per annum, and that of Mr. A. H. CLARKE, senior engineer-in-charge, from £130 to £140, from April next.

Mr. R. N. MAYNE, manager of Redditch electricity works, whose commission in the Bedfordshire Regiment was cancelled by the War Office some time ago owing to the indispensable character of his services in connection with the extension of the undertaking, informed the Council last week that he proposed to renew his application for a commission having regard to the urgent demand for unmarried men under 41 years of age. He asked the Council to release him as early as possible. The matter was referred to the Electric Supply Committee.

Mr. L. WILDE, commercial assistant in the Ilford U.D.C. electricity department, has enlisted as a sapper in No. 4 Company, London Electrical Engineers, and is now stationed at the Fort, Newhaven.

The Hackney Electricity Committee reports that the Borough Electrical Engineer considers that it is imperative that the vacancy caused by the resignation of Mr. H. G. Barraclough, generating engineer, should be at once filled, in view of the large demand on the electricity undertaking. The number of generating engineers required is four, but as at present there are only two on the staff, it has become necessary to engage another at a salary of £3 per week, which is obviously unfair to the engineers on the staff whose maximum salary is below that figure. The Committee is endeavouring to get Mr. A. G. Hilling, assistant distributing engineer, released from H.M. Forces, and, if successful, it is intended to employ him on distributing work generally and to take the place of a generating engineer in case of emergency. If the release of Mr. Hilling is obtained, it would only necessitate the engagement of one man at £3 per week. The Committee recommends that the salaries of Messrs. E. K. Wilkinson (£135), F. D. Osborn (£120), and A. G. Hilling (if released from service with the Colours) (£127 10s.) be increased forthwith to £156 per annum.

The Wolverhampton Town Council on Monday appointed Mr. C. O. SILVERS to be general manager and engineer of the Corporation electric tramways, in succession to the late Mr.

W. A. Luntley, at a salary of £350 per annum, rising by annual increments of £50 to £500. During the illness of Mr. Luntley, extending over eight months, Mr. Silvers had acted as deputy-manager. Mr. MARTIN GRIFFITHS, clerical assistant, was appointed chief assistant to the general manager, and Mr. HIRAM HEWITT, rolling-stock superintendent, was appointed assistant engineer.

General.—Mr. GEOFFREY GORE GERDENITS, electrical engineer, of Weeping Cross, near Stafford, has changed his name to Geoffrey Gore.

The King has conferred the Territorial Decoration upon the undermentioned officers of the Territorial Force.—*London Electrical Engineers.* Major W. H. Merrett, A.M.I.E.E. *Western Signal Companies* (*Army Troops*). Lieut.-Col. F. A. Cortez-Leigh, M.I.E.E.

Mr. OLIVER H. BARKER, of Blackheath, will shortly be leaving for Spain, to take up a position in the electrical department of the Rio Tinto Co., Ltd.

Mr. GEOFFREY N. DOLBY, eldest son of Mr. E. R. Dolby, M.Inst.C.E., senior partner in the firm of Messrs. Dolby and Williamson, consulting engineers, Westminster, enlisted in the Queen's Westminster Rifles in August, 1914, and, after ten and a-half months at the front, has now been gazetted second-lieutenant in the same regiment, to date from November 26th, 1915.

Mr. Alderman SEAL, J.P., who was one of the chief promoters of the Sutton Coldfield electricity department 16 years ago, and became its first chairman, piloting the concern through the first nine years of its existence until he saw its financial success was assured, has again become chairman in response to the unanimous desire of the members of the Electricity Committee.

Roll of Honour.—Private E. J. DAVIS, of the 1st Queen's Royal West Surrey Regiment, who was engaged prior to his enlistment with Messrs. J. & T. Robinson, electricians, Croydon, has been killed in France by a sniper.

Sapper F. WALTER, of the 3rd Field Company, Kent Fortress Engineers, who was for 14 years on the staff of the Folkestone Electricity Co., is now reported to have been drowned in the sinking of H.M.S. *Hythe* in the Mediterranean.

Private ERNEST MASON, of the 7th North Staffordshire Regiment, who was on the staff of the North Staffordshire Railway electricity department, has been wounded in action at the Dardanelles.

Private A. CADMAN, of the Army Service Corps, who was engaged as an electrician at the Chillington Edge Tool Works, of Wolverhampton, and was on similar work in the Army, has been killed in action in France.

Bombardier J. R. HARDYSIDE, of the "D" Battery, 71st Brigade, Royal Field Artillery, has been awarded the Distinguished Conduct Medal and the French Médaille Militaire for bravery in repairing wires under very heavy fire, although suffering from the effects of gas fumes. When war broke out he was engaged at Rugby with Messrs. Willans & Robinson, Ltd.

Rifleman ALFRED HOUSE, of the King's Royal Rifles, killed in action in France, was, prior to the war, engaged at the Rugby works of the British Thomson-Houston Co., Ltd.

Private H. T. ANDERSON, of the 8th Battalion The Buffs (East Kent Regiment), who was with Messrs. Siemens Bros., Ltd., of Charlton, S.E., prior to his enlistment in August, 1914, is reported wounded and missing in France.

Private CYRIL BALL, of the 1/5th North Staffordshire Regiment, who has been killed in action, was prior to his enlistment in October, 1914, engaged with Messrs. Bullers, Ltd., of Hanley.

Second-Lieutenant H. LIONEL HARRIS, Royal Engineers, second son of the late Mr. H. Graham Harris, died on December 1st from wounds received in action in France. After an engineering course at Rugby he entered the firm of Bramwell and Harris. A few years ago he was employed by W. T. Henley's Co. in the laying of a new cable for the Western Telegraph Co. He came home from Argentina a year ago.

Obituary.—MR. WM. SHEA.—Mr. Wm. Shea, whose death is announced at the age of 52 years, had been connected with the telephone service for many years, joining the National Telephone Co.'s construction department 32 years ago, and being promoted to Burnley and Blackburn, where he became head clerk. He was subsequently appointed telephone manager for Blackpool and the Fylde, and was later transferred to Southport.

MR. FRANK IAGO.—We regret to read of the death of Mr. Frank Iago, late secretary of the Westminster Electric Supply Corporation, Ltd., which occurred on December 8th at the age of 54 years.

NEW COMPANIES REGISTERED.

Newtons (Camborne), Ltd., (142,373).—This company was registered on December 10th, with a capital of £5,000 in £1 shares, to carry on the business of scientific and mathematical instrument makers, opticians, mechanical, electrical, civil and hydraulic engineers, gun makers and fitters, tool makers, founders, metal workers, etc. The subscribers (with one share each) are: S. Staples, 34, Vicarage Road, Neasden, N.W., clerk; A. W. Kelly, 13, Clancarty Road, Fulham, S.W., clerk. Private company. The number of directors is not to be less than two or more than five; the first are S. Staples and A. W. Kelly (provisional directors). Qualification (except first directors), £100. Registered office: 47, Bishopsgate, E.C.

Arcorundum Abrasives, Ltd. (142,352).—This company was registered on December 9th, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers of abrasive materials, engineers, founders, smiths, machinists, electricians, manufacturers and workers of and dealers in electricity and electrical motive power, etc., and to adopt an agreement with W. R. Hague. The subscribers (with 100 shares each) are: F. E. Tidswell, 51, Holloway Road, N., emery manufacturer; W. R. Hague, 42, Newport Road, Stafford, civil engineer; G. Millington, Elmwood, Rowley Park, Stafford, engineer. Private company. The number of directors is not to be less than two or more than three; the first are F. E. Tidswell, W. R. Hague, and G. J. R. Millington. Qualification, £100. Solicitors: Greatrex, Warner & Beswick, Bank Chambers, Stafford. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

O'Neil's Recorder Syndicate, Ltd. (142,362).—This company was registered on December 9th, with a capital of £2,000 in £1 shares, to acquire certain patents for inventions in relation to signalling for use on vessels, and recording the course steered by vessels at sea, and to carry on the business of mechanical, electrical, hydraulic and general engineers and contractors, etc. The subscribers (with one share each) are: C. A. Beldam, 1-2, Gracechurch Street, E.C., merchant; R. S. O'Neil, 16, Lee Road, Blackheath, S.E., engineer. Private company. C. A. Beldam and R. S. O'Neil are governing directors, and may retain office while holding between them half the issued share capital. Solicitors: Wansey, Stammers & Co., 28, Moorgate Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Naylorgraph, Ltd.—Debenture, dated November 13th, 1915, to secure £400, charged on the company's undertaking and property, present and future. Holder: J. M. Hunt, Fairlawn, Park Road, Southborough.

Chepstow Electric Lighting and Power Co., Ltd. (70,646).—Capital, £10,000 in £1 shares. Return dated October 23rd, 1915. 5,510 shares taken up; £1,537 paid, leaving £68 in arrears; £3,905 considered as paid. Mortgages and charges: £1,000.

Tramways Light and Power Co., Ltd.—Trust deed, dated November 15th, 1915 (supplemental to trust deed of February 26th, 1914), securing £100,000 5 per cent. debenture stock, charged on certain shares, debenture stock, and debenture scrip specified in the principal deed, and the company's general assets. Trustees: Trustees, Executors & Securities Insurance Corporation, Ltd.

Colne Valley Electric Supply Co., Ltd.—Debenture, dated December 2nd, 1915, charged on the company's undertaking and property, present and future, including uncalled capital, to secure all moneys due or to become due from company to Barclay & Co., Ltd., 54, Lombard Street, E.C.

CITY NOTES.

The Oerlikon Machine Works.

THE Maschinenfabrik Oerlikon, of Oerlikon, near Zurich, reports that a diminution took place in the net profits in 1914-15, owing to the impossibility of maintaining normal working through the difficulties experienced in obtaining raw materials, and to the losses due to the fall in exchange, which however, had been written off; whilst at the same time manufacturing was disturbed by the constant changes in the number and efficiency of the officials and workers available in consequence of the alterations in the military requisitions, each change having necessitated a reorganisation in the shops and offices. The orders received gradually increased during the year until the stock had reached the normal level in nearly all departments, but the obstacles in question, together with the troubles incidental to procuring export or transit permits and the lack of transport facilities at times, prevented advantage being taken of the situation.

The department for general electrical machinery and transformers was well occupied on the declaration of war, when the undertaking was increasingly engaged for the home market. As a result of the scarcity of petroleum, benzine, and crude oil, it was necessary for users of light and power to substitute electricity, and the demand for motors and transformers of low powers consequently advanced. The report then refers to the advent in England, France, and Spain of American competitors who, it states, sought to secure the markets by the offer of low prices and exceptionally short periods for delivery. Their success, however, did not seem to be great, because customers entertained some doubts regarding the particular types of construction, and apprehended difficulties in connection with the subsequent provision of spare parts and the execution of repairs.

The railway department confirmed the successful inauguration of working in connection with the deliveries for the London & North-Western Railway Co., the question concerning an initial supply of the electrical equipment of 43 three-coach trains with motor coaches, each of 1,000 H.P. The control was effected by an automatic multiple remote controller on a new system devised by the company. The favourable results of the starting of the service had induced the railway company to place a repeat order of a similar extent. After exhaustive preliminary trials, the deliveries of the electrical equipment of three-phase locomotives of a rating of 3,000 H.P., with four different grades of speed, were being carried out for the Italian State railways. The locomotives for the Lotschberg railway continued to answer the purpose, the large commutator motors in particular showing exceptionally low wear and tear. The results indicated the success of the single-phase alternating current system for heavy traction, which would probably put an end to doubts and experiments as to the system suitable for the Swiss railways. It is stated that the company undertook the supply of fuse components for the Swiss military authorities, but the delivery of war materials and munitions to all belligerent States was refused.

The accounts show gross profits amounting to £120,000 for 1914-15, as compared with £137,000 in the preceding year. After meeting general expenses, interest charges, and depreciation (£34,000, as against £39,000), the net profits and balance forward are returned at £35,000, as contrasted with £48,000 in 1913-14. It is intended to pay a dividend of 6 per cent., being the same rate as in the previous year, on share capital of £320,000.

Adelaide Electric Supply Co., Ltd.

The directors report that during the year ended August 31st, 1915, there was a further capital expenditure of £79,198, making £829,622, less £12,074 written off. The capital necessary to keep pace with the continued growth of the company's business has been provided for by the issue during the year of the balance of 10,365 preference shares, and of a further £25,000 debenture stock. In pursuance of authority received at the meeting of October last, the directors recently applied to H.M. Treasury for permission to issue a further 20,000 ordinary shares, and to offer the same at a premium of 30s. per share to the holders of the existing ordinary shares in the proportion of 4 new shares to 10 old. Permission having been granted on the understanding that the issue be made only to shareholders residing in Australia, a circular has been issued to the latter offering them their *pro-rata* allotments of the new shares. 2,142 new consumers were connected to the mains during the year, bringing up the total number connected to 15,334, an increase of 16 per cent., as compared with the preceding year. The power supply has increased by 12 per cent., the electric motors now connected being equivalent to 8,236 H.P., while the total connections, including lamps, motors, heating, and other apparatus, have increased by 14 per cent.; the total units sold by 5 per cent.; and the gross revenue by 7 per cent. The profit and loss account shows that the gross revenue amounted to £119,897, an increase of 7 per cent. After payment of debenture interest, and management and general expenses in London and Adelaide, and after allocating £9,129 to debenture stock service fund, there remains a credit balance of £42,068, plus £10,815 brought forward, making £52,883. After paying dividends of 6 per cent. on the preference and 10 per cent. on the ordinary shares, a bonus of 2 per cent. on the latter is recommended, carrying forward £7,920.

Date.	Number of consumers.	Lighting in KW.	Motors in rated H.P.	Total connections in KW.	Total units sold.
Aug., 1913	11,354	7,752	6,270	14,022	5,446,483
Aug., 1914	13,192	10,107	7,347	17,454	6,740,991
Aug., 1915	15,334	11,744	8,236	19,980	7,055,015

The business of the company continues to make good progress notwithstanding the adverse influences of war and the recent drought, the demand for electric light and power in the extensive area served by the company being maintained satisfactorily in the circumstances.

Annual meeting: December 21st.

Melbourne Electric Supply Co., Ltd.

In their report for the year ended August 31st, 1915, the directors state that in pursuance of the resolutions passed by the shareholders at the last annual general meeting, and with the permission of H.M. Treasury, the directors issued a circular on February 1st last, offering 75,000 ordinary shares of £1 each at par to the holders of the existing £300,000 consolidated ordinary stock, payable on March 1st, 1915. The whole of these shares were taken up, and subsequently converted into consolidated ordinary stock.

To provide for essential capital expenditure and thereby to enable the company to fulfil its statutory obligations, the directors recently applied to H.M. Treasury for permission to issue the balance of 125,000 ordinary shares of £1 each, and to offer the same at par to the holders of the existing £375,000 consolidated ordinary stock as nearly as possible *pro-rata* (*i.e.*, 1 in 3) Permission having been granted subject to an issue being made in Australia and to Australian stockholders only, a circular will shortly be issued to the latter offering them their proportion on the above basis. The rights of stockholders on the London register to their *pro-rata* allotments are reserved for issue to them at a future date when Treasury permission is granted or has ceased to be necessary. Certificates to this effect will be issued to stockholders on the London register.

£5,000, as provided for in last year's accounts, has been applied during the year in writing off certain items in the Melbourne account. The capital expenditure at Melbourne was £94,192, and at Geelong £9,827, for the year. The balance of expenditure stands at £1,111,633. 4,125 new consumers were connected to the mains during the year, bringing up the total to 23,191, an increase of 22 per cent. The power supply has increased by 41 per cent., the electric motors now connected being equivalent to 17,609 H.P.; the total connections, including lamps, motors, heating, and other apparatus, have increased by 26 per cent.; the total units sold by 25 per cent.; and the gross revenue by 20 per cent. The profit and loss account shows that the gross profit derived from the Melbourne and Geelong undertakings amounted to £117,677, as compared with £104,340, an increase of 13 per cent. After payment of debenture interest, and management and general expenses at the London head office, and after making the following allocations, viz.:—To first debenture stock sinking fund £2,500, consolidated debenture stock sinking fund £2,690, income certificate service fund £1,800, general reserve (raising it to £70,000) £5,000, and writing off the balance of cost of increase and issue of capital (including Government Stamp Duty) £517, there remains a credit balance of £77,208, plus £7,820 brought forward, making a total credit balance of £85,028. Deducting from this the dividend on the 7 per cent. first cumulative preference shares for the half-year ended February 28th, 1915, and the interim dividend of 5 per cent., free of income-tax, on the consolidated ordinary stock paid on June 1st, 1915, there remains £64,778. A dividend of 7 per cent. on the preference shares and one of 10 per cent. for the year on the ordinary stock leaves £40,778 to carry forward.

Date.	Number of consumers.	Lighting in KW.	Motors in rated H.P.	Total connections in KW.	Total units sold.	Gross profit.
Melbourne—						
Aug. 31, 1913	18,571	12,139	9,581	21,720	9,740,104	£68,581
Aug. 31, 1914	19,066	16,316	12,444	28,760	13,963,000	£93,202
Aug. 31, 1915	23,191	19,932	17,609	37,541	17,486,300	£107,515
Geelong— (including trams)						
Aug. 31, 1913	1,456	1,734	1,846	3,580	1,034,052	£8,511
Aug. 31, 1914	1,889	2,051	2,085	4,133	1,252,153	£11,137
Aug. 31, 1915	2,290	2,306	2,155	4,461	1,270,516	£10,162

The business of the company has been well maintained notwithstanding the adverse influences of war and the recent drought. There is an increasing demand for light and power from all classes of the company's consumers, including numerous firms in Melbourne and Geelong engaged in the manufacture of war munitions and requisites. The directors record the death of Mr. J. F. Albright, who had been a director since the formation of the company in 1899.

Annual meeting: December 22nd.

India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.

The accounts for the year ended September 30th, 1915, show, after provision for doubtful debts, a net profit of £80,404. Adding £1,034 brought forward, deducting £12,500, the dividend on the preference shares paid in January and July and accrued to September 30th, and £12,500, the interim dividend on the ordinary shares paid in July, there remains a disposable balance of £56,438, which, after providing for the proposed dividend on the ordinary shares, will leave £18,938 to carry forward. The directors recommend that the payment of the half-yearly dividend of 5s. per share, or at the rate of 5 per cent. per annum, be made to the preference shareholders and that a dividend of 15s. per share, free of income-tax, amounting to £37,500, making with the interim dividend paid in July a total payment of 10 per cent. for the year, be paid to the holders of ordinary shares. The directors are pleased to be able to make such a satisfactory report in spite of the constantly increasing cost of coal, labour and raw material, and the dislocation of transport. Although the works at Persan remained closed till after the beginning of the financial year, and labour has been exceedingly scarce in France owing to the war, it is a matter of congratulation that the loss on the previous year has been converted into a profit in the year under consideration. The branches abroad have also shown much better results. The foregoing statement proves that the directors were justified in paying an interim dividend in July last. The directors cannot now estimate the amount of tax on profits which may become payable under the Finance Act when it becomes law on account of this year's trading; but the carry forward has been considerably increased. The *Dacia* has had a fair share of employment, and the *Silvertown* was chartered for a short period during the year. The works and machinery at Silvertown have been efficiently maintained. The directors regret to report the death, on September 2nd last, of Mr. Matthew Hamilton Gray, who had been associated for so many years with the work of the submarine department at Silvertown, and at the time of his death was consulting engineer to the company in these matters.

Meeting: December 22nd.

Costa Rica Electric Light and Traction Co., Ltd.

The accounts for the year ended 30th June, 1915, show that the net earnings in Costa Rica, after charging all expenses incurred, amount to £21,662, a decrease of £4,689 (mainly due to the adverse exchange). The net surplus profit is £3,833, which the directors propose to carry to the credit of "discount and commission on debenture issue" account. The power plant at El Brasil has worked well throughout the year. Some trouble, which was experienced in times of floods, has been eliminated by the installation of larger sluice gates. Electrical cooking has continued to develop during the past year, and the revenue from this source has been satisfactory. In common with other countries, Costa Rica is suffering considerably from the European War, and the business of this company has, as anticipated in last year's report, suffered considerably from the interruption of exports and the general upset of trade relations. In view of this, and of the serious loss entailed by the high exchange, the net result of this company's operations for the year must be considered satisfactory. The management of the business in Costa Rica continues to give the directors every satisfaction. During the year the gold premium has averaged 150 per cent., as against 112 per cent. for the previous year.

Annual meeting: December 22nd.

German Electrical Companies.

The liquidator of the *Helios, Elektrizitats Gesellschaft, of Cologne*, has not yet been able to wind up the proceedings. The report for the year ended June 30th, 1915, shows no change in the investments held or in the deficit of £419,000 brought forward from 1913-14.

The Norddeutsche Kabelwerke, A.G., of Neu-kölln, which company was first formed last March, and took over a private cable manufacturing concern of the same name, proposes to pay a dividend of 10 per cent. for the financial year on a share capital of £75,000. A large interest in the undertaking is held by the Mix & Genest Co.

The Deutsche Gasgluhlicht A.G., of Berlin, reports net profits, after placing £18,000 to depreciation in 1914-15, as against £24,000 in 1913-14, amounting to £169,000, as compared with £224,000, exclusive of the balance of £101,000 brought forward from the previous year. A dividend of 25 per cent. has been declared on the ordinary share capital of £495,000, as in 1913-14, whilst the preference share capital has been redeemed to the extent of £165,000 out of banking credit, which has thereby, together with £400,000 subscribed to war loans, been reduced to £385,000. The report contained no statement as to the electrical department, nor was any reference made to it at the general meeting.

The report of the *Telephon Fabrik, vorm. Berliner, of Hanover*, states that a particularly favourable development took place in the year ended with June 30th, 1915, as the war afforded the possibility of fully utilising the departments, and thereby earning large profits. Large orders were on hand for the Government, and the turnover was much greater than in the preceding year, whilst the net profits were considerably greater, notwithstanding the higher prices for raw materials and the increased rates of wages. It was also possible to make substantially greater allocations for depreciation and the reserve fund. The net profits, which were recorded in this journal on December 3rd, have permitted of the payment of a dividend of 18 per cent., as against 10 per cent. in 1913-14. It is added that the new financial year commenced with a large stock of orders on the books.

The Bayerische Stickstoff Werke, A.G., of Munich, which company was entrusted by the Government with the construction and working of two cyanamide manufacturing works, apart from its own plant of the same kind, reports that the sales of stocks and products were buoyant in 1914-15, when new plant was installed to increase the capacity. The sum set aside for depreciation was £33,000, as contrasted with £27,000 in 1913-14, leaving net profits of £57,000 and £32,000 in the two years respectively on an ordinary share capital of £400,000. A dividend at the rate of 12 per cent. has been declared, as compared with 8 per cent. in the previous year, and it has been decided to raise the share capital to £600,000, partly for the purpose of developing the power of the Alz at Tachertingen. It is stated that the two new works for the Government have now been completed, the company having established a special department for this purpose and a branch in Berlin.

Venezuela Telephone and Electrical Appliances Co., Ltd.—The report for the year ended June, 1915, shows a profit of £17,644, plus £10,433 brought forward. After providing for interest on prior lien, first and second debentures, and for payment of income-tax, there remains a balance of £20,401, out of which it is proposed to pay a dividend of 30 per cent., amounting to £2,580 (less income-tax) cumulative preference shares, thus discharging arrears of dividend to December 31st, 1906, to place the sum of £6,000 to reserve for renewals and depreciation, and to carry forward the balance of £11,821. £6,191 has been spent on capital account during the year.—*Financial Times*.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—The directors announce an interim dividend of 3 per cent. (being at the rate of 6 per cent. per annum) on account of the dividend accrued on the 6 per cent. cumulative preference shares.

Ruthin Electric Supply Co., Ltd.—The first annual meeting was held on November 25th. The works were opened last February. The number of consumers connected exceeds the promoters' expectations. The directors were re-elected.

Canadian General Electric Co., Ltd.—A quarterly dividend of 1¾ per cent. on the common stock for the three months ending December 31st is announced.

Blackpool, St. Anne's and Lytham Tramways Co., Ltd.—The accounts for the year ended October 31st, after providing £7,500 for interest on debenture stock and £1,500 for sinking fund, show a debit balance of £42,235 which is to be carried forward.

Eastern Telegraph Co., Ltd.—The directors announce a dividend at the rate of 3½ per cent. per annum, less income-tax, on the preference stock for the past quarter, and the third quarterly interim dividend of 1¼ per cent. on the ordinary stock, free of income-tax.

J. G. White & Co., Ltd.—No interim dividend is to be paid on the preference shares.

Marconi's Wireless Telegraph Co., Ltd.—An interim dividend of 5 per cent. on the ordinary shares is announced, also a dividend of 7 per cent. on the preference shares.

Marconi International Marine Communication Co., Ltd.—Interim dividend of 5 per cent., less income-tax.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets all round are very quiet. The larger capitalists have been putting substantial amounts into the French Loan, the subscription lists for which closed on Wednesday in this week. Quantities of the British Treasury bills are being taken by the banks and other financial institutions, the funds thus employed not passing through the Stock Exchange at all. The Government scheme for buying American railroad bonds is another factor making for quietude in the markets, and smaller sums are being reserved for investment in our own War Loan which is to come. With regard to the last, it is said now that its advent may be postponed until early spring; and this consideration has done something to help the price of Consols. The news from the various war fronts remains uncertain enough to check any speculative disposition on the part of the public; nor has anything sufficiently exciting come of late from the Latin-Canadian countries to galvanise the different markets connected with their securities.

Charing Cross City preference relapsed 5s. to 3, and the 4 per cent. debenture stock at 78 is 2 points down. St. James' fell ¼ and South Londons ⅛, to 6¼ and 2¾ respectively. South Metropolitan ordinary have been changing hands in the neighbourhood of 13s. Business in this section is meagre. An apt illustration of the prevailing state of affairs is to be seen in the fact that although St. James', as already mentioned, are down ¼ to 6¼, no shares have changed hands in the Stock Exchange since the beginning of June, the last recorded bargain having been at 7 5/32.

Bournemouth and Poole ordinary have been dealt in within the last week at 9¼. There is a little business doing in County of London ordinary and preference, the prices in each case being 10, with the preference slightly better than the ordinary. Yet still the difficulty of obtaining shares is noticeable in certain cases. A buyer of Melbourne Electric preference has been bidding 5½ without success, although the shares last changed hands on this basis early in July.

Dividend estimates are being cast by those interested in the electric lighting market, and a good deal of curiosity is felt as to how the various companies will emerge from the present half-year. Speaking generally, it is expected that the West End undertakings will be found to have fared badly. The City Company may be expected to show comparatively good results, having regard to the circumstances of the times. The County of London, with its extensive ramifications and its large circle of customers using current for power, should be in a better position than most of the others.

If there should happen to be any supply companies in the group which have undertaken big contracts without the saving protection of a coal clause, the absence of such a safeguard will probably make itself felt severely in the accounts. Pending the dividend announcements and the issue of the reports, it is superfluous to do more than re-echo these generalised ideas current in Stock Exchange circles.

British Aluminium ordinary shares, which had a sharp rise last week, have gone back a shilling, but retain a good deal of elasticity and market animation. The company, as already mentioned, is said to be doing exceedingly well, and there is a talk of the previous 5 per cent. dividend being doubled. The 6 per cent. preference shares have drooped to 18s., at which the return is 6⅔ per cent. on the money. Castner-Kellners are changing hands pretty freely on the basis of 60s. Edison & Swan 4 per cent. debenture has risen 5 points to 62, and business was marked at this price at the end of last week. General Electric preference have been done at 9 11/16, and a bargain was recorded in the ordinary shares a few days ago at £10 9s. 3d. per share.

India-Rubber, Gutta-Percha & Telegraph Works ordinary rose 25s. to 9 upon an excellent report, which shows that the poor results of 1914 were the temporary matter which the board then anticipated. Last year, it may be recalled, the reserve fund was raided to the extent of £50,000 in order to pay the preference dividend, and 5 per cent. on the ordinary. For the year just finished, the company's profit came to £80,400, against a loss of £19,000 in the preceding twelvemonth. The carry-forward is raised from the bagatelle of £1,000 to £18,900; and the dividend on the ordinary shares reverts to 10 per cent., free of tax. It is one of the most satisfactory reports which we have seen for a long time, and shareholders are to be congratulated upon the achievement.

The feature of the week in markets devoted to electrical issues is a sharp rise in the various issues of the British Columbia Electric Railway. We restored four of the company's stocks to our price lists a few weeks ago, on the assumption that affairs in the Dominion and Farther West were sufficiently promising to justify the anticipation that more interest was going to be taken in the stocks and shares connected with them. The deferred and the preference are both up 7 points, the preferred gained 3, and the 4¼ per cent. debenture stock went up 2. Once again the monotonous statement has to be repeated that there is very little stock to be obtained, and buyers want the offer.

The Adelaide Supply Co. has had a fine year, and the ordinary dividend of 10 per cent. is supplemented with a bonus of 2 per cent. More capital is required, and the Treasury's sanction has been obtained to an issue of 20,000 ordinary shares, at 30s. premium, on the understanding that the shares shall be offered only to proprietors in Australia.

British Electric Traction preference were sold a few days ago at 73, the 7 per cent. non-cumulative and the 6 per cent. preferred ordinary changing hands at 46 and 15 respectively, while the deferred was done at 10 and 8¼. London & Suburban Traction ordinary have dropped back to 2s. 6d., and the 5 per cent. preference can be obtained at a shade under half-a-sovereign. The last recorded bargain in London United Tramways 4 per cent. debenture stock was at 51.

The Anglo-Argentine Tramways group keeps very steady, most of the business nowadays being in the 5 per cent. debenture, on the basis of 81. Brazil Tractions have gone back to 53½, more in sympathy with the dullness of other markets round the House than from any particular apprehension on account of the decline in the rate of the Rio exchange. Mexico Trams and Mexican Light & Power descriptions are a trifle uncertain. The first mortgage bonds of the latter company are a point lower at 48. Business in the shares occasionally takes place about 42, but the absence of news from Mexico is a good reason for the lack of business now apparent in this section.

Home Railway Steam stocks tend to sag, in spite of the near approach of the dividend distribution. With the uncertainty surrounding the Government attitude in the matter of dividends, people refuse to buy Home Railway stocks, except by occasional spasms. But the electrical group is firm, with Central London 1½ better at 72½. Recently some reviving attention has been paid to East London ordinary stock, where buyers have been giving about £4. Metropolitan Consolidated ordinary, deferred dividend, stock was done the other day at 15¾, and the Surplus Lands stock at 15⅛. Districts are better at 15½. Underground Incomes lost a small fraction.

There is a rumour to the effect that the Treasury intends to remove all minimum prices, from stocks affected by their previous regulation, on January 1st next. Meanwhile, there is a fair amount of business passing in Metropolitan District 6 per cent. debenture stock, this being one of the securities not "protected" by the Treasury restriction. The stock carries 3 per cent. dividend, payable at the end of the year; it can be bought at 114, and at this price the yield on the money comes to £6 2s. 10d., allowing for inclusion of the interest.

Telegraphs present a firm front as a whole, with small advances in Anglo-American preferred and Eastern Extensions. River Plate preference are ⅛ lower, and Oriental Telephones have eased off. Marconis are a very dry market at present, the price having hardly moved for about a month. Henleys are in demand, with a rise of ¼ to 13, though the preference lost a similar amount at 4¼. British Insulated preference have also weakened, while the ordinary at 10½ are ⅜ to the good. It would seem that holders of preference shares are exchanging them for ordinary—at all events, in this particular department. Rubber shares are well maintained with the price of the product, which keeps about 3s. 7d. per lb. In the leading rubber shares business is still reasonably active, but the recent rush to buy is over for the time being.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Blackpool-Fleetw'd	Sept. 25	7,085	+2,182	38	33,886	— 458	8	..
Bristol	Nov. 26	38,599	+7,081	47	451,173	+45,649	80·5	..
Cork	„ 25	1,798	— 8	47	28,639	+ 25	54·25	..
Dublin	„ 26	22,522	+ 257	47	287,405	+10,698	9·89	..
Hastings	„ 25	2,930	— 106	..	..	— 166	19·8	..
Lancashire United	„ 24	6,247	+ 476	47	81,852	+ 5,145	42	..
Llandudno-Col. Bay	„ 26	761	+ 150	48	17,294	+ 1,787	6·5	..
Tyneside	„ 24	2,070	— 28	21	13,000	— 581	11	..
Anglo-Argentine	„ 25	310,986	+2,480	7	2,897,085	—134,417	..	..
Auckland	„ 19	20,910	1,519	20.2	104,036	— 482	25·42	1·06
Calcutta	„ 27	16,811	+ 698		..	— 8,238	..	..
Kalgoorlie, W.A.	Sept.	2,937	..	39	25,116	..	..	..
Madras	Sept. 30	1,837	+ 269	39	85,204	+ 721	..	..
Montevideo	Nov.	28,407	+1,826	4	28,407	+ 1,826	..	..
Dublin-Lucan Rly.	Nov. 26	556	+ 12	21	8,275	+ 90	7	..

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend, 1914.	Price Dec. 14, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	7½	—	£6 18 4
do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	3½	—	7 2 10
do. do. do. 4½ Pref.	4½	3½	—	6 0 0
do. do. City Pref.	4½	3	— ½	7 10 0
do. 4 Deb.	4	73	—2	5 2 7
Chelsea	5	4¼	—	5 17 8
do. 4½ Deb.	4½	87	—	5 3 6
City of London	9	12¼	—	7 7 3
do. do. 6 per cent. Pref.	6	11	—	5 9 1
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10	—	7 0 0
do. do. 6 per cent. Pref.	6	10¼	—	5 17 8
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	83	—	5 8 0
Kensington Ordinary	9	6	—	7 10 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4¼	—	7 1 2
do. do. 4 Deb.	4	75	—	5 4 0
Metropolitan	3½	2¼	—	7 15 7
do. 4½ per cent. Pref.	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	85	—	5 6 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6¼	— ¼	8 0 0
do. do. do. 7 per cent. Pref.	7	6	—	6 16 8
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2¾	— ⅛	7 5 6
South Metropolitan Pref.	7	1$\frac{1}{16}$	—	6 14 0
Westminster Ordinary	9	6¼	—	6 18 6
do. 4½ Pref.	4½	4⅛	—	5 9 0

Telegraphs and Telephones.

	Dividend, 1914.	Price Dec. 14, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	101	+ ½	5 19 0
do. Def.	1½	22⅞	—	6 11 3
Chile Telephone	8	6½	—	6 8 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	12⅜	+ ⅛	*6 9 3
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord.	7	128	—	*6 4 0
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	10⅝	—	*6 9 2
do. Pref.	6	10⅝	—	5 12 6
Gt. Northern Tel.	22	33½	—	6 11 4
Indo-European	13	48 xd	—	6 15 4
Marconi	10	1⅞	—	5 6 8
New York Tel. 4½	4½	101	—	4 9 1
Oriental Telephone Ord.	10	1⅞	— $\frac{1}{16}$	5 6 8
do. Pref.	6	⅞	—	6 17 2
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	6	—	*7 12 5
do. Pref.	6	4¾	— ⅛	5 8 1
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12⅝	—	*6 7 0
do. 4 Deb.	4	80	—	5 0 0

Home Rails

	Dividend, 1914.	Price Dec. 14, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented	4	72½	+1½	5 10 6
Metropolitan	1¼	24½	—	5 2 0
do. District	Nil	15½	+ ½	Nil
Underground Electric Ordinary	Nil	1⅝	— $\frac{1}{16}$	Nil
do. do. "A"	Nil	5 9	—	Nil
do. do. Income	6	77	— ½	*8 17 6

Foreign Trams, &c.

	Dividend, 1914.	Price Dec. 14, 1915.	Rise or fall this week.	Yield p.c.
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do 5 Deb.	5	95 xd	—	5 5 0
Anglo-Arg. Trams, First Pref.	5½	8	—	6 17 6
do. 2nd Pref.	5½	8½	—	7 17 2
do. 4 Deb.	4	76	—	5 5 3
do. 4½ Deb.	4½	76	—	5 18 5
do. 5 Deb.	5	81	—	6 4 0
Brazil Tractions	3½	53½	— 2½	6 10 10
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb	4½	85	—2	5 3 0
British Columbia Elec. Rly. Pfce.	5	60	+7	8 6 8
do. do. Preferred	—	40	+3	Nil
do. do. Deferred	—	40	+7	Nil
do. do. Deb.	4¼	64	+2	6 12 10
Mexico Trams	Nil	42	—	Nil
do. 5 per cent. Bonds	—	49	—	Nil
do. 6 per cent. Bonds	—	44	—	Nil
Mexican Light Common	Nil	30	—	Nil
do. Pref.	Nil	42	—	Nil
do. 1st Bonds	—	48	—1	—

Manufacturing Companies.

	Dividend, 1914.	Price Dec. 14, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	2$\frac{5}{16}$	—	6 1 9
British Aluminium Ord.	5	22/6	—1/-	4 9 0
do. Pref.	6	18/-	—3d.	6 13 4
British Insulated Ord.	15	10½	+ ⅜	7 2 10
do. Pref.	6	5⅜	— ½	5 11 7
British Westinghouse Pref.	7½	88/6	—	7 16 0
do. 4 Deb.	4	70	—	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	10½	—	7 2 10
do. 5 Pref.	5	4¼	— ¼	5 17 8
do. 4½ Deb.	4½	90	—	5 0 0
Castner-Kellner	20	3	+1/-	6 13 4
Edison & Swan, £3 pd.	Nil	9/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	62	+5	6 9 1
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	14/-	—	8 11 6
do. do. Pref.	7	19/9	—	7 1 4
Gen. Elec. Pref.	6	9¾	—	6 3 1
Henley	20	13	+ ¼	*8 15 9
do. 4½ Pref.	4½	4¼	— ¼	5 6 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	10	9	+1½	*11 8 2
Telegraph Con.	20	31½	—	*8 1 0

* Allowance made for dividends being paid free of income-tax.

International Light and Power Co., Ltd.—According to a financial paper, the quarterly dividends on the preference shares are deferred for the present.

ELECTRICAL ACCIDENTS IN MINES.

(*Concluded from page* 762.)

In one of the underground accidents a coal-cutter machine man worked a 25-H.P. Hurd bar cutter driven by a medium pressure (about 440 volts) squirrel-cage three-phase motor. The deceased was the chargeman.

At the time of the accident the machine was about midway between the gates, and it was stopped so that deceased might lay a set of rails. When working, the machine travelled towards the gate-end box, to which it was connected by a trailing cable some 80 yards in length, containing three vulcanised rubber-covered leads each 0.035 sq. in. section, and an insulated earth conductor of 7/20 copper wire (0.007 in. section), the whole four wires being twisted round each other and packed with some hemp inside a leather cover stitched together by a longitudinal seam.

It appears that when deceased was fitting a rail to a steel sleeper just in front of the machine he received the shock which killed him. On hearing a shout, his mate went round by the gate and switched the current off the cable at the gate-end box, and then discovered deceased lying full length on the trailing cable with his legs slightly pulled up, his head being close to the front wheel of the machine. The loose rail he was laying was in his left hand and a hammer in his right.

At the inquest an assistant electrician spoke of having examined the trailing cable about ten hours before by passing his hand along the leather covering. By such an examination he could not judge more than that the covering was right. As regards the continuity of the earth wire, this had been tested and found all right about a month before. After the accident the trailing cable was opened out and found to be in bad condition, there being two faulty places on the conductors and two breaks in the earth wire. Under these circumstances the death of deceased was easily accounted for.

Owing to the way in which the cable was constructed, Mr. Charles D. Mottram, H.M. Inspector of Mines, who visited the mine to investigate the accident, could not definitely say where the cable was faulty until the leather cover had been stripped off. As regards the broken earth wire, only a test would indicate this defect. The cable had been in use five years, and it could hardly be expected to be in other than a well-worn condition. That the earth wire was found to be broken was no doubt due to the constant coiling and uncoiling of the cable under working conditions.

It was evident that a month was too long to trust to the continuity of any earth conductor, and Mr. Nelson, H.M. Electrical Inspector, who also visited the colliery and attended the inquest, expressed the opinion that earth conductors of trailing cables should be tested for continuity on each day before the cable is put to use.

As the earth conductor was of less cross-section than .022 sq. in., the minimum provided by General Regulation 125 (*b*), proceedings were taken against the agent of the colliery for a violation of the regulation referred to. The facts were not in dispute. The use of an earth conductor which failed to comply with the regulations was proved, but it was argued in defence that as the trailing cable, which included the earth conductor, had been in use before the 1st June, 1911, the company was within its rights, under General Regulation 137 (*b*), in continuing the earth conductor in use, even though the coal-cutter had been installed since the 1st June, 1911.

The Bench held that the defence was right, and dismissed the case without, however, giving the defendant his costs.

In the other accident, an assistant electrician was killed whilst splicing an electric cable carrying 550 volts pressure in a gateway. The deceased had, before proceeding to work, written with chalk on the junction switch-box cover: "Don't touch this switch, N. Lumb." The current was subsequently switched on by some person unknown. Coal-cutters driven electrically were about to be used, but the machine chargeman swore on oath at the inquest that, while it was his custom to switch on the current, if not already on, when going inbye, he did not do so on the occasion of the accident, as the current was already on when he passed in to work.

This accident, which was an avoidable one, was due, apparently, to the carelessness of some person not reading the notice on the switch. The management have since arranged to lock the switch-lever while repairs are going on between the switch and the coal face. In such cases the key should be in the possession of the individual working on the dead conductors. This appears to be the practice in working on high and medium pressure mains on the surface, and it is obviously as necessary underground. Clearly no person's life should depend upon a chalked message being observed and acted upon.

In the Lancashire and North Wales Division there were no fatal accidents, but three persons were slightly burnt.

In the South Wales Division there was one fatal accident below ground, and six non-fatal accidents in which seven persons were injured. As regards the fatal accident, an assistant electrician received a fatal shock while attempting to replace the cover of a switch-box without previously having switched off the current. The pressure was 500 volts. As regards the non-fatal accidents, the Inspector reports these "were caused by irregular or improper manipulation of electrical plant, and one by a faulty connection." Why will workmen not remember they are working with a live and dangerous force, which is not to be treated with contempt?

In the Midland and Southern Division there were two non-fatal accidents below ground and three above ground. Of the former, one occurred to an electrician who was changing a fuse. Finding that the fuse he had did not fit, in order to allow the motor to work, he attempted to couple up a short length of insulated wire to act temporarily. While doing so he apparently allowed one end of the wire to touch a live part after the other end had been fixed. The result was a short circuit, which caused a flash which burned his face slightly. He was subsequently fined by the manager for contravention of General Regulation 131 (*g*). The second accident was very similar. An assistant electrician was making an examination for the purpose of discovering the cause of the stoppage of an electrical coal-cutter. When pulling out a fuse, a piece of wire protruding from the bridge made a contact which caused some sparking, which slightly burned his right hand and forearm. Had the current been cut off as provided for by General Regulation 128 (*b*), the accident would have been prevented.

Of the surface accidents, one occurred to a power-house attendant who was replacing a fuse which had blown. A liquid starting switch controlling a 16-H.P. motor (500 volts) had not been taken out. In replacing the fuse, the attendant brought the contacts of the switch, which was of the ordinary double-pole tandem quick-break type, together slowly, and then opened it. The result was an arc, which burned him superficially on the hand and wrist.

In the second case, two electricians had been changing the armature in a motor, and in coupling up again, one of them in error failed to connect one of the supply cables on to the field, with the result that the no-volt release got the full load without any resistance. The no-volt release coil insulation was completely destroyed inside the starting switch box. Without knowing what had occurred, the assistant electrician put in the switch, and an explosion immediately resulted, blowing off the switch-box cover, which struck him on the stomach and slightly injured him.

The third accident occurred in the same powerhouse and to the same attendant as was injured in the first accident. He was actuating a change-over switch on a lighting panel, and appears to have manipulated it improperly. The result was an arc, which slightly burned him on the forehead and eyes. The switch was of an old type, but had been in use for some 14 years. It has since been replaced by one of modern type.

These accidents are interesting as showing that in nearly every case they could easily have been avoided with a little attention and care. It is surprising that much of the apparatus was poorly constructed and faulty in spite of all the Home Office regulations. We sincerely trust that all colliery managers will benefit by these records, and have their own installations put into thorough order.

OUR TRADING OPPORTUNITIES THROUGHOUT THE WORLD.

(*Continued from page* 764.)

The Trade of New Zealand.

In his final report as H.M. Trade Commissioner for New Zealand, Mr. W. G. Wickham urges manufacturers to educate their prospective customer, whilst studying his particular requirements, into appreciating the superior value of British goods. At the same time Mr. Wickham points to the necessity for lowering selling prices to a more competitive level, and he makes some suggestions for effecting this by improved shipping arrangements and better methods of distribution. His remarks are summarised below. He evidently takes the view that more orders would pass to the Mother Country if the manufacturing exporter got into closer touch with the purchaser, and by this means terminated, or at least curtailed, the system by which the New Zealand importer indents on buying agents and shipping agents for the goods required. Mr. Wickham's experience from investigating complaints is that many mistakes for which manufacturers are blamed are due to these agents, who work in grooves, and are just as ready to place orders in Continental hands as British. The statements that this and that line cannot be got in England, and that manufacturers will not do this or that, or modify something else, nearly always proceed from them. After the outbreak of war, Mr. Wickham circularised the leading New Zealand importers suggesting that they should instruct their London buyers to consult at the Board of Trade the lists of manufacturers who were prepared to supply goods previously furnished by Germany and Austria. He found that some importers would not be convinced, in spite of all the evidence, that they could get what they wanted from England, and they transferred their inquiries and business to America at once. This tendency, whether proceeding from indifference of the buyer or lack of push on the part of the maker, should be changed.

On the general subject of foreign competition in New Zealand there is less to be said about Germany than about the United States. It is worth noting, however, that the elaborate cultivation of the market by German exporting organisations—backed by the Nord-Deutscher Lloyd—was carried on in return for a share in the import trade of the Dominion amounting to only 5 per cent. of the total. This characteristic of the Teuton of contenting himself with a small return at first in the hope of ultimate profit is one which might be more frequently imitated by the British trader.

The report, which deals with the trade of the Dominion for the year 1914, gives the following figures of imports and exports for the past three years, those for 1914 being subject to revision.

	Exports.	Imports.
1912	21,771,000	20,977,000
1913	22,987,000	22,286,000
1914	26,261,000	21,856,000

American and German Competition.

The opening of the Panama Canal has already been shown to have brought the Eastern States of America into closer touch with New Zealand. This was dramatically brought home to importers when the first direct steamer *viâ* the Canal reached Auckland in advance of the mail which carried the relative documents, and a situation somewhat embarrassing to consignees resulted. Attention has been called on more than one occasion to the serious growth of competition for trade with New Zealand which is resulting from more rapid and more frequent steamer connection between America and New Zealand. The better steamers across the Pacific to the west coast of America are inducing people to an increasing extent to treat the route across the United States or Canada as "the way home"; and it frequently happens that business men, even if they have no particular intention of doing business until they reach England, are captured *en route*. Every effort is made in America to secure the goodwill of such travellers by hospitality, and by giving facilities for seeing works and business systems. Hitherto, the slow and indirect steamer facilities from the manufacturing side of America have militated against trade with New Zealand. It may be seen at once, therefore, that the immense reduction in distance effected by the opening of the Canal is a fact which British manufacturers cannot afford to ignore. Freight rates must also be closely watched. American manufacturers have been materially assisted in the past by the preferential low rates conceded to them by British shipping companies, ostensibly in order to keep the shipping from American ports in British bottoms. Similar preferential rates have been given to goods shipped on through bill of lading from Antwerp, Bremen, and Hamburg, *viâ* London, and carried in British ships. The alternative for German merchants was to send goods by Nord-Deutscher Lloyd boats to Sydney for transhipment to New Zealand. The excessively low rates, in some cases as much as 30 per cent. less than from London, unquestionably tended to divert trade to Germany, especially in bulky cheap goods. Assisted in this way, German trade had grown to such dimensions that the Nord-Deutscher Lloyd opened offices in New Zealand in the early part of 1914, and arranged to bring their steamers right through. The first steamers were on the way when war broke out. From this, it is evident that the policy of giving low freights to German goods, while damaging to the British manufacturer, has failed to achieve the object which was its justification.

Meeting the Market.

The closing of the German market as a source of supply has called attention to the goods in demand in the Dominions, and the large number of these which have been supplied from Germany. Many are little more than cheap imitations of British makes, and in this case it is exceedingly doubtful whether it is desirable that we should lower our standard. If skilled labour is fully occupied in a particular trade, it would undoubtedly be a serious error to divert it from making high-grade goods, for which there is a good demand and less competition, to turning out low-grade articles in which the competition is severe. My own view is that manufacturers are blamed unjustly in many cases for not cheapening their goods by making a lower quality. On the other hand, they are extraordinarily obstinate when they persist in disregarding the use to which goods are put, and making them unnecessarily heavy, cumbersome, and awkward to use. The accusation against the manufacturers is that they invariably reply that what is good enough for the home market is good enough for New Zealand. If, however, the New Zealander lives and works under different conditions, and in a different way, the manufacturer is merely showing his ignorance of the fact that there is considerable variety of taste and habit in different parts of the world. When the manufacturer, further, refuses to parcel his goods and pack them as his customers require, he is simply putting himself out of the market, and deserves no assistance.

It is quite certain that the trade done hitherto in New Zealand by Germany and Austria will not drop into the British lap and stay there without deliberate effort. It may be that the present time will induce the public to make trial of, and the retailer to stock, better quality British goods, instead of Continental makes which cannot be procured. Buying agents in London and Birmingham may be forced to widen the area of their acquaintance with British manufacturers. The latter, however, must first realise that if they do not unbend and hustle, the whole trade will go to America or any other country which will meet the requirements of buyers.

Firms manufacturing for both Australia and New Zealand ought to realise one important contrast between the two markets. In proportion to its population, the latter has an exceptionally large number of more or less independent importing and exporting centres. This not only augments the number of towns for agents to visit, makes travelling expenses higher in proportion to sales, multiplies the number of firms to be dealt with in order to cover the Dominion, reduces the size of individual orders, and widens the area of and so increases the cost of advertising, but it is the most important factor in raising retail prices through the high cost of distribution.

Selling Prices.

The main difficulty in selling British goods of any and every kind is that they are almost invariably more expensive than any others. In most cases they are better quality, and in many cases they are better by much more than the difference in price; in other words, they are better value. Starting from the standpoint of unwillingness to reduce quality, which is in the main a sound attitude, Mr. Wickham says that there seem to be only two alternative courses: Either the cost must be reduced while retaining the quality, or the public must be convinced that it is advantageous to buy the more expensive goods. On these two main lines a few suggestions deduced from a study of trade methods in New Zealand may be of use. In the first place, as few manufacturers do their own shipping, the fact has not been sufficiently appreciated by them that the price of goods, which determines their sale, is not the works' cost, but the cost delivered in the consumers' market. From the point of view of the ultimate buyer, it makes not the slightest difference whether a low price is brought about by economies in manufacture or in packing, in freight or in reduction of breakage. If manufacturers are working on too small a scale to do their own shipping at rock-bottom cost, they must either depend on merchants or adopt some co-operative method which will enable them to share in a single efficient and economical selling organisation. If they do their own selling, they must realise that it is to their interest to employ as much time, brains, and energy in producing economies in the packing and shipping of goods as in reducing costs in manufacture. If their export office is not well organised and staffed they will fail to meet competition in distant markets, in spite of all the chemists and technical experts whom they may introduce in their works. In goods such as insulators, British manufacturers are beaten on price by Continental competitors, whose large scale of production lowers their costs. The Colonial habit of deferring orders, and then requiring urgent delivery, makes it important that large stocks should be carried.

New Zealanders must not be blamed for purchasing comparatively "cheap" goods. Cost of distribution makes retail prices high compared with landed costs. The retail trade makes very little effort to sell on quality. The dominating policy is to get something cheaper than competitors and to push goods solely on price. It remains to consider what, if anything, can be done by the manufacturer to promote the sale of his goods in spite of their being more costly than others.

Points to Consider.

The following are some points which may be suggestive:—

Give the agent, merchant, and retailer special inducements and adequate remuneration, bearing in mind cost of distribution, or travelling, and of living. Large margins must be allowed for commission or discount.

Study the convenience of those who handle the goods by adopting neat parcelling and labelling. This saves time and labour in distributing and retailing.

Get away from the pleasant self-satisfied British belief that everyone in the world wants British goods. Take the trouble and go to the expense of making them known and wanted. Call in the assistance of a good local advertising expert, and plan to stimulate demand.

Demonstrate to the New Zealand purchaser that British manufactures are good value, whilst the foreign are merely cheap substitutes, and bad value at the price. To do this send consignments, after consultation with an agent, and arrange for them to be displayed.

Let the manufacturer come out and go round with his agent in order to learn the difficulties of selling, and what technical information will be of use to his agent.

Mr. R. W. Dalton, who, as already announced in our pages, has been appointed to succeed Mr. Wickham as H.M. Trade Commissioner in New Zealand, has had many years' experience in the Board of Trade Commercial Intelligence Branch, and his activities in that department have acquainted him very thoroughly with the abilities and characteristics of British manufacturers. We have good reason for speaking highly of Mr. Dalton's qualifications to efficiently fill the important office to which he has been appointed. He is no stranger to electrical and engineering matters, and we do not doubt that in him our firms will have both a staunch champion and an intelligent critic.

REVIEWS.

Modern Illuminants and Illuminating Engineering. By L. Gaster and J. S. Dow. London: Whittaker & Co. Price 12s. 6d. net.

There are now many works dealing with the subject presented by the authors, but the matter before us is treated in a very different manner to any of the other English books which we have seen. It would appear, however, to be modelled to a large extent upon the lectures in Illuminating Engineering delivered at the Johns Hopkins University. We are of the opinion that the writers have been mistaken in attempting to work on such broad lines, and the reader who is on the look-out for a good practical work is apt to be disappointed.

In their preface the writers state that their aim has been to bring together matter not usually available in a single volume, and there is no doubt that they have succeeded admirably from this point of view. They also make a further apology for not entering deeply into details, and they draw attention to the large number of references which enable readers to refer to the original papers for fuller information. Here, again, we have nothing but praise for the immense amount of work which has been carried out, but there are very few who take up this book who will be able to find time to refer to many of the sources of information, even were they able to get at them, since there are very few libraries which collect technical papers such as those referred to.

With regard to the actual production of the book itself, we are pleased to see that anti-glare paper has been used. This, together with the fact that the type itself is very clear, adds greatly to one's comfort in reading such a volume; but we are very disappointed at the illustrations, which are largely reproductions of what has previously appeared in the technical Press.

The first chapter contains a sketch of the history and development of methods of illumination, and, while the reading of this is no doubt of considerable interest, we do not think that its inclusion was absolutely necessary. In the first pages there are several facts which are, apparently, contradictory to accepted ideas regarding the introduction of various illuminants. The latter part of the chapter deals with the trend of modern development, and is of rather more service. The authors next deal with gas lighting, and this portion will no doubt be of considerable interest to electrical engineers. It is in this chapter that we note the laxity of the authors in speaking of candle-power. This criticism applies not only here, but also to subsequent chapters, and indicates a slavish copying of published information without the editing of the details.

The next chapter treats of electric lighting, and many of the remarks contained therein are of extreme interest. One notes that the statements contained in this chapter are generally more precise than those in the chapter relating to gas lighting, and there is also evidence that there has been a certain amount of editing so far as the claims put forward by manufacturers are concerned. A considerable number of pages are devoted to the subject of vapour lamps, details of which are usually somewhat difficult to obtain.

Oil, petrol air gas and acetylene lighting are next dealt with. The information given should be of considerable assistance to those whose duty it is to advise concerning country house lighting and other installations where an isolated plant may be required.

The two following chapters should be of very great use to those who desire to study the physical side of illumination, and, except in the lectures referred to above, we have not seen the physiological side treated so fully. The table indicating the intrinsic brilliancy of various illuminants would have been better had it been brought up to date and the more modern light sources tabulated therein. Much of the information given regarding the effects of coloured light is not generally known, and illuminating engineers would do well to carefully consider the remarks dealing with this portion of the subject. We are inclined to think that this section has been greatly neglected in the past, and this neglect is no doubt responsible for the many light-wasting devices which are on the market, and it is only by a thorough understanding of the facts put forward in these two chapters that one is enabled to appreciate the reasons for good lighting to the fullest extent.

The authors next deal with the measurement of light and illumination, and, while the fundamental laws are carefully set forth, we think that there is room for improvement; in some of the more elementary works we have noticed that the essential facts and formulæ have been more clearly defined. The description of essential instruments is very brief; it would have made the book better and of greater use had the authors dealt with the matter completely.

While appreciating that colour photometry is somewhat difficult to those not used to the work, we are inclined to think that far too much attention is paid to it, and the large number of pages devoted to it in the present work are quite unwarranted, especially in view of the more important matters omitted.

Chapter VIII is devoted to globes, shades and reflectors, and calculation of illumination, and while we recognise that the authors have endeavoured to be impartial, it is strange to find so much reference to prismatic glassware. We do not think that practical illuminating engineers will find much information which will be of assistance to them in this or the following chapters. The lighting calculations are but few, and data relating to indirect and semi-indirect lighting, which one would expect to find, are missing. We certainly share the view expressed by the authors that the lighting expert should thoroughly understand architectural style, and study how the architectural and artistic aspects of the problem can best be reconciled.

The following chapter is devoted to the problem of interior illumination. After some simple rules for good lighting, there follows a table showing the specific consumption for various systems. This table in itself is incomplete and is not at all up-to-date; following closely there are somewhat rash statements regarding the intensities of illumination usually found. The table of maximum foot-candle intensity is very brief and could be extended with advantage. A discussion on shadows and direction will be read with interest. Local and general lighting are next treated, and peculiar statements regarding the sub-division of units in a large room are to be found under this heading. Much attention is paid to domestic lighting, and school lighting, too, is treated very fully. The pages devoted to industrial lighting are generally good, but comparatively few data which would be of service are given. The illustrations of installations in this section are relatively poor and are open to much criticism. A few paragraphs regarding the lighting of buildings for large gatherings are next presented, shop lighting and illumination for games played under cover are dealt with, and the chapter closes with a few paragraphs relating to decorative and spectacular lighting.

The final chapter is devoted to outdoor lighting, and is very largely a résumé of papers and discussions, particulars of which have appeared in the technical Press. The book closes with an appendix indicating the works dealing with illumination, most of which are referred to in the text.

As a book dealing with generalities regarding lighting and illumination, there is every reason to congratulate the authors upon the admirable collection which they have made, although there are many statements, which those who have had actual experience will know cannot be justified in practice. We believe that much has been written which could have been left out with advantage, and, correspondingly, more data could have been included without making the work a highly mathematical treatise. If the authors could see their way to publish a supplementary book embodying the features indicated, we think that it would be met with general approval.

A Treatise on the Theory of Alternating Currents. By Alexander Russell, M.A., D.Sc. Vol. I, Second Edition. Cambridge: University Press. Price 15s. net.

Readers who are interested in the mathematical theory of alternating currents need no introduction to Dr. Russell's treatise, which has occupied a definite and well-merited place as an authoritative work of reference for the last ten years.

As in the case of several other works involving a great amount of labour, the call for a revised issue of the first volume has had to be met before the completion of the second volume has been accomplished.

According to the original plan of the author, the first volume contains the more general theorems of the subject of his treatise, while the second volume is to include matter more directly connected with the practical applications of alternating currents to industrial purposes, and will deal with the theory of alternators, motors, transformers, converters, and the transmission of power by polyphase currents.

The present edition contains a considerable amount of new matter, and this new material is of special value because of its bearing on many branches of electrical theory which are intimately related to advances in practical achievement of the present time.

A new chapter is devoted to the consideration of the self and mutual inductance of circular and helical circuits—a subject bearing on many problems of power and telegraphic transmission. In this connection, the author has necessarily referred to the important work published by the Washington Bureau of Standards.

Another important new chapter deals with high-frequency currents, and gives very fully the special conditions governing the transmission of such currents in a concentric cable. This subject will be of special interest to readers who are interested in telephony and wireless telegraphy. In Chapter IX, which is also new, the mathematical student of wireless telegraphy will find a discussion of the mutual actions which take place between two linked oscillatory circuits which should be of great value to him.

Another new chapter deals with a subject to which the author has already devoted much attention in papers presented to several Societies; this is the study of the electrostatic field between two charged spheres. In connection with problems on the design of high-tension transmission lines and insulators, the theoretical work of this chapter is again of a character to be of value to the earnest student of modern practical developments.

Dr. Russell's work will always prove valuable to the electrical engineer engaged in research or in pioneer work, where the theory of physical phenomena has to be reduced to mathematical symbols, and we, consequently, welcome the present enlarged issue of his important work. It is no adverse criticism to say that his treatment of the many problems with which he deals is primarily that of a mathematician and not of an engineer. He offers valuable material for the engineer to work upon.

We trust that the completion of the author's plan by the issue of the second volume of the *Theory of Alternating Currents* may not be long delayed.

Standard Handbook for Electrical Engineers. Edited by F. F. Fowle. Fourth Edition. London: Hill Publishing Co. Price 21s. net.

This volume contains 2,000 pages; the index alone occupies 68 pages, and the book is divided into 25 sections, each of which is packed as tightly with information as the editor-in-chief and his large staff of specialists—many of whose names are of world-wide reputation—can cram it. To review such a work and to do every part of it justice would obviously require a similar staff of specialists, and would be of little service to the reader after all; we can only deal with it in general terms.

The last edition appeared in the autumn of 1910, and was reviewed in our pages in 1911; it consisted of some 1,500 pages. The "total issue" was then 19,000; now it is recorded on the title-page as 35,000. No better testimony could be given as to the position it has attained in the electrical engineering world since its first appearance in 1907.

Five years is a long period in modern engineering, and therefore it has been necessary not only to enlarge and revise the contents, but in many cases to rewrite sections completely; at the same time the sections have been re-arranged on an improved system, with carefully selected subheads in bold type, bibliographies have been added, as well as numerous references in the text to sources of more detailed information, and many new sections have been introduced.

Any attempt to examine the contents of a section too closely usually results in the reviewer's attention becoming absorbed in the subject there discussed, a disastrous occurrence in view of those 2,000 pages and the limitations of human longevity. We must content ourselves, therefore, with remarking that we kept the previous edition constantly at hand, and found it extremely useful; our examination of the new one shows us plainly that it represents a great advance upon its predecessor, and that it will be an indispensable desk companion—one of those things that an electrical engineer cannot do without. That the *Standard Handbook* as a work of reference is unexcelled by any other compendium of the same kind is beyond question.

While we have not examined the work very closely for misprints, we note a couple on p. 1823, namely "Utah" for "unit" in a headline, and 6 for 9 in the value of g in the table.

The Elements of Electro-plating. By J. T. Sprague. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net.

This little book, intended as an introduction to the study of the elements of electroplating and electrotyping, is a reprint of the chapter on "Electrometallurgy" from the late Mr. J. T. Sprague's well-known text-book on "Electricity: Its Theory, Sources, and Applications." The text-book itself has for long been deservedly popular, and this extract from it was well worth separate publication to put into the hands of the experimenter beginning the practical study of his subject, or the mechanic engaged in it industrially. Indeed, it may be said that there is no existing text-book of this scope that contains so much information, put, too, in as clear and attractive a fashion as could be wished. Many an old plating-hand will find here hints and suggestions that even he will find worthy of attention.

There are, however, one or two errors; one of them on page 59 a serious one that calls for criticism. The author there writes, speaking particularly of the electro-deposition of copper, that "means have been devised to cause a circulation of the liquid, but they have mostly failed." There is probably in existence not a single modern electro-depositing plant of any magnitude, no matter what metal is being deposited, in which the electrolyte is not circulated, and it frequently happens that adequate circulation makes all the difference between commercial success and failure.

In page 110 it is recommended to keep nickel solutions slightly alkaline. That is opposed to general experience, which, on the contrary, favours a slightly acid solution, as the metal tends to strip when deposited from a neutral or alkaline bath.

The forecast on page 114 that the deposition of iron is not likely to have extensive practical application now seems likely to be falsified, for pure electrolytic iron is quite possibly going to prove of considerable industrial value.

We mention these flaws to indicate the limitations of this little manual, but nothing can detract from its extreme usefulness and remarkable fullness of information considering the tiny space into which the author has succeeded in compressing it.

SOME DIFFICULTIES OF DESIGN OF HIGH-SPEED GENERATORS.

By PROF. A. B. FIELD, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *November*, 1915.)

(*Continued from page* 766.)

Stator Construction.—We have so far dwelt upon the difficulties of rotor construction, inasmuch as these were felt to be perhaps the hardest of solution. The electrical conditions to be met in the stator are by no means easily provided for; some of them will be briefly touched upon. Reference has already been made to the high air-gap inductions and the severe way in which the annulus of stator material in the neighbourhood of the slots must be worked. The comparatively small air-gap and considerable length of the machine forbid the use of radially-disposed stator vents receiving their entire air supply from the air-gap. Some system of axial ventilation is practically imperative, and in these machines very complete axial ventilation is provided. The provision for the air supply is particularly liberal immediately behind the teeth; in fact, behind each slot are arranged three oval ventilating openings, with only a narrow strip of punching separating them from one another and from the slot; in this way the amount of core cooling surface is properly proportioned to the cross-sectional area of the air vent.

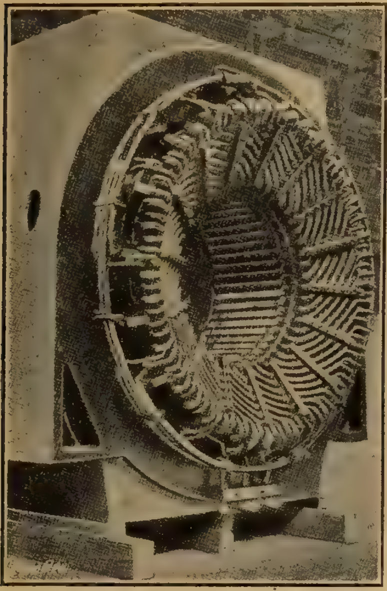
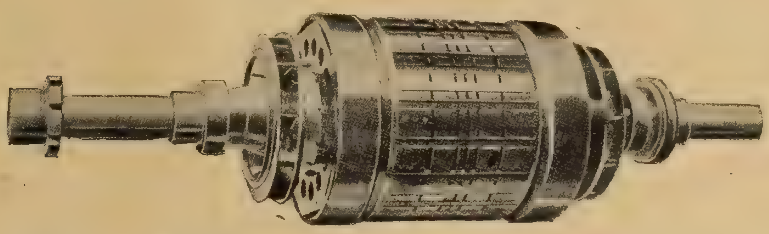


Fig. 9.

Fig. 10.—Solid Cast or Forged Rotor Construction.



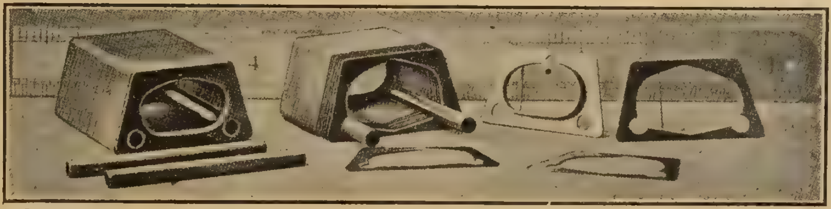


Fig. 11.

On account of the length of these machines, the cooling air is admitted at each end of the stator and discharged at the centre, avoiding the considerable difference of air temperature between inlet and outlet involved when the air is passed along the entire length of the machine. This arrangement also considerably simplifies the question of rotor ventilation. The total volume of cooling air required by such a machine is in the neighbourhood of 60,000 cubic feet per minute; and in order to accommodate these volumes a large central opening is necessary. This could be provided in the form of a number of vent ducts, but a large amount of resistance to the air flow would be occasioned by so much breaking up of the continuity of the axial air-passage. It becomes desirable, therefore, to attempt the equivalent of a single central opening. However, as it is not feasible to make any provision in the rotor for the absence of stator material at this place, a great concentration of flux is to be expected in the punchings immediately adjacent to and on each side of the central duct. Also, a great deal of stray flux from the rotor would enter these punchings at their face surface instead of at their edge. These conditions would be so severe as to cause prohibitive heating in this part of the stator if suitable provision were not made. This provision must be made in two ways: First, by properly proportioning the flux per inch of core immediately next to the vent; and second, by taking care of the large stray flux leaving the rotor from this vent zone. The stray flux can be taken care of by placing a couple of packets of punchings in the centre of the vent with the teeth cut back somewhat, the thickness of the packet being properly proportioned with respect to the increased air-gap of this part of the core, so that each packet will carry a correct amount of flux. The conditions at the end of each half of the core can similarly be taken care of by cutting back the teeth in steps, so that the air-gap is graded here to allow for the fringing effect from the rotor. In some cases it is of advantage to obtain these increased air-gaps, not necessarily by an increased inter-iron space, but by removing some of the magnetic material of the teeth themselves or immediately behind the teeth.

External Short-circuits.—One of the great difficulties anticipated from the start in the case of these large machines was the conditions arising in the case of a feeder short-circuit or its equivalent; and much discussion has arisen with regard to the advisability of using large reactance coils between the generators and their bus-bars. While a certain amount of external reactance has its use in some cases, it has been felt by some of us that these large machines should in any case be so built that they could be "dead short-circuited" at their terminals when running excited and giving full voltage. Where these units are required it is seldom of importance to have a close inherent regulation—rather the contrary. A poor regulation and a comparatively low ratio is desirable between the excitation required for full voltage at no load, and that required for full-load current on short-circuit.

In a paper read before the American Institute of Electrical Engineers, the author suggested that when a short-circuit takes place across two terminals of a 3-phase machine at the instant of zero voltage between those terminals, the maximum flux is being enclosed by the short-circuited band of conductors, and that as the rotor progresses, tending to withdraw this flux, the short-circuited stator copper maintains the flux at that time encircled, whilst the rotor also, by reason of its low-resistance circuits, maintains its own flux. The enormous short-circuit stator currents and increased excitation currents, together with the circulating currents in the body of the rotor and in the slot wedges, distort these fluxes, making each complete its circuit as best it may circumferentially through the air-gap and through whatever space is found available.

It has since been possible to obtain some confirmations of these conditions from oscillograph tests on some of these large generators. Exploring coils were threaded through the stator immediately behind the slots, to test first, the course followed by the flux encircled by the short-circuited stator copper, and secondly, that of the flux associated with the rotor. By means of two exploring coils of approximately one pole-pitch span, one of which coils has its axis coincident with the axis of the short-circuited stator copper, and the other of which has its axis displaced 90 deg. (electrical), we can trace the action during the short-circuit. From the first exploring coil we find a normal voltage wave up to the instant of short-circuit, from which time onwards the voltage generated in the exploring coil has a very small amplitude, and such voltage as arises is clearly due to high-frequency pulsations connected with slot-pitch questions. Were there any considerable 60-period changes of flux as the successive poles pass under the short-circuited copper, this exploring coil would be bound to show a correspondingly large 60-period voltage, such as is recorded immediately before the short-circuit. The second exploring coil shows the voltage produced by the stator flux which does not thread the short-circuited copper; in other words, it samples the rotor flux; and the oscillogram given by this exploring coil shows a continuity passing through the instant of short-circuit, the curve only gradually changing shape and amplitude after many cycles beyond the short-circuit point.

An appreciation of the general nature of these distortions arising on short-circuit is of some importance, indicating among other things the great gain that may be expected by providing what will be, from this point of view, an increased air-gap; that is to say, by increasing the physical distance between the stator copper and such part of the rotor (generally very near to the surface) as is effective in carrying large currents. The author does not believe that there is much to be gained by the presence of magnetic material in the interspace between the windings; for instance, a partial closing of the stator slots by overhanging tooth-tips would not be of appreciable benefit under short-circuit conditions. The chief requirement is more space. In the machine mentioned, this increased space is obtained by a device which became necessary owing to entirely different relations; it is obtained by the use of the laminated magnetic slot-wedge described below. The results of short-circuit tests on a 20,000-K.V.A. machine with this construction showed by oscillograph tests how effectively the maximum short-circuit current had been kept down. The maximum possible short-circuit current found at full voltage, assuming the short-circuit to occur under the worst conditions of phase, amounted in this machine to only about 14 times the maximum of the full-load current wave. In some other machines, not requiring the laminated wedge, the desired separation has been obtained otherwise.

As regards protecting the part of the winding external to the core, the means adopted in this case are believed to be more substantial than ever before used. Fig. 9 indicates the type of stator end-winding and bracing adopted, but it does not clearly show that the supporting conditions obtaining throughout the length of the core, by reason of the teeth and slots, are again reproduced in the end-windings. This is effected by means of bronze herring-bone castings placed between the two layers of the end-connection winding, the casting have fins projecting between the coils on each side of it, thus locking the two layers together and entirely providing for any tendency of the one layer of winding to shear relatively to the other. In fact, we have at every one of the 16 metal supporting brackets practically slot conditions reproduced.

Rotor Surface Losses.—It has seldom been the case in the past in turbo-generator work that with reasonable design it has been necessary to pay much attention to the question of rotor-face losses occasioned by the open stator slots. With reasonable stator slots the air-gap has been generally ample, even in spite of the very great peripheral speed of the rotor. In the present case, however, with an air-gap of only about 1 in. radially and with the very high air-gap inductions involved, great caution was needed. It happened that, in the first few machines concerned, the stator voltages were sufficiently low to enable a cautious compromise to be adopted, with a size of slot that did not appear to involve too great risks, such slot, however, being smaller than is desirable from an electrical point of view. However, some orders having been taken for machines of high voltage (such at 13,200 volts), it was obviously necessary to discard compromise and devise a means of using a large stator slot without serious rotor loss. In this connection it may be pointed out that, while for low peripheral speeds and machines of the type common in engine and water-wheel practice we have sufficient data to determine fairly well what will be a harmful configuration of slot, air-gap, air-gap induction, etc., we have not got these data for turbo-generator conditions. In the classical article* of F. W. Carter, investigating the air-gap reluctance as affected by stator slots, this author proceeded to indicate in a general way the manner in which the various factors were involved which determine the pole-face loss under certain hypothetical conditions, although the formula given was probably never intended to be a quantitative indication of the pole-face loss. According to this investigation, a figure involving the following factors should be some criterion of the amount of loss per square inch:—A factor depending upon the ratio of slot to gap, which can be most easily obtained from a curve; the square of the ratio of the rotor ampere-turns for the gap to the gap length; the peripheral speed of the rotor to the 1.5th power; and, finally, the square root of the slot-pitch. The other quantities involved may generally be considered constant from one machine to another. While it is not possible to compare, say, an engine-driven machine with a turbo-generator on the basis of this criterion, the figure has been found to furnish some kind of guide between one machine and another of similar type.

Another group of investigators having carried out experimental researches on the pole-face loss due to open slots give the factors involved as follows:—Air-gap density to index 2.5; peripheral speed to index 1.55; ratio of slot-width to air-gap to index 1.88; square root of slot pitch. This differs from the previous one chiefly in the way in which it involves the ratio of slot to gap.

This criterion may be valuable for speeds and conditions in the neighbourhood of those corresponding to the experimental researches, but, again, it cannot be applied to turbo-generator conditions on a comparative basis. Also, comparing one turbo-generator with another, the relative merits on the basis of this criterion will be quite different from those on the Carter basis. There is, in fact, room for further experimental investigation on this matter at the actual high peripheral speeds, great air-gap inductions, and other relative proportions involved in recent turbo practice.

Tests were made on the completion of the first machines in which, as mentioned above, a compromise width of stator-slot was used, this width being considered to the best of our knowledge to be just on the margin of safety. These tests indicated that we were not far off in our judgment, and while we had commenced to incur some little rotor losses, which would have been serious had the slots been larger, it was not necessary to use the semi-magnetic wedges that had been prepared as a precautionary measure for these slots. For the 13,200-volt machines a built-up magnetic slot-wedge had been devised, consisting of a group of punchings assembled between little flanged brass end-plates in sections about 3 in. in length. These wedges, which were 1½ in. thick in a radial direction, had a very light magnetic material bridging the slot and a large clear vent-space through the centre. The wedge was put in place in the slot, and a small fibre wedge of rectangular section driven between it and the coil. Fig. 11 shows the laminated wedge and the parts from which it is assembled. This device enabled us to use with a 1-in. air-gap a stator slot 1.62 in. wide, and a stator coil which could be constructed of desirable mechanical and electrical proportions; it saved the situation.

The problem of devising a stator conductor of the size required, and with the eddy-current losses kept down to a sufficiently small value, is not entirely easy. With the protection afforded against external flux by means of the magnetic wedge, there is no great objection to using a strip about ½ in. wide across the slot, and the conductor can be built up of a number of such strips in parallel. It is usually sufficient with such a winding to have the strips insulated from one another, and arranged so that at the end of the coil the conductor is turned over in such a way that the strand which in the one slot is nearest to the air-gap takes a position nearest to the bottom of the slot when it occurs in the other half of the coil. It can easily be shown to what extent this transposition will avoid eddy-current losses, and that in the case of the present machine, where the total depth of the strands of each conductor amounts to 1.25 in., there being two such conductors in the depth of the slot, and where the active length of the conductor is a large percentage of the length of the turn, this disposition is not sufficient to bring down the loss to a reasonable figure. It therefore becomes necessary to use a slightly more complicated connection at the end of the coil, the coils being connected together strand by strand, or in groups of strands, in such a way that there is a more thorough transposition of the location of the strands in the slot. Effectively we obtain the result of a much smaller conductor with a several-circuit winding, except that this is so arranged that there is but an insignificant voltage between the several parallel conductors, avoiding the loss of space that would be entailed were we to use a multiple-circuit winding and insulate the conductors accordingly. In view of the considerable length of the machine and the somewhat severer conditions obtaining at the centre than near the ends, and also the smaller facility than usual for end-wise conduction of heat along the copper, it was considered desirable to use a stator insulation as nearly fireproof as possible, merely as a precautionary measure. For this purpose, mica wrappers were applied by machine to the coil, giving an exceedingly solid insulation, having some 70 or 80 per cent. of solid mica. Tests on coils insulated in this way, on a small section of core placed in an oven and heated by independent means to temperatures very greatly in excess of any occurring in the machine, have indicated the high heat-resisting qualities of such an insulation.

Considerations such as the above, however, bring home forcibly the fact that the difficulties that we are encountering are largely connected with the size of the conductor that we have to use, and that increasing the copper section to relieve the temperature conditions tends to introduce troubles as fast as we cure them. For instance, were it possible to use, say, a fused silica tube for stator insulation, we could immediately cut down the size of the slot copper, at the same time overcoming much of our eddy-current trouble; and we should have no reason to be alarmed, even should the central part of the active length of the conductor occasionally reach very high temperatures. The part exterior to the slot could be of twice the section or more, and the loss entailed by reason of the higher ohmic resistance of the stator winding would be entirely insignificant. Some of the characteristics of fused silica, and the recent rapid commercial development of this material, are promising as far as they go, but many obstacles to its use for this purpose remain.

In conclusion, the author acknowledges his indebtedness to the Westinghouse Electric & Manufacturing Co., of Pittsburg, without whose cordial acquiescence he would not have felt at liberty to describe these constructions.

Discussion at Leeds.

Prof. Field's paper was discussed at a meeting of the Yorkshire Local Section, at Leeds, on Wednesday last week.

Mr. W. B. Woodhouse, in opening the discussion, said he thought it was common knowledge that during the last few years progress in turbo-alternators had gone ahead of the experience of steel makers, designers, and constructors, and the purchasers of these machines had been the unwilling experimenters at their own cost. The stresses were very considerable, and in these bigger machines one was dealing with large masses of metal; they must remember that every steel forging was a casting, and the more work there was put into the metal in the shape of rolling and forging, etc., the better is was for the metal. The problem was to produce a good steel free from the curious diseases that cast-steel suffered from. One hoped that electrical furnaces would help considerably in that direction. The plate construction was a considerable step in advance, the weakest link in that construction being, apparently, the forging of the ends and the bolts. In the present case, apparently, the stresses were not reduced below those which arose in other constructions. Building up a rotor in that way as compared with a solid rotor seemed a loose construction, despite the very heavy stress put on the bolts holding the disks together. One wondered whether under heavy stresses, such as those caused by short-circuits, accompanied by repeated heating and cooling, this construction would gradually wear the holes a little larger or permanently stretch the bolts. It would be of interest if the author would tell them what alternative constructions were possible for rotors of the size referred to in the paper, and what, in his opinion, was the limiting peripheral speed for a threaded plate design such as had proved fairly satisfactory in small machines. Another point dealt with was that of unbalanced loads in the stator windings, and he thought that was a very good one. There was an increasing tendency nowadays to put single-phase loads on 3-phase systems, and there was always the possibility that the machine might by the failure of some section of the system be wanted for a short time as a single-phase machine, and it was important that the machine should be able to stand that. The losses from the user's point of view were not so important as the question of temperature; running the machine as a single-phase machine very seriously heated up the rotor, and he knew plenty of cases where machines had burnt out due to being accidentally run as single-phase machines. At the best of times the cooling arrangements in the end windings of the rotor were bad. Even in the present construction, so far as one could judge from the figures given in the paper, the amount of cooling at the ends was not as good as on part of the coils in the ducts. That was a common fault in all these designs, and the thermo-cable as a permanent part of the machine would be a very good thing. Some years ago he asked the makers of a machine of this kind to give him thermo-cable throughout the machine, but they said it was a most unreliable thing, and finally the cable was not put in. The machine had since burnt out. He joined very heartily with the author in regard to the necessity for every machine, before it was accepted, to be submitted to a short-circuit test. He hoped that all makers would regard these tests as essential. The first cost in large turbo-alternators was a very important consideration, but the failure and breakdown of the machine on load might cause the user of the machine losses which were out of all proportion to any saving he could effect by taking a smaller machine in which the design had been forced, and one hoped, in view of the experience of past years, that both the purchaser and the manufacturer would take a rather broader view of these things, so that they would get a machine, not necessarily to give the highest test, nor purchasable at the lowest price, but a machine which was efficient and would stand up to its work.

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* F. W. Carter. "Air-gap Induction." *Electrical World and Engineer*, vol. 38, p. 884, 1901.

Mr. T. Roles asked Prof. Field to state what capacity he thought 3,000-revolution machines could safely be made up to at the present time. The author dealt more in the paper with machines up to 1,800 revolutions, but a large number of machines of 50 periods were being built for 3,000 revolutions, and from what he could see himself they were limited to about 5,000 kw. He asked also the limiting size for the solid rotor on these machines, for 1,500 and 3,000 revolutions. He was very pleased that the author had mentioned the matter of running single-phase loads on 3-phase machines. Within the last month he had been called upon to take on a supply which would be single-phase up to 2,000 k.v.a., and he was wondering what effect it would have upon the machines at the Bradford station. It appeared to him that they would all have to consider seriously this question of single-phase loads, because they would get more demands in that way, and it almost seemed necessary to specify that machines should be capable of taking a large proportion of single-phase load. He was very glad indeed to notice the author's remark that it did not appear unreasonable that a purchaser should desire to see his machine short-circuited on the test floor or after erection. It had been his practice to put a clause in the specification to that effect, and when he mentioned it to some of his fellow station engineers they seemed to think he had very great temerity. It was desirable that the machines should be short-circuited preferably at the makers' works if it could be done, because if anything went wrong it was easier for the repairs to be carried out at the works. He had taken that matter up with a number of the chief makers, and it had been put to him that it was not altogether a reasonable proposition. It appeared that British makers had been putting their heads together with a view to absolutely refusing to take this test. In the case of one of the first machines they put in at Bradford, the short-circuit test was specified and would have been taken, but it was not taken at the maker's works; and at Bradford the machine short-circuited at the tank and broke down very badly. The makers were upset, and said the short-circuit was accidental, and external reactance would have to be used. This was coupled up in the case of two machines. Those two external reactances were as much a source of danger, and quite as likely to be short-circuited. He thought the machines should be so built that they could be short-circuited without external reactance.

Mr. W. M. Selvey said that only the previous week a machine had come before him with 80 volts on the rotor, and the first thing to go was the rotor, which went into flames. That was happening continually, and he could not explain it. The author anticipated high temperatures in the future, but his (Mr. Selvey's) information foreshadowed that the rotor temperature would be limited, and perhaps the suggestion which Messrs. Parsons had just patented of an internal water cooler would help matters. Steel was being made in a barbarous manner, and until the electrical engineer took up the question and made ingots of steel, he did not think there would be much advance made. If they got pure steels they could, he thought, get over a good deal of the necessity for this plate construction. In his opinion, it was just as necessary that the stator should stand up to the short-circuit test as the rotor. In running machines in parallel, it had come to his notice that the newer types of machines would not take the wattless current.

Mr. Barclay, referring to the bending of the end ring due to centrifugal force, said that in the case of a typical 5,000-kw. alternator it increased about three-hundredths of an inch, and it was seldom that one was asked to provide a ring with such an initial shrinkage that it could be kept on, with the result that it was actually floating. In the case of single-phase machines, a narrow band of manganese bronze could be introduced between the ring and the core, and the extra cost was justified by the mechanical soundness gained. An effective gap between the core and the ring might be provided, which would considerably reduce the magnetic leakage which the author had referred to, and also improve the ventilation in the rotor end windings. He understood that at the discussion in London it had been stated that no steel manufacturer would guarantee certain tests in regard to the amount of stress; that was not correct. Tests which he actually took that morning in connection with a 31½-in. diameter rotor, having a core length of 51 in., showed an elastic limit of 19½ tons, and an ultimate strength of 35 tons. A test taken on the periphery gave 20 tons elastic limit and an ultimate strength of 36.8 tons. Similar tests taken at the opposite side gave 19½ tons elastic limit and 38.4 ultimate strength. There was not much doubt that the most economical and mechanical construction was the solid forged rotor; probably the soundest construction was to have the hollow forged cylinder shrunk on to the shaft. With that construction a definite guarantee could be given for the tensile strength of the steel rotor. After the forging was made it should be annealed, and after turning re-annealed and oil-hardened.

Mr. Burnand said with regard to the 4-in. diameter bolts, which stretched as much as one-tenth of an inch on their initial tension, he did not think there was much reason to anticipate trouble, with the class of steel used. Regarding critical speed, the author appeared to recommend that this should be above the running speed of the generator, and, provided it was well above the speed of the generator, that was quite sound. The only point against this was that the higher the critical speed the more violent were the effects when they reached that speed, and that was rather in favour of the lower critical speed. While the paper showed that many difficulties had been overcome, something might have been learned if the author had given them instances of promising devices which had failed to overcome the difficulties which they were designed to counteract. He wondered whether the author had tried turbo-alternators having an armature rotating portion. There were difficulties there due to the large number of plates, but he did not suppose they were insuperable. The armature, he thought, would stand short circuits when rotating at a high velocity that it could not stand up to when stationary.

The Chairman (Mr. H. Hodgson Wright) said that the author emphasised the necessity of designing the generator for a running speed below the critical speed. If that condition was to be satisfied, the distance between the bearings must of necessity be kept as short as possible, owing to the fact that the critical speed was inversely proportional to the square of the distance between the journals. He thought it was good practice to have the running speed at least 30 per cent. above or below any critical speed. The de Laval turbine was an exceptional case; steady running had been obtained in that instance by having the running speed about seven times greater than the lowest critical speed. Nickel steel had a permeability of less than one-third of chrome nickel steel; the method of protecting the steel end ring was interesting, but rather costly. In reference to external short circuits, he thought it was generally admitted that the best engineering practice at present was against using external reactance coils. The advantages of being able to dead short-circuit the machine outweighed the disadvantages of bad power regulation; a generator which could be short-circuited whilst running fully excited, or that could be inadvertently left standing idle on the bus-bars, was one that any station engineer could put his confidence in.

The Author, replying to the discussion, said that with plough steel wire they could get considerable ductility at 125 tons to the square inch. That was giving them an ideal to aim at, which would be extremely useful to the builder if they could get that kind of material in larger pieces. The chrome nickel steel which was used for the end rings was a sample of what one could get in fairly big pieces if one paid the price, but if they built the whole rotor of high-tensile steel the cost would be considerable. The idea of using steel wire for the end rings had occurred to several, but there were difficulties to be encountered which made it rather unpromising to tackle. A considerable number of big machines had been built with forged plates threaded on a shaft, but that was rather costly in material, and when they had to put a 10, 12, or 14-in. shaft through a rotor like that the shaft was not going to stiffen the thing at all; if it could be built the other way it was preferable to do it. There was also the alternative possibility of using the single forging; that was more or less a question of what material could be obtained. He did not say in London that steel makers would not supply these forgings, but that in the States they were not able to buy a forging to a specification that they considered satisfactory. Steel makers would willingly supply them with forgings, but if they wanted to insert an acceptance or rejection clause based upon radial tests and the ductility and elongation and contraction of area in regard to these tests, then no steel maker would take the order. It appeared that it was possible to get these in England, and if this material could be got in the large sizes, and they could get reasonable ductility, then the large forging was a reasonable construction. The end winding was the most difficult part of the rotor to keep cool. It was not possible to ventilate it satisfactorily. The total temperature rise in these windings was entirely safe from the insulation point of view; it was really the question of expansion and contraction which was going to limit them in the matter of temperature rise rather than insulation. In the States they rated machines upon their maximum continuous output, and in England they were in the habit of calling for continuous overloads, so that what one might call at 5,000-K.V.A. machine would perhaps be more nearly 6,000 K.V.A. on the basis of the paper. Short-circuiting at the works in some cases might damage the machine; the final puncture test should be taken the very last thing, so that if any damage was done to the winding it would show up on the puncture test. Deformation of the end ring certainly occurred with an increase of the temperature, and when the machine got up to high speed there was usually a distortion of the ring due to the asymmetry of the windings. The ring expanded with temperature and changed from a circle to a more or less elliptical figure. It was not possible to put these rings on with such initial tension that they did not rise off their seat. The question was raised why so much trouble arose on the rotor, with a low voltage as compared with the stator; the trouble was not a matter of voltage, he was afraid; it was a mechanical trouble. Trouble had also arisen due to dirt accumulating, and he did not think the trouble had been any greater on 250-volt rotors than on 120-volt machines. One speaker asked why they had elongation in the material for the rotors. He thought they needed a ductile material capable of suffering a certain amount of elongation for several reasons. In the first place, they knew that in turning out these big machines in the shop they got all sorts of shop accidents. A tooth would get bent. There were heavy pieces to handle, and they were not always dealt with as carefully as they might be. Again, they knew it was not possible to get the effects they looked for. When the machine was actually run the wedge, which was supposed to distribute the stress properly along the length of the tooth, held in one or two places and gave local stresses. They needed ductility from various points of view. It was the tangential stress and radial stress they had to take care of. He fully realised the importance and advantage of cleaning and washing air, but in the States there had been, until recently, a great opposition on the part of operating engineers, because it was a nuisance and they did not want to be bothered with the matter. The rotor insulation was mica everywhere. Even in machines with 220 volts or so, the copper edge-winding was quite thick, something like one-tenth of an inch, and it was not hard to edge-bend. He had seen the machine bend coils 15 mils thick by about 7½ in. wide. Each segment had two dovetails in the frame, and they took the extra precaution of insulating the core from the frame; they did not gain a great deal in reduction of core loss by doing that. Just how much variation one could allow in stress was a matter which had been the subject of a great deal of investigation. In the present case the stress was something like 4,000 lb. in the steel bolts, and the range of stress on the rotor was less than 1,000 lb. The total range of stress even on the bottom of the thread was less than the safe limit for an indefinite number of reversals. With regard to expansion, the tenth of an inch was elastic expansion; it was not a stretch. The point raised in the paper was not that they could not get the tensile strength radially, but they could not get ductility. In reply to the Chairman's remarks, he said that machines had been built of 10,000 K.V.A. at 1,500 R.P.M. with self-contained blowers, and it was simply a matter of balancing up the advantages and possibilities. Personally, he thought in big machines there were considerable advantages in using separate blowers, particularly when they came to modern stations in which the ventilating system could be thought out in advance and they could get a proper intake duct running the whole length of the station, and outlet duct and filtration plant, etc.

Colombia.—H.M. Minister at Bogota says that electric light fittings and shades are among the goods hitherto supplied by German firms that are in demand there.—*Board of Trade Journal.*

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

16,780. "Switches for electric cycle lamps." F. Westwood. November 29th. (Divided application on 7,909/15. May 28th.)

16,781. "Electric generator or motor." W. H. F. Murdoch. November 29th.

16,797. "Casings for portable electric flashlights." E. C. R. Marks (Inter-state Electric Novelty Co., U.S.A.). November 29th. (Complete.)

16,814. "Electric steel and alloy making and refining processes." J. R. Hyde. November 30th.

16,817. "Body warming electrical apparatus." M. H. Goldstone. November 30th.

16,836. "Electro-magnetic driving or transmission gear." A. A. Canton. November 30th. (Complete.)

16,846. "Electric switches." E. T. Brook & O. H. Bishop. November 30th.

16,853. "Terminals for the flexible cables of medico-electrical apparatus." E. E. Lakin. November 30th.

16,854. "Dynamo-electric machines of the commutator type." M. Walker. November 30th.

16,865. "Portable electric lamps." V. C. H. Gibson & E. G. Benns. November 30th.

16,866. "Hunting or copying switch arrangements, and electrical range-finding systems embodying such arrangements." G. L. Conner. November 30th.

16,898. "Alternating-current motor-starters." O. Ellefsen. December 1st.

16,900. "Cables for the distribution of electrical power." J. H. Bowden and H. F. J. Thompson. December 1st. (Divided application on 4,585/15. March 24th.)

16,915. "Spur gearing." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). December 1st.

16,928. "Dynamo-electric machines." E. Girardeau. December 1st. (Addition to 16,107/15. Convention date, December 2nd, 1914, France.) (Complete.)

16,933. "Rotary converters." O. H. Pieper & A. F. Pieper. December 1st. (Complete.)

16,934. "Intercommunication telephones." F. T. Jackson. December 1st.

16,990. "Sparking plugs." V. Perrett. December 2nd.

16,992. "Electrical signalling systems or annunciators, chiefly for hotels." International Electric Co., Ltd., & R. G. le Noir. December 2nd.

16,993. "Switches." International Electric Co., Ltd., & R. G. le Noir. December 2nd.

16,994. "Electrical heat radiators." A. F. Berry. December 2nd.

17,000. "Audible signal devices." International Electric Co., Ltd., and R. G. le Noir. December 2nd.

17,008. "Electric starters for internal-combustion engines." B. Brooks and W. Holt. December 3rd.

17,022. "Electric furnaces." Aktiebolaget Elektriska Ugnar. December 3rd. (Convention date, December 16th, 1914, Sweden.) (Complete.)

17,033. "Electric lamp fittings." A. G. Deller. December 3rd.

17,034. "Means for laying and collecting field telephone wires." A. C. G. Smith. December 3rd.

17,060. "Connection between electric incandescent lamps and holders." S. Fildes. December 4th.

17,062. "Electric furnaces." H. A. Greaves & H. Etchells. December 4th

PUBLISHED SPECIFICATIONS.

1914.

7,692. Contact-breaker Device for Electromagnetic Vibrating Members. A. H. Maitre & V. H. G. Martin. March 26th.

22,437. Arc Incandescent Electric Lamps. E. A. Gimingham. November 12th.

22,550. Electrical Heating Unit, and method of manufacture thereof. A. N. Macnical. November 14th.

22,715. Automatic and Semi-automatic Telephone Systems. Relay Automatic Telephone Co. (formerly known as Betulander Automatic Telephone Co. and W. Aitken). November 18th.

22,720. Apparatus for Heating and Sterilising Liquids. British Electric Heater Co. & C. Kratt. November 18th.

22,867. Electrolytic Cells. H. C. Jenkins, F. F. Pattinson & R. Wellesley. November 21st.

22,931. Method of manufacturing Electric Condensers. Galvanophorenwerke (System Vogt), S. Szubert, Kommanditgesellschaft & Vereinigte Elektricitatswerke Ges. November 23rd. (November 22nd, 1913.)

23,282. Telephone Hand Sets or Instruments. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). November 30th.

23,292. Electrical Process for Producing Cyanides. J. E. Bucher. November 30th. (June 25th, 1914.)

23,676. Electrical Heating Elements. F. S. Grogan. December 7th.

24,108. Controllers for Electric Motors. Pickerings, Ltd., and J. Fothergill. December 15th.

24,631. Electric Insulators. Soc. Ceramica Richard-Ginori. December 24th. (April 30th, 1914.)

1915.

569. Electrical Steering and like Gear. Harland & Wolff, Ltd., and H. H. Bentley. January 13th.

1,404. Controlling Dynamo-electric Machines Running at Varying Speeds H. F. Foster & Sharpe. January 28th.

1,671. Protective Apparatus for Dynamo-electric Generators. W. T. Tallent-Bateman. February 2nd.

2,928. Electric Light Fittings or Brackets. E. R. Hough & L. Harrison. February 23rd.

3,502. Induction Motors. British Thomson-Houston Co. (General Electric Co., U.S.A.). March 4th.

7,206. Electric Starters for Internal-combustion Engines. A. H. Midgley & C. A. Vandervell. May 13th.

7,675. Manufacture of Electric Cables. W. F. Smith. May 22nd. (May 23rd, 1914.)

10,133. Process for the Electrolytic Deposition on all Metals of Aluminium, Tin, Nickel, Copper, Zinc, Iron, Steel, or Alloys thereof. P. Marino. July 12th.

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ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: December 24, 1915. [No. 1,987.

	Page
Domestic Electric Heating	801
Lead	802
National Electrical Development in Italy	802
Munition Workers and Recruiting	803
The British Standardisation Rules for Electrical Machinery (*concluded*)	803
Legal...	805
British Business Methods which must go	807
New Electrical Devices, Fittings and Plant (*illus.*)	809
Correspondence—	
The Institution and Alien Enemy Members	810
The A.E.G. Meeting	811
To Investigate the Russian Market	811
Electrolytic Copper	811
Trade Statistics of the Straits Settlements	812
War Items	813
Business Notes	814
Notes	818
City Notes	820
Stocks and Shares	823
Share List of Electrical Companies	824
Market Quotations	824
Exports and Imports of Electrical Goods during Nov., 1915	825
After the War	826
Electric Heating, by G. Wilkinson (*illus.*)	828
The Design of High-Pressure Distribution Systems, by J. R. Beard	829
Foreign and Colonial Tariffs on Electrical Goods	832
New Patents Applied for, 1915	832
Abstracts of Published Specifications	832
Contractors' Column ... ... Advertisement page	xviii

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DOMESTIC ELECTRIC HEATING.

JUDGING by the interesting lecture of Prof. A. H. Barker which was reported in our last issue, the vexed question of radiation *versus* convection is making decided progress towards a scientific solution. Prof. Barker and Prof. Leonard Hill have devoted close attention during recent years to the study of physical comfort—a condition which is determined by the most vague and indefinite criteria, involving the personal element in its most aggravated forms, together with questions of a physiological, and even a psychological, nature, which help to render the problem in the last degree elusive and intangible. In spite of these obvious difficulties, many of which are owing to the extraordinarily wide range over which Nature provides for automatic compensation in the human organism, and which enables a man to *be* comfortable when he *thinks* he is comfortable, these investigators have already thrown light on many obscure aspects of the subject, and have overthrown some of the most firmly established of our prejudices. Amongst the latter is the belief that the oppressiveness of a vitiated atmosphere is due to its impurities, whereas it is derived almost entirely from monotony of temperature, lack of motion of the atmosphere, and excess of moisture content. Experiment has proved to demonstration that the percentage of CO_2 in the air of crowded rooms has nothing to do with the discomfort that is experienced—at the worst it never amounts to 1 per cent., while the proportion of oxygen is never reduced by more than 1 per cent. Our faith in the "normal" air temperature of 60° F. has also been rudely shaken; and now Prof. Barker shows us that cool air and efficient radiation are the objects at which we should aim, if we wish to make the most efficient and appropriate use of electric heating in our homes. On the other hand, he has in effect confirmed the old saying: Keep the feet warm and the head cool.

The scientific man, when confronted with a strange new problem, will at once set about reducing it to terms of exact measurement; until he has succeeded in this his advice is of no more use than that of any looker-on. This is what Profs. Hill and Barker have taken in hand; the former invented the "katathermometer" and (with Mr. Griffiths) the "caleometer," which we described in May last year, while the latter has devised special thermometers for measuring air and radiation temperatures. With these and other apparatus the subject of physical comfort is being defined in terms of degrees and watts, and we hope that in due course it will be possible to provide every person with a "comfort formula," such as we now have for our eye-glasses—and to specify the exact means by which the formula can be most effectively applied.

In the meantime, neither we nor the author of the lecture must be understood to condemn the convector type of electric heater, which also has its uses; the conditions to which Prof. Barker specifically referred were given in our report, and it will be noted that he was dealing only with the *occasional* use of electric heating. In the I.E.E. paper by Mr. G. Wilkinson, of which an abstract appears in this issue, the problem is attacked from a totally different point of view. We are pleased to note that the author's experiments were based upon a suggestion that we made some time ago, to the effect that it might prove commercially feasible to maintain a room at a uniform temperature even if occasional heating were found impracticable; for it would only be necessary to make good the loss of heat, instead of having to warm up the walls, furniture, &c., each time from the cold—a proceeding which, as Prof. Barker has shown, demands a relatively enormous output from the heating apparatus. It will be admitted by supply engineers that a 24-hour demand of this kind, with a fixed maximum and an excellent load factor, could be awarded an extremely low tariff—certainly not exceeding ½d. a unit, and probably much less. Mr. Wilkinson makes no extravagant claims for the system which he has developed, and recognises that the relative values of radiant and convected heat have yet to be decided; that a due proportion of the former is indispensable to comfort (according to British standards) is explicitly stated in his paper. On the other hand, Prof. Barker makes it clear that the air temperature must be raised above a certain minimum in order to attain to comfortable conditions. It will be seen, therefore, that the authors' views are by no means opposed to one another, though their methods differ so widely, and we feel that each of them has materially assisted in advancing the cause of electric heating.

Our congratulations are due to Mr. Wilkinson on his successful development of ingenious automatic devices for controlling the temperature, which seem likely to prove useful also in other relations.

Lead.

There have been sharp movements in the lead market during the past few weeks which have resulted in values being placed upon a higher level than for very many years, and in view of the enormous consumption of the metal for munition purposes, there is a general feeling in the market that the vigorous buying impulses which have become a recurring feature in the situation, may, perhaps, develop again, and establish still higher records before the dawn of peace. On the whole, there has not been any excess in the arrivals of metal coming to hand here; in fact, there have been periods during which very little available lead has come forward from the principal producing countries. A large proportion of the Broken Hill output is being shipped direct to the Far East, in connection with Russian ammunition requirements, and this naturally tends to reduce the quantity of lead available for London. There has latterly been more lead coming in from the United States, but the difficulties which have to be overcome in getting material from the smelters to the coast, and from there across to Europe, are at times most trying, and the result is that less relief than might reasonably be expected is forthcoming from trans-Atlantic sources. In America the tendency of prices has again been upwards under the influence of heavy buying, mainly in connection with growing home requirements, and, so far, the excessive figures ruling have not the result of checking any buying. Of course, round present prices consumers will not purchase far ahead. So far, their policy has been unfortunate, but, nevertheless, speaking broadly, users are, no doubt, right in limiting their commitments. The duration of the war is, of course, most uncertain, and there is growing impatience in the commercial community at the dilly-dallying which has marked every stage of its conduct, and at the lack of grasp of every situation which had to be handled by our authorities.

The future of lead, like all other metals, depends upon the display of a greater determination in high quarters to wage the war energetically; and the longer there is delay in carrying out the policy to which we are committed, the longer will it be before prices can reach a reasonable figure again. There has not been any Russian buying so far this month, indeed it is stated that all credit facilities have been suspended, and that ship owners do not know where their vessels are; people with metal to ship are not able to ship it because they are not able to get credits open, and generally a state of chaos prevails which is felt keenly in connection with lead.

National Electrical Development in Italy.

The endeavours which are now being put forth in Italy with the object of emancipating the country from the predominance held in that market prior to the war by foreign electrical machinery are becoming stronger month by month. Among the latest developments is the attitude which has been assumed by the managing engineers of a number of supply works who met at Milan in November to consider the question of obtaining relief from the Government tax on the consumption of energy used for heating purposes. After temporarily disposing of this problem the engineers who represented the electricity works at Milan, Brescia, Como, Cremona, Modena, Parma, Rome, Turin, Verona, Vicenza, Voghira, Bergamo, and Padova, proceeded to discuss the action taken by the Associazione Elettrotecnica Italiana in order to promote the national industry in the construction of electrical machinery, and they decided to recommend their respective electricity supply administrations to give preference to manufactures produced in Italy. It is impossible to ascertain from this particular report what precise action has been or is intended to be taken by the Association in question, which represents the electrical profession in that country; but early in December information came to hand which proves that if necessary even a technical association can become sufficiently patriotic to consider dignity of no account when national industrial affairs are regarded as of primary importance.

The A.E.I., we learn, has inaugurated a movement aiming at the development and independence of the industry, and an extensive programme of action has been arranged. In the first place, the Association has decided to invite the various sections to promote conferences on the subject, and to form in connection with each section a Committee for the purposes of propaganda, so as to keep alive the attention of the public in regard to national manufactures. The second object in view is to endeavour to secure that writers of recognised authority shall discuss the political and social aspects of the question in the technical and political Press, and that monographs shall be published illustrating the Italian works in which machinery and plant wholly or partly of national production are installed—emphasis being laid on the results which have been achieved. In the third place, it has been agreed to take action in relation to the Government, the provincial authorities, the municipal councils, and the companies, with a view to the public administrations being induced to give absolute preference to national manufactures. The Association has also undertaken to develop action in respect of the import duties, to promote the improvement of national products, and, finally, to improve the system of technical education. By way of preliminary work the Milan section has now made arrangements for a series of lectures, which are intended to educate the public as to the potentialities of the country in the sphere of industrial economics, and among the names of the lecturers, in addition to Signor (Engineer) Semenza and Profs. Menozzi, Belluzzo, Motta and Giordiano, is to be noted that of the well-known statesman and economist, Signor Luigi Luzzatti.

The programme of the Italian Association, which also deserves the attention of the Council of the Institution of Electrical Engineers, will, doubtless, satisfy to some extent the wishes of our Italian contemporary, the *Elettricita*, but it is highly probable that the latter will find, after careful examination, that the scheme does not go sufficiently far. Our contemporary, discussing the problem of the advancement of national industry shortly before the announcement of the A.E.I.'s programme, suggested that a forward step in this direction would be made when the Italians had succeeded in securing uniformity in the conditions of contract for the delivery of machinery by the adoption of rules to be observed by all, and it was urged that the Association should establish standards with which machinery and materials should comply, as a guarantee of efficiency, and that those who agreed to adhere to the rules should offer guarantees in this respect. In this way purchasers of plant of small sizes, who desired to save themselves the expense of consulting advice, would obtain a sense of confidence in national manufactures. The Italian journal is also impressed with the special trade-mark which has been introduced in France by two trade federations, including the Hardware Federation, for the prevention of fraud, and which, it is suggested, should also be adopted by the French electrical engineering industry. It is assumed that the trade-mark which is referred to in connection with the French electrical industry would likewise be of advantage if applied to Italian industry, with the word "Italy" in the centre of the oval ring, instead of the word "France."

Munition Workers and Recruiting.

Very little, if any, improvement appears to have taken place in the conditions ruling in the wire-drawing industries during the past few weeks. Manufacturers are sparing no efforts and expense to ensure reasonable working conditions, despite the heavy odds to the contrary. A fair proportion of the workers of military age appear to have attested under Lord Derby's scheme, but this action, in view of the statement made by the Minister of Munitions at the last moment, was quite voluntary, and the failure to attest did not carry with it any troublesome responsibilities or reflections. With regard to the question of the exemption of munition workers, whether of military age or not, it is doubtful if any single man engaged in the manufacture of wire can be transferred to any military service whatever without causing grave difficulties in the workshops, and it is, therefore, of the greatest importance that no military or official agency of any kind, other than the Minister of Munitions, be allowed to interfere with, or decide upon, this question. We cannot expect to secure the maximum output of munitions if men are withdrawn from the workshops for military service. The fact that a proportion of munition workers of military age have attested under Lord Derby's scheme, while others have not, has caused, as it was bound to do, some uncertainty in controlled workshops. It might have been more satisfactory for all concerned if something more definite and conclusive had been decided upon before putting the scheme into effect.

THE BRITISH STANDARDISATION RULES FOR ELECTRICAL MACHINERY.

(Concluded from page 743.)

While in many respects the new standards correspond closely with those adopted by the British Electrical and Allied Manufacturers' Association (which were published in our issues of May 23rd, 1913, and May 21st, 1915), there are numerous points of difference in detail, and the two codes are drawn up in quite different styles.

The E.S.C. rules no longer include 25 cycles as a standard frequency, only 50 cycles being so named; the B.E.A.M.A. rules retained both values. In addition, the latter gave a list of standard voltages for high-pressure A.C. work, for generators, and for consumers' terminals, but in the new rules all these have been relegated to an appendix, and regarded apparently as evils that cannot now be remedied, being described as "the pressures in use on systems already in operation." It is, however, recorded that manufacturers "in the past" have been accustomed to standardise their motors for pressures of 110, 220, 440 and 500 D.C., and for 200, 400 and 500 volts A.C., with a variation of 5 per cent. above or below these pressures. As for generator pressures, the E.S.C. is content to say that they have been standardised "for a pressure suitable for the system which they are to feed"—surely a superfluous observation. Under the head of "Types of Machines," there are no variations of importance, but the old "enclosed-ventilated" type is given the less cumbrous title "semi-enclosed."

The sections on "Rating" show some marked differences; the E.S.C. rules no longer recognise definite overloads for stated periods, and therefore the section which in the B.E.A.M.A. code specified those overloads and periods has no counterpart in the new code. The latter, moreover, recognises only two standards for short-time rating—one hour, and half an hour—whereas the former apparently accepted any period as standard provided that it were specified. The E.S.C., however, recognises a "duty-cycle rating," which is defined as the "continuous rating which is the thermal equivalent of the cycle of duty specified."

In the B.E.A.M.A. section on "Overloads," provision was made for discriminating between open and totally-enclosed machines, the latter not being required to carry overloads.

The next sections deal with the all-important subject of cooling-air temperature, and temperature rise: in the B.E.A.M.A. code the temperature of the atmosphere was taken as 25 deg. C., and on this basis open machines were allowed a temperature rise of 40 deg. C. on the windings and 55 deg. on the commutator and slip rings (by thermometer), or 55 deg. to 60 deg. for field coils (by resistance), while higher values were permitted in the case of semi-enclosed or totally-enclosed machines—up to 70 deg. C. (by resistance) on the shunt field coils of totally-enclosed D.C. machines.

Bearing in mind the clauses relating to overloads, it will be seen that the purpose of the rules was to avoid exceeding an actual temperature of about 90 deg. C. in all cases. For tropical conditions or other cases where the cooling-air temperature was over 35 deg. C., the permissible temperature rise was to be reduced by 20 per cent., except where special heat-resisting insulating materials were employed. Thus it will be seen that the various points which have given rise to so much discussion were dealt with in the B.E.A.M.A. rules in one way or another; but we think that the simple clear-cut standards now put forward by the E.S.C. will be welcomed generally by manufacturers, as they rest upon the simple and scientific basis that certain standard final temperatures shall under no circumstances be exceeded. It is quite easy to remember that, starting from 40 deg. C., the temperature of textile insulations on stationary windings of all kinds must not exceed 95 deg. C., that of rotating windings, 90 deg. C.; and that with incombustible insulating materials the temperature may be 20 deg. higher. This, of course, is not quite accurate; rotating field coils may go up to 95 deg. C., and short-circuited windings to 100 deg., but the approximation is good enough for memory work.

In the E.S.C. rules the observable temperature and the observable temperature rise are the "thermal quantities which determine the British Standard Rating of a machine," thus testifying to the high importance attached to this consideration by the Committee, a view which is shared by the corresponding authorities in foreign countries; and, consequently, the sections dealing with temperature limits, etc., are comparatively extensive, comprising some 36 clauses, as compared with 7 in the B.E.A.M.A. code.

The mechanical strength and stalling torque tests which follow appear to be unrepresented in the B.E.A.M.A. rules except in the case of motors with short-time rating. Obviously, such tests are desirable. Roughly speaking, they correspond to the application of mechanical forces double the normal values.

We now come to the dielectric tests, which are second in importance only to the temperature regulations; these are set out at great length in the E.S.C. rules, occupying 19 clauses. It cannot be said that the new code possesses the same simplicity in this respect as the B.E.A.M.A. rules, the voltages to be applied being arrived at in a variety of ways, and being subject to numerous variations and exceptions. As an extreme instance, in Clause 83 (Duration of high pressure test) there is an exception within an exception, leading to a highly involved construction. In the table of test pressures we find twice, thrice, ten times, and 2½ times the rated pressure of the machine or transformer employed, with various additions and minima; surely the desired result could have been attained without all this complication. It is not as if the quantity tested were capable of precise determination; the test, in fact, merely shows that it is above a certain value, but how much above is unknown.

The E.S.C. rules have little to say about short-circuit tests, except that when required they must be specified at the time of ordering the machine. The B.E.A.M.A. clause on this subject, on the other hand, runs out to quite a little treatise on short-circuit tests (against which objections are raised) and the use of reactances.

Tolerances are provided in the B.E.A.M.A. rules for steam consumption, efficiency, etc., but in the E.S.C. code only for the speed of a motor above 3-H.P., and it is explicitly stated that there is *no* tolerance on temperature rise.

It may be noted that the B.E.A.M.A. rules allowed a tolerance of 2 deg. C. on the temperature rise, 2½ per cent. on steam consumption, a scale of tolerances for the efficiency of transformers and machines, and the power factor of the latter, and provided a conventional "average load" on which to base average-load guarantees. Tolerances were also allowed on the speed of motors, the slip of induction motors, and inherent pressure regulation rise. Penalties and bonuses were to be taken only on the amount by which the observed deviation from the guaranteed results exceeded the tolerance. Elaborate specifications were also drawn up with regard to the amount of angular displacement and cyclic irregularity permissible in the case of alternators intended to run in parallel, as well as the precautions to be taken to prevent hunting due to resonance by the provision of suitable fly-wheel effect or damping devices on the generator.

The information to be given on the rating plate receives a good deal of attention in both codes, especially in the case of A.C. machines and transformers. The B.E.A.M.A. rules provided for letters on the terminals of the different phase windings, and connection diagrams; the E.S.C. for letters on a similar plan and connection diagrams, together with vector diagrams showing the phase relations in a three-phase transformer. This information is very necessary, and will save a great deal of time and trouble, as well as expense arising from mistakes in connections. Directions for carrying out the system are given in great detail in both codes.

The E.S.C. rules also include particulars of information to be given with inquiries and when ordering machines, which were not provided for in the B.E.A.M.A. rules. It is interesting to note the recommendation in the former that the most economical load of generators and turbines should be equal to 80 per cent. of the maximum continuous output of the generator (*i.e.*, of the rating in kilowatts); the power factor, if not specified, is to be taken as 0.8, and the steam inlets of the turbine should be capable of dealing continuously with outputs 12 per cent. in excess of the rated output, or 40 per cent. in excess of the most economical output. The B.E.A.M.A. rules, on the other hand, also contain sections not represented in the E.S.C. code, providing symbols for switches and connections, miscellaneous gear and parts of machines, and instruments, as well as letters for use on diagrams and rules for the arrangement of bus-bars, etc. These and other useful features of the B.E.A.M.A. rules might well be incorporated, with modification, if necessary, in the E.S.C. code in the future, and if they can be accorded international agreement, so much the better—though this may prove a difficult matter.

Harmonics in Oscillograms.—In the issue of the *Journal* of the Institution of Electrical Engineers for December 1st there is a communication by Prof. G. W. O. Howe on the subject of the amplitude and phase of the higher harmonics in oscillograms. The author studied these owing to a doubt as to the accuracy of the magnitude and phase of the ripples in the potential-difference wave of alternators as recorded by the oscillograph; he has recently shown that the ripples due to the teeth of an alternator should be symmetrical with respect to the fundamental, assuming that the machine is on open circuit and that there is no dissymmetry in the magnetic field. Many oscillograms showed the ripples to be unsymmetrical, and the question arose whether the oscillograph could be in any way to blame. In the result, says the author, the oscillograph was completely exonerated, and the cause of the displacement of the ripples must be sought elsewhere. By varying the damping of the oscillograph, he finds that for general purposes an oscillograph should be adjusted until there is a slight but obvious overshoot on suddenly applying a steady potential difference, as with this condition (with the oscillograph slightly underdamped) the amplitude and phase displacement of the harmonics are more correct than with critical damping.

Educational Note.—City and Guilds of London Institute: Department of Technology.—The report of the department for the past Session, which was issued last week, states that the number of students in attendance at the technical classes fell from 55,996 to 47,050, and the number of candidates for examination from 23,119 to 15,623, of whom 9,866 passed; many classes that were registered at the beginning of the Session had to be abandoned later on, owing to the small number of students in attendance. The candidates in telephony showed but little falling-off, but in telegraphy the number was less by 40 per cent. The proportion of failures in electric wiremen's work and in electrical engineering, Grades I and II, was so high as to receive special comment. The passes were as follows:—Telegraphy, 415; telephony, 452; electric wiremen's work, 126; electrical engineering, 626; electrometallurgy, 29. The examiners express regret at the lack of initiative and ingenuity displayed by candidates in all grades of electrical engineering, and state that the students are not taught sufficiently well to think for themselves and to get down to what is really useful. They remark that the examination should be a test *not so much of what the student knows as of what he can do.*

Pit Youths Fined.—Two pit youths were each fined three guineas and costs, or in default six weeks' imprisonment, for taking the insulation off an electric light cable at the Mansfield Colliery and connecting the cable with the signal wires. Two men received shocks in consequence of the youths' "larking."

LEGAL.

Workmen's Compensation Cases.

In the City of London Court, on December 16th, before Sir John Paget, Bart., K.C., the case of Watson *v.* Telegraph Construction and Maintenance Co., Ltd., was mentioned. Plaintiff, Henry Watson, of East Greenwich, made a claim against the defendants for damages under the Workmen's Compensation Act for the loss of his right eye, caused by the loose end of an electric wire hitting it, necessitating its removal. He was totally incapacitated for work for a period of two months, and would not be fit to resume his former work, at which he earned 24s. 4d. a week, for about three months. The defendants agreed to pay £70 in full discharge and the plaintiff accepted it. His solicitor, Mr. Watts, said he would want a glass eye, and his father had spent various sums on his behalf. The Deputy Judge sanctioned the payment of £30 to meet the plaintiff's immediate necessities, and directed that the balance, £40, should be invested in War Loan for the plaintiff's benefit later on

In Falkirk Sheriff Court, parties' agents were heard in debate in an action under the Workmen's Compensation Act, 1906, at the instance of the Scottish Central Electric Power Co., Falkirk, against Wm. Kerr, of Grangemouth, one of their employés, asking the Court to review a weekly payment which they agreed to make to the workman under an agreement dated September 25th, 1914, and recorded with the Sheriff Clerk at Falkirk on October 8th, 1914, whereby the employers agreed to pay, and the workman agreed to accept, compensation at the rate of 12s. per week during the claimant's total incapacity for work as the result of an accident. The workman returned to work with the employers, when payment of compensation was stopped, and the employers aver that the workman's incapacity has now ceased. The workman lodged defences in which he pleaded that, there being no weekly payment in existence to review, the application should be dismissed. Sheriff Moffatt has now repelled this objection, and has allowed a proof. His Lordship remarked that it appeared to him that the respondents were entitled to have a weekly payment reviewed when it was the subject of a recorded agreement.

Attwell *v.* West Ham Corporation.

In the Bow County Court, on December 15th, his Honour Judge Smyly, K.C., gave his considered decision in the case of Attwell *v.* the West Ham Corporation. The facts have already been reported in the Electrical Review. The case was tried by the jury, who sat for five whole days, finally giving a verdict for the plaintiff for £350 damages and costs. A new trial was then applied for on the ground that the verdict was against the weight of evidence, and the legal arguments lasted two days.

Judge Smyly said he failed to find any ground for interfering with the verdict of the jury. There might be a lot to be said about the gloves, but the jury had had the evidence before them, and having decided, his Honour could see no reason to upset the verdict. There was a suggestion that the jury were not impartial, as they had shown signs of impatience, but he saw nothing of it and thought they displayed marvellous patience. His Honour therefore ordered the verdict to stand, but granted leave to appeal.

A Dublin Arbitration.

In the Chancery Division, Dublin, last Friday, Mr. Justice Barton gave judgment in favour of the Kingstown Urban Council on the application made on behalf of the Dublin Southern District Electric Supply Co., Ltd., in the matter of an arbitration between the company and the Council in respect of the Electric Lighting Act, 1882, and the Electric Lighting Order Confirmation, No. 8, Kingstown Act, 1914, for an order directing the Taxing Master to tax the costs of the Company against the Kingstown Urban District Council referred for taxation under order of the Court of March 31st last, under the scale provided for by the Acts for the taxation of Parliamentary costs, or, in the alternative, directing that the costs should be taxed as Chancery costs on the higher scale as between solicitor and client, or for such order as to the Court might seem reasonable. The arbitrator, Mr. S. L. Brown, K.C., in his award, had awarded costs as between party and party, and his Lordship decided that he had no power to enlarge the terms of the award in that respect.

Munitions Cases.

At the Bolton Munitions Court on December 15th, complaint was made by an employé of the South Lancashire Tramways Co., that the company had unreasonably withheld his leaving certificate. He contended that he had not been engaged on munitions, directly or indirectly. For the company, Mr. Edwardes, general manager, said the man had been employed as an attendant at a sub-station at Hindley, where electrical energy was transformed and used for tramway purposes, for collieries, and for the electric lighting of a military camp. Mr. Sellars (chairman) said that collieries were not munition works, and he did not see that the lighting of a military camp came within that description. No leaving certificate was necessary in this case, and the applicant would be supplied with a statement to that effect.

At the Blackburn Munitions Court, on December 15th, an electrician employed at Preston complained that his employers had unreasonably withheld his certificate. He said that his work had considerably increased since the war started, and he contended that he was inadequately remunerated. Before the war he earned £2 a week and received 4s. per week for teaching at the Technical School. He had had to give up the latter since the war; his wages were now about £2 10s., and he worked 14 or 15 hours more than he did before the war. He considered that he was doing two men's work. Mr. T. E. Mansfield (chairman) questioned applicant, who admitted that he had lost a lot of time.—A representative of the firm said he had never heard applicant complain that he was overworked.—Mr. Mansfield: He is not overworked; it is rubbish. —The representative of the firm added that the man's average wages for the past ten weeks were £2 10s. 3d., but he could have earned about 7s. per week more if he had worked all the hours. In answer to questions, applicant said he had not decided upon another job, and he would probably try to join the Army.—Mr. Mansfield said he would get more than this if he joined the Army, and he would advise the man not to make the change if he found his present employment "hurt him." This was the worst case he had had before him of this kind. The certificate would be refused, and he felt half inclined to make applicant pay the costs. The case had been an absolute waste of time, and the applicant ought to have known better than bring it.—The representative of the firm said they did not ask for costs, and the Chairman said that if anyone else brought a case of this kind, the applicant would have to pay costs.

Dealings in Marconi Shares.

In the Court of Appeal on Thursday, 16th inst., Lords Justices Swinfen Eady, Phillimore and Pickford delivered their reserved judgments on the appeal of Mr. Samuel Segar, in the action which he unsuccessfully brought against Mr. Godfrey Isaacs for an alleged breach of an oral agreement to take over blocks of shares in the English and American Marconi Companies and the Pekin Syndicate, or to pay the difference between their purchase price and the sale price, namely, £8,655.

Mr. Justice Bailhache, who tried the action, whilst holding that the agreement was made, came to the conclusion that the consideration alleged was not the true consideration, and was quite inadequate to support the promise. He further found that the true consideration consisted of improper, indirect threats, and he held in terms that the claim was from first to last a blackmailing claim, and that the action was a blackmailing action. He accordingly entered judgment for the defendant, but without costs. The plaintiff appealed contending that the consideration was in fact that which he affirmed it to be, namely, forbearance on his part to bring an action against the defendant for misrepresentation and misfeasance.

Lord Justice Swinfen Eady, in a lengthy judgment, said that he was perfectly satisfied that the judge arrived at the right conclusion, that the plaintiff's claim was a blackmailing claim, and that this action was a blackmailing action. Therefore, in his opinion, the appeal should be dismissed.

Lord Justice Phillimore dissented. In his view, the alleged agreement was not improbable, and, like Mr. Justice Bailhache, he was driven to the conclusion that it was made. He, however, could not agree that there was any turpitude on the part of the plaintiff in making the agreement, or that the claim was a blackmailing claim, or the action a blackmailing action. He thought that the plaintiff was entitled to judgment.

Lord Justice Pickford gave judgment, dismissing the appeal. In his opinion there was no ground for interfering with the findings of the judge in the Court below.

By a majority, therefore, the appeal was dismissed, with costs.

S. Wolf & Co., Ltd., *v.* Auto-Wheels, Ltd.

In the King's Bench Division on December 17th, before Mr. Justice Bailhache and a special jury, an action was brought by S. Wolf and Co., Ltd., mechanical and electrical engineers, of Southwark Street, S.E., against Auto-Wheels, Ltd., of Russell Road, Kensington, to recover £2,584 for auto-wheels and magnetos supplied to the defendants. The principal defence set up by the defendants was that the plaintiffs were not principals in the transaction, but were the agents of the German firm of Unterberg & Helmle, of Durlach, Germany, manufacturers of the "U & H" magnetos, and that the plaintiffs could not remit the account because of the proclamations against trading with the enemy. In reply to this, the plaintiffs denied that they were agents of the German firm, and said they bought from Unterberg & Helmle and sold again, as principals, to the defendants.

Mr. Holman Gregory, K.C., and Mr. Bromley Eames appeared for the plaintiffs, and the defendants were represented by Mr. Gordon Hewart, K.C., and Mr. McCardie.

There was a counterclaim by the defendants for damages for alleged fraudulent misrepresentation. This alleged misrepresentation was denied by the plaintiffs.

Mr. Holman Gregory, K.C., in opening the case, said that the plaintiffs were mechanical and electrical engineers, and defendants carried on business making auto-wheels and magnetos. The claim was for £2,584 for magnetos sold and delivered, and the defendants alleged that, the money being due to the German firm, they could not pay. The plaintiffs would show that they bought from the German firm who made these magnetos and then sold to the defendants.

Mr. Gordon Richard, a director of the plaintiffs, then gave evidence.

Eventually Mr. Gordon Hewart announced that the plaintiffs' claim would not be further contested. The defendants withdrew the suggestion that the plaintiffs were agents in the transactions, and withdrew the charge of misrepresentation. Judgment was entered for the plaintiffs for £2,546 12s. 6d., and costs.

Shrimpton *v.* The Northern Power, Light and Coal Co.

In the Chancery Division Mr. Justice Peterson, on Thursday, December 16th, heard this action, which again raised a question as to the defendant company's borrowing powers.

Mr. Disturnal, K.C., and Mr. Hurmann appeared for the plaintiff, Mr. Hogg for the company, and Mr. Owen Thompson for the defendant directors.

Mr. Disturnal said the plaintiff was a bondholder in the company, and in substance he asked for a declaration that the company had no power to issue further bonds which were a prior charge upon the property comprised in the original bonds, and for an injunction to restrain the defendants from issuing any bonds charging the property of the company in priority to the plaintiff's charge. The statement of claim alleged a number of grounds in support of the claim, but the matter was really confined to the single issue of whether or not a resolution authorising further borrowing powers was valid or not, and that would depend upon the true construction of a section of the Companies' Act of 1906. The question was whether the Act meant that the resolution adopted at a meeting held at Dawson City in September, 1911, must be passed by a majority of two-thirds of the subscribed capital of the company, or by two-thirds of the subscribed capital of the company represented at the meeting.

His Lordship took the view that the Act contemplated the resolution being passed by a two-thirds majority of the subscribed capital represented at the meeting, and accordingly dismissed the action with costs.

Taylor & Earley *v.* West Bromwich Corporation.

This case, which came before Mr. Justice Neville in the Chancery Division last week, related to an agreement made in 1912 between plaintiffs and defendants respecting a supply of electricity for power to plaintiffs' works for five years. The matter is reported in the *Times* for December 18th. Plaintiffs agreed to pay for their supply at a certain charge per unit, which should not be less than £266 per annum, a minimum of 80,000 units per annum being agreed upon. In December this year plaintiffs received a letter from the Corporation announcing that the price of energy must be advanced by 20 per cent. on the contract price owing to the rises in coal, labour, &c. If they were not willing to agree to the increase, the amount of energy supplied would be either reduced or the supply cut off altogether. Plaintiffs replied that they would hold defendants to their agreement, and defendants sent notice to the effect that they would curtail the supply by cutting them off two hours per day from December 20th. Plaintiffs then applied for the injunction that was now sought. It was explained that to cut off the supply would materially affect the execution of very pressing work. Mr. Justice Neville granted an interim injunction extending until the first Friday of next sittings.

Osram Lamp Works, Ltd., *v.* Pope's Electric Lamp Co., Ltd.

The Court of Appeal, consisting of the Master of the Rolls and Lords Justices Bankes and Warrington, on Wednesday, December 15th, delivered considered judgments in this case upon the appeal of the plaintiffs from a judgment of Mr. Justice Joyce, in the Chancery Division, in favour of the defendants in an action by the plaintiffs to restrain the alleged infringement of Letters Patent No. 23,899 of 1904, granted to Dr. A. Just and Franz Hanaman for "Improvements relating to the manufacture of incandescent lamps." The trial was reported in the Electrical Review of July 2nd to 23rd, 1915. Mr. Justice Joyce decided that plaintiffs' patent was not for making filaments of tungsten, but only for making them by the particular process specified, that defendants did not use an atmosphere of steam and hydrogen in the sense in which it was used in plaintiffs' specification, and that defendants had not been guilty of infringement. He further held that if it had been necessary to decide the question of the validity of plaintiffs' patent, it was doubtful if the subject matter and the directions were sufficient. Upon the ground that the defendants had not been guilty of infringement he dismissed the action, with costs, and from that decision the plaintiffs now appealed.

When the arguments upon the issue of infringement concluded, the Master of the Rolls intimated that the Court would consider its judgment upon that issue, but if it was thought desirable to hear further argument upon the other issues raised, notice to that effect would be sent to the parties. In the event the Court unanimously decided that the appeal must be dismissed, on the question of infringement, and the other issues were not dealt with.

Lord Justice Bankes said the patent in question was for improvements relating to the manufacture of incandescent electric lamps, and it had for its object the making of filaments used in such lamps of tungsten metal. All the processes for making filaments, to which the Court's attention had been mainly directed, had this in common—that at some stage in the process the selected material was forced through a tiny aperture in order to reduce the material into filament form. In all the processes also the selected material included some material containing carbonaceous matter, the quantity depending upon the object of the patentee in making use of it at all. When the object was to make a carbon filament, as much as possible was used, because the ultimate object of the process was to produce a pure carbon filament containing nothing but carbon. When the object was to make a metal filament, as little as possible would be used, because the object of the process was to get rid of all carbon, or carbonaceous matter, and to produce a filament consisting of nothing but metal. In the making of carbon filaments the materials, when mixed, were, owing to the presence of such a quantity of carbonaceous matter, necessarily moist, and the operation of forcing this mixture through the proper sized aperture required little force; a further result of the use of this class of material was that the filament produced was rough and uneven, and required a further process, called equalisation, in order to render the filament uniform and fit for use. He had no doubt that Welsbach had these features of the process for making carbon filaments in his mind when he described the mixture he proposed using as "viscous," and the forcing process as "squirting." Welsbach's discovery consisted in the fact that he found that by making use of the known reaction between steam and carbon, he could, in the presence of hydrogen, turn out the carbon from the material forming the filament, leaving a coherent filament consisting of pure metal. The discovery which was intended to be protected by the plaintiffs' Letters Patent was the discovery that Welsbach's process could be successfully applied to the metal tungsten; that was to say, that the steam and carbon reaction, in the presence of hydrogen, would get rid of all carbon from the material forming the filament, leaving a coherent filament consisting of pure tungsten. The defendants manufactured pure tungsten filaments by a process which they alleged was essentially different from that employed by the plaintiffs, but which the plaintiffs alleged was an infringement of their patent. The defendants' case was that they arrived at a pure tungsten filament not only by employing a process entirely different in kind from that of the plaintiffs, but also by making use of a different reaction to get rid of the carbon, namely, the reaction between oxygen and carbon.

In the case of Marconi *v.* British Radio Telegraph Co., Mr. Justice Parker, as he then was, stated the law applicable to a case like the present in the following words:—"It is a well-known rule of Patent Law that no one who borrows the substance of a patented invention can escape the consequences of infringement by making immaterial variations. From this point of view the question was whether the infringing apparatus was substantially the same as the apparatus said to have been infringed." To make this statement of the law exactly applicable to the present case "process" must be substituted for "apparatus" and "uses" for "borrows." The expression "borrows" seemed to imply an intentional act. In the present case he was satisfied that infringement, if infringement there were, was not deliberate or intentional. In order to succeed the plaintiffs must establish that the defendants' process was substantially the same as that described in their specification and claim. The simplest way of seeing whether this was so or not appeared to him to be to ascertain first, what the defendants' process was, and then what the plaintiffs' process was, and to contrast the two. The defendants' process was fully and accurately described by Dr. Passmore. The only point upon which he had not been able to find any evidence was as to the exact height of the iridium furnace. The main features of the defendants' process might be stated thus: The material they used was composed of tungsten metal, tungsten oxide, and a mixture consisting of amyl acetate, castor oil, camphor, and a small quantity of nitro-cellulose.

The first step in dealing with the material after mixing was to calender it, which consisted in placing it under rollers moving in opposite directions. At this stage the material was in the form of a hardish paste, containing about 12 per cent. of carbonaceous matter, or potential carbon. The paste was next forced by hydraulic pressure of several tons to the square inch through a fine orifice in a diamond die, and received on a card by an operator, who, by movements of the card, shaped the filaments into the required form, so that after cutting, they were in hairpin shape. In this form they were hung in bundles and introduced into an oven, and dried at a temperature of about 120°. At this stage of their manufacture the filaments contained about 2 per cent. of carbonaceous matter.

The next step in the process was that the filaments, in bundles of 300 or 400, were hung upon a kind of hook, which was introduced into the bottom of an iridium tube or furnace, about 1½ to 2 in. in diameter, which was heated at the upper end to a temperature of 950° C. The hook on which the filaments hung was moved by mechanical means up the furnace at the rate of about 1½ to 2 in. per minute, and after about 6 to 10 minutes spent in the hot zone was moved down again. The whole time occupied in travelling up and down was about 30 minutes. During the whole time that the filaments were in this furnace a rapid stream of dry hydrogen was being passed down the furnace from the top. After being allowed to cool, the filaments were removed from this furnace, when they were found to contain about 0·2 per cent. of carbon. The next step in the process was the ovening, which consisted in placing the filaments in an oven which was gradually heated up to 220° C., and in which the filaments were allowed to remain for an hour or thereabouts. After being removed from this oven the next and last step in the process was that they were placed in a second tube or furnace into which hydrogen was introduced as before, and which was heated at its upper end to 1,850° C. The filaments were moved up this tube by hand quite rapidly, the operation taking from a few seconds to a few minutes, depending upon the size of the filaments.

The defendants' second process was in all respects identical with the one already described, except that the first furnace was dispensed with, and the filaments were heated to 950° C. in a vacuum. He must now consider the plaintiffs' specification for the purpose of ascertaining what the process there described was and what the invention claimed was. That was a question of construction, regard being had to the state of knowledge at the date of the application, which was November, 1904. The process as described consisted really of two separate treatments, the first comprising the composition and treatment of the material down to its carbonisation, and the second what might be called the decarbonising and the unification treatment. It was the first of these two latter which was claimed to be the real invention on the ground put forward by Dr. Passmore at Question 67, when he said that what was not before known was that steam and hydrogen having removed the carbon, the tungsten filament would be left intact. Mr. Colefax adopted this view of what the real invention was in his address to this Court. He had no doubt whatever that what the framer of the specification intended to describe by the "usual manner" of forming filaments was not the mere mechanical process of "squirting," but the squirting of a material with pressure to force it through the appropriate orifices. He came to this conclusion, not only because he was satisfied on the evidence that the usual process in the year 1904 was the process spoken of as the soft-paste process, but also because of the inclusion of unification as a necessary part of the process and of denitration being also necessary when nitro-cellulose was used as part of the binding medium.

With regard to the first part of what he had called the second treatment, it was not disputed that the process described included heating the filaments by passing current through them, and introducing them into a previously prepared atmosphere of steam and hydrogen. So far as the process claim was concerned he could not read the second claim as anything different from the first claim.

He passed now to consider the main points in which the defendants' process and the plaintiffs' process differed. In the first place, the composition and the condition of the material were different. In the defendants' process it was hard, requiring tons of pressure per inch to pass it through a diamond orifice. In the plaintiffs' it was soft, and could be squirted through an orifice made of glass. In the second place, in the plaintiffs' process carbonisation was done separately, and before any attempt was made to decarbonise. In the defendants' the carbonisation, and practically the whole of the decarbonisation, were done at one and the same time in the first furnace, or in the vacuum, as the case might be. In the third place, the heat necessary for the decarbonisation part of the process in the plaintiffs' process was produced by passing an electric current through the filaments. In the defendants' it was applied externally. In the fourth place, the defendants' filaments were not exposed to a previously-prepared atmosphere of steam and hydrogen. These were, in his opinion, the important differences.

A great deal had been said about carbonisation and about binding material. It was said for the defendants that in their process they did not carbonise at all, and that the material used other than tungsten metal was not used as a binder, but as a lubricator. He did not attach much importance to these points. It was quite true that they did emphasise the difference between the materials used in the two processes, but carbonising was a chemical process, and might be used for the purpose of creating a quantity of pure carbon, or it might be used in order to convert a small quantity of carbonaceous matter into carbon as a step in getting rid of it altogether. In either case the process was carbonising. So also with regard to the binding material employed. One man might so carry out his process as to require, or might use, though he did not require, a considerable quantity of binding material. Another man might require and use very little.

In the present case he considered the differences between the two processes on these two points as differences in degree rather than in kind, and that the material used by the defendants did, in the very early stage of the process and before the calendering, act as a binder; and he could not find any evidence upon which he could accept the suggestion that the 0·2 per cent. of carbon found at the end of the first furnacing was not a residue at all, but was caused by the absorption by the metallic tungsten of gases given off during the passage of the filaments up the furnace. There remained, however, the question whether the defendants' process as a whole, and having regard particularly to the four points indicated above, was substantially the same as the process said to have been infringed. In his opinion it was not.

(*To be concluded.*)

BRITISH BUSINESS METHODS WHICH MUST GO.

By JOHN MARKS.

In the discussions at present proceeding on the best methods of securing our own trade from future Teutonic invasions, much time and energy are being needlessly wasted by partisans of one school of economic opinion stating that only their particular remedy will be able to ensure our prosperity in the days after the war, and by the opposite school of thought contradicting these statements. Neither side seem to reflect that when a catastrophe of so great magnitude overtakes a civilisation, ideas must be altered to suit the altered circumstances; nor do many of the disputants appear to go far beneath the surface of the whole matter.

Whether Government assistance is desirable or necessary, or whether it is dangerous and obnoxious, do not strike the writer as being the important questions. What is of importance is to ask ourselves whether we have had such methods of business in this country as would assist our trade, or whether our methods have not tended to retard the development of the home product, and encourage the development of the alien article. In asking this question the writer would again point out that he refers not to the governmental assistance or the lack of it, but to the actual methods pursued by the business community in finding and developing new ideas and markets. Let the writer give one or two examples to illustrate the matter, from his own personal experience.

About 12 months before the war an intimate friend brought out an ingenious mechanical device which, had it been taken up by our own manufacturers, would have resulted in a substantial trade to our lighter engineering firms. The nature of the device is unimportant; what is of importance is the respective attitude of the British and German business men towards the matter. The inventor patented the idea, and approached different British firms, in that particular line, as to taking up the manufacture and sale of the device. It is of interest to note that the person in question is a smart engineer.

The best offer he could get from a British firm was that he must face the initial expenditure on tools and jigs, that he must give a definite order for at least 12 gross before the firm would consent to manufacture at all; and, finally, that he was to find the whole of the selling organisation. As a result of careful inquiry into the matter, the firm in question informed him that the materials for making the article would cost, say, *x*d. per article. The expense of making the necessary tools and jigs was alone more than £180, and this was to be put down by the patentee before any move whatever was to be made.

The above offer made it impossible for the patentee to consider the development of the device in question, and for some time the matter was in abeyance. The only alternative the inventor had was to approach a financial man, and ask him to take up and float the matter. Knowing full well that all he would get out of such proceedings would be a little cash, a great deal of paper, and more worry, the inventor declined to take this course.

The sequel throws a strong light on the difference between the methods of our enemies and our own. A polite request came to the inventor from a German firm for an interview at his convenience, at which the question of taking up his idea might be discussed.

There are two points to note about this stage of the business: (1) The fact that he was approached by the alien firm in question, and had not to go round begging, cap in hand, as when he interviewed the British firms. The device had been noted in the patent records, and the inventor approached. The second point worthy of notice is that the inventor was so thorough a Briton, that he said to the writer: "I don't know whether to bother with them; one hardly knows what they will want, or whether it is worth while." Finally, he decided that no harm could come by the matter being discussed, and the firm's offer considered. When the offer was disclosed it was businesslike, enterprising, and generous.

Briefly, the offer was as follows:—The firm in question would make all tools, jigs, and templates without cost of expense to the inventor, would find the whole of the necessary selling organisation, and offered a substantial royalty on each article sold. In return they asked for the sole manufacturing rights for the world, and guaranteed to put the finished article on the market for a price actually 8 per cent. less than that stated by the British firm to be the bare cost of the necessary materials. Here, then, one found enterprise, willingness to take a fair share of risk, courage, and determination, and liberality towards the actual patentee.

Against such enterprise on the one side and such timidity and insistence on immediate profit on our own side, no help from any association or Government is going to prevail for long. If Government assistance is necessary, let us have it;

but do not overlook the fact that such backward and unenterprising methods must go; otherwise, a few years will find us in the old position of not being able to keep our place in the world's markets.

Note also the different methods of financing the article. On the German side there was no flotation of a preliminary company, which would afterwards be floated on to the public at an inflated price, the only people to benefit being the company promoters. The firm in question were ready to start straight away on the job without any waste of time or capital. This fact bears out the statement of a British business man acquainted with both German methods and our own, that whereas every British company carries a large proportion of water in its capital, this undesirable asset is almost, if not altogether, absent from the companies formed in Germany.

Personally, the writer has been let down by British financial people, simply because he would not consent to the over-capitalisation of certain schemes which particular financial men wished him to take up for them. The matter is easily explained; the writer had made a reputation in a particular electrical development, and had shown that, granted honest and careful capital expenditure, a certain hitherto unpaying industry could be made to pay a fair return on capital invested, and give satisfaction to its customers.

The financial people in question asked for a comprehensive scheme to be drawn up, asked the writer if for a certain salary he would attach himself to the enterprise, and went even so far as to get ready a guarantee fund for this stated salary for a period of three years. Meanwhile, the writer let two very good opportunities of improving his position pass, and devoted time to the scheme in question.

The first prospective customers approached were anxious to take up the matter and go on with the scheme, and when the cost of equipment came into consideration, stated that they could themselves find the whole of the necessary funds. It was here that the rift in the lute started. The financial people would not hear of this idea, but proposed to find the development money themselves and charge the prospective clients a matter of 16 per cent. for finding money which could be found locally without any trouble. In vain did the writer point out that he had publicly stated that it was this policy which had ruined similar schemes in times past, and that he could be no party to what was barefaced robbery; of no avail was it to point out that there was a clear 11 per cent. legitimate trading profit to be obtained from each client, and that this profit would be realised in about eight months. Neither was it of avail to demonstrate that the clients in question would find it profitable to continue the purchase of stores and renewals through the construction organisation. The sole reply was :—"Well, if you cannot see your way to agree with us the matter must drop: we can make more profit in a day or two on the Stock Exchange, and with far less trouble, than by the methods you propose."

Let it be noted that the people concerned are not in any way of the financial type known as sharks; they are looked upon as careful and prudent men, and at least two of the partners would hold up their hands in horror at the thought of anyone connected with them betting, and have even been known to question the propriety of mixed bathing.

The result has been that this particular development has been left on the shelf; the people who were ready and anxious to take the matter up have had to be disappointed, and the British electrical industry suffered in consequence.

In conclusion, let the writer quote two instances of the far-seeing manner in which our present enemies have approached any business problem in which they have been interested.

Last month the writer was chatting with an influential man in the textile industry. Matters which are now under discussion came up, and the writer was given the following, amongst other instances, of the shrewdness of the Teuton. A certain fabric used for shirt-making was only obtainable from Germany; this fabric was used for the most expensive type of shirt, and was of a quality not usually made in Germany. In fact, it was known that the British textile industry could beat anything in the world in this particular line. Yet the problem was present as to why it could not be obtained from a British firm.

The gentleman in question being a large buyer, came to an agreement with two other gentlemen to bottom the matter. To come to the point, it was found that this fabric *was* made in England, and by an English textile mill. The proprietors of the mill had been approached by a German firm with the following proposition :—"Your goods are the pick of your particular market; they are wanted the world over, and we are prepared to keep your mill running day and night, and to find all the markets for you, providing that you dispense with your own selling organisation and supply the world through us only."

Here, again, pluck and enterprise saw the opportunity, and grasped the same; for a considerable period the whole of the output of this particular mill was sold only through Teutonic hands.

It is useless to grumble, and try to throw scorn on such methods; they are the methods of the bold and enterprising man, and, of whatever nationality, such a man will always reap and deserve his reward.

The above agreement was, of course, determined by the war, and its operation occurred before the war; now, when a good deal of damage must have been done, precautions have been taken to see that it shall not occur again.

The second instance concerns the conduct of one of our great banks towards a small, though sound, engineering business. The firm in question were manufacturing a good class small machine tool, largely to the order of a London firm who found the selling organisation. This London firm contained a partner of Teutonic origin. The head of the small engineering firm was a clever designer and inventor, and for that reason was left to himself a good deal by the London firm.

The writer knew the manufacturing firm and its leading men intimately, and, from their own statements, learnt that, as they were often requiring money for additional plant or extensions, they had to ask the bank for accommodation occasionally. They had never been long in lifting their overdrafts, the bank people knew for whom they worked, and knew well enough that there was good security. Yet, in spite of these facts, they constantly bothered the head of the manufacturing firm as long as ever they had even a small overdraft.

This naturally worried the head of the firm, and on two or three occasions he asked for and obtained a three months' bill from the London house, and so satisfied the bank people. This, of course, was not a profitable proceeding, and in the course of conversation with the Teutonic partner of the London house on the occasion of a visit, the head of the manufacturing firm mentioned that it was by no means easy to contemplate certain extensions on account of the attitude of the bank concerning accommodation.

This conversation was the last held on the matter, and there was no more badgering from that particular bank. The Teutonic partner of the London house asked to be allowed to put money behind the manufacturing firm, and took the financial state of affairs under his own direction. This, amongst other matters, included the closing of the account with that particular bank, and the transference of the business to a rival.

The first bank squealed about the matter, and were ready to be most accommodating, but to no avail; they lost the business, and yet they knew all along for whom the manufacturing firm were working. They knew perfectly well that the money was safe enough, but they preferred to badger and worry the works manager for the sake of screwing more money out of him in bank charges. Had this works been in Germany, the banks there would have nursed the business and helped to put it on its feet; any of our banks would have done the same as the first bank, viz., their best to throttle the business with overcharges and worry.

These few notes have not been put together in order to flatter the Teutonic business man, but for the purpose of showing that if we do not use their enterprising methods, and drop our usual timidity and greediness, we shall find that after the war the German will soon regain his old place.

Our business men are mostly to blame for the above state of affairs; and it appears to the writer only common sense to state that no Governmental assistance of whatever nature can save the situation for any nation which leaves enterprise and foresight on one side to the extent that our British firms have done.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

The "Pointolite" Lamp.

In our issue of the 10th inst. we published full particulars of the new type of lamp that has been developed by the Edison and Swan United Electric Light Co., Ltd., of Ponder's End, Middlesex; the company has now placed on the market the first of the new lamps, under the apt title of the "Pointolite" lamp. The

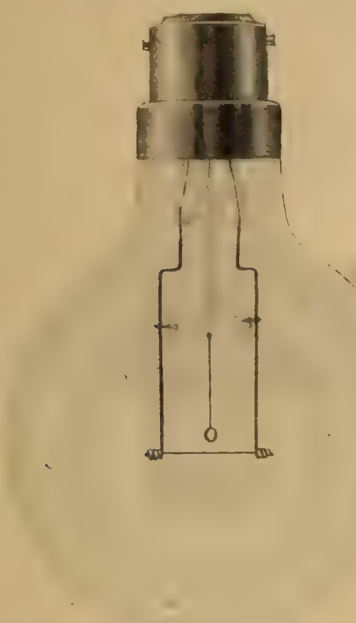
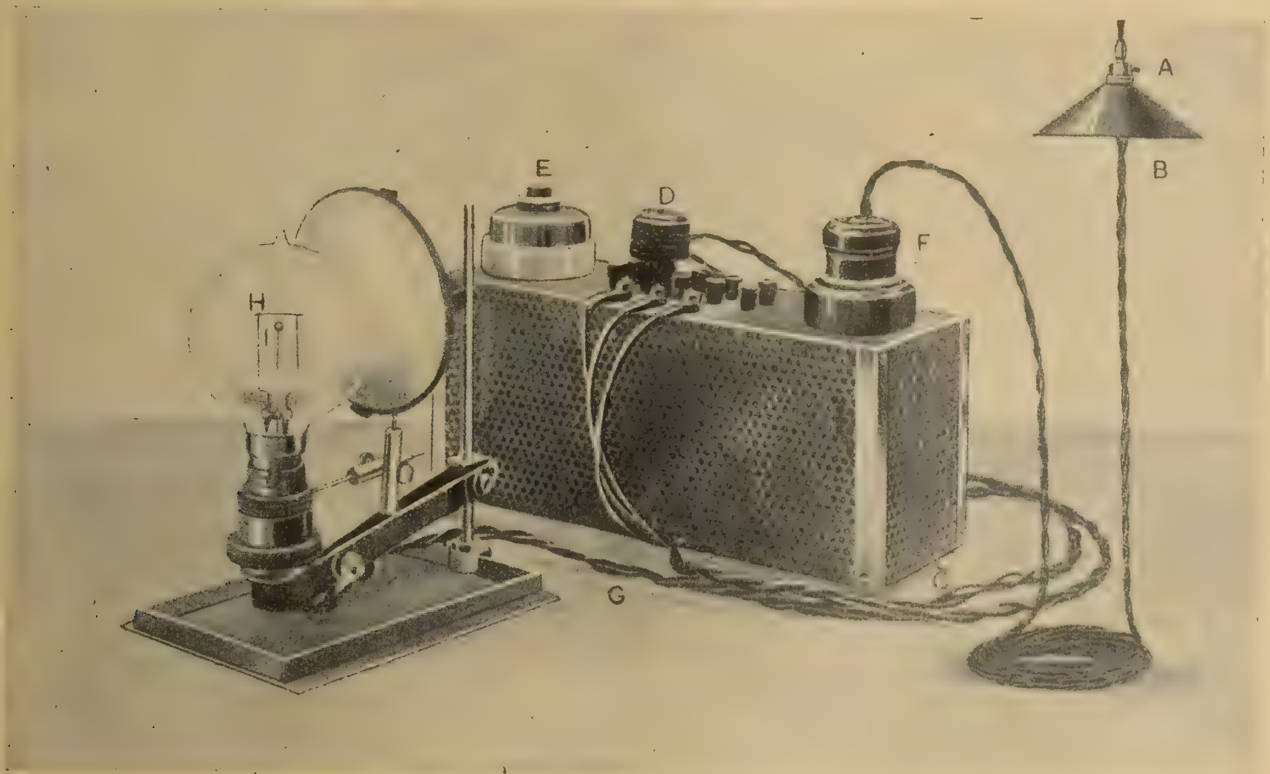


Fig. 1.—Royal Ediswan "Pointolite" Lamp.

new-comer is of 100 candle-power, and in the first instance is put forward for use in optical projection lanterns, an application for which it is particularly well suited, as the light emanates from a small ball of tungsten, shown almost full size in fig. 1. The ionising filament is seen under the ball, and the latter, as previously explained, when the arc is struck is immediately moved by an automatic bimetallic support to a different position, slightly lengthening the arc and avoiding the ageing of the portion of filament opposite the ball when cold. The extreme concentration of the source of light, practically all of which emanates from the ball, enables the most accurate focusing of the lamp with regard to both the lens and the reflector to be effected, giving a perfectly uniform disk of light on the screen, while the light is almost indistinguishable from daylight in colour. At present the lamp can be used only on D.C. circuits, and a resistance box is provided, as shown in fig. 2, with plug connections which enable the outfit to be used on any voltage from 100 to 250 volts. The supply is obtained from an ordinary lampholder; the push-switch shown is pressed for a second or two, energising the ionising filament, and is then released, when the arc strikes between the ball and the filament. If the polarity is wrong the arc does not strike readily, but this is easily remedied by reversing the position of the adapter in the lampholder. There are, of course, many other uses to which the lamp can be put besides that indicated above.



A, lampholder; B, adapter; C, resistance box; D, resistance plug; E, push switch; F, supply plug; G, wiring; H, ionising filament; I, tungsten ball.

Fig. 2.—"Pointolite" Lamp, Reflector and Resistance Box ready for use.

Jackson Heating Apparatus.

The Jackson Electric Stove Co., Ltd., of 38, Blandford Street, W., have recently issued an interesting and instructive little 16-page booklet on the subject of electric fires, and more especially the Jackson fire. It is intended more especially for the electrical retailer, and sets out in simple language the why and wherefor of the constructional features which should be found in the modern electrical fire, concluding with a description of the especial features of the Jackson construction.

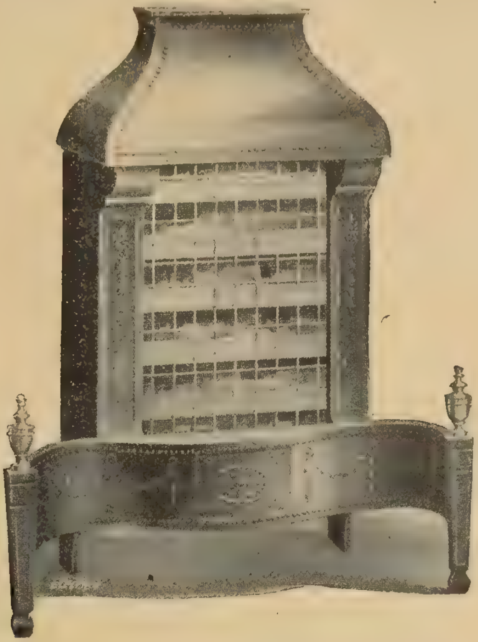


Fig. 3.—Typical Jackson Electric Fire.

As some of our readers are, no doubt, aware, the electric fire has made a great advance during the last year or two, the tendency being to simplify construction details and produce a design which is easily accessible for replacements and repairs, and at the same time sufficiently robust to withstand fairly hard usage. The Jackson fire is quite representative of this class.

It consists essentially of an inner standard type of cast-iron frame carrying the heating bars or elements, together with all the wiring and switches, &c., forming a complete unit, which is enclosed, but easily removable as a whole from the carcass of the stove, which may be ornamental or plain to taste.

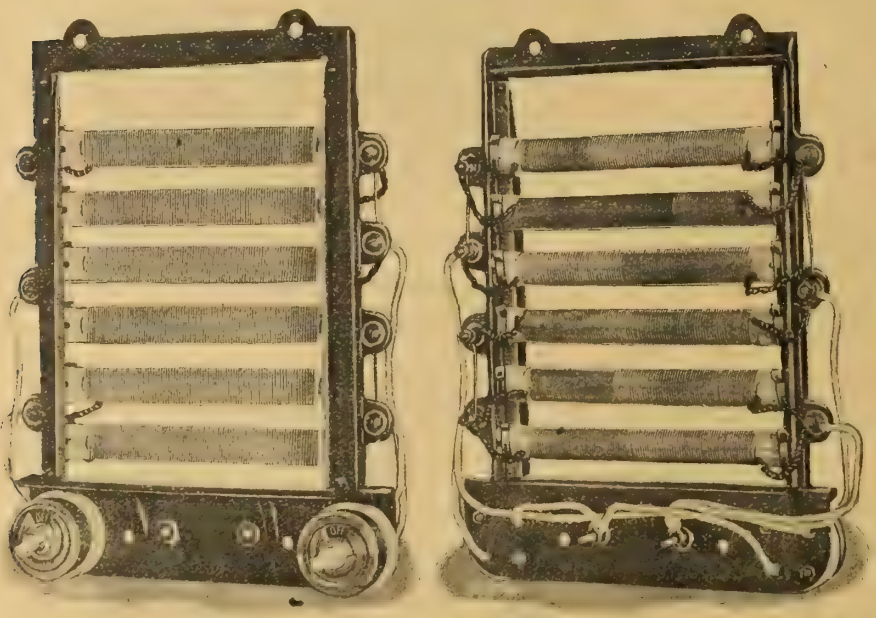
The heating elements consist of fireclay bars, wound with flat nichrome wire; the front of the bar is concave, and the wire standing clear immediately attains full heat, while partly owing to the small cubical contents of the Jackson bar and its being surrounded with wire, the whole bar soon attains red heat. These bars are carried in metal clips on the frame previously mentioned, being free to expand and easily removable; the heating wire connections are quite separate, being carried to terminals on the frame. All the connections are of pure nickel wire with asbestos insulation, while the switches are Diamond H pattern, on all but the smallest size.

The heating elements have a standard 500-watt loading, are inexpensive to replace and guaranteed for two years, and the fires are listed in sizes from 2 KW. to 4 KW., although other sizes can be supplied. The fronts are of cast-iron, finished in black, coloured vitreous enamel, and, in certain designs, armour bright; from two to four yards of flexible is supplied with each fire.

It may be mentioned that the Jackson fires are enclosed, except in front of the bars, expressly with a view to preventing air currents from passing over the hot bars, and thus lessening the burning of dust particles in the air, which in certain circumstances is said to cause stuffiness and throat irritation.

The Jackson Electric Stove Co. specialises in electric cooking apparatus, and has supplied many large installations for public and private buildings. Various designs of cookers, grills, fryers, hot plates, urns, boilers, &c., are made.

It may be of interest to note that in their latest domestic cooking stoves the oven space can be divided into an upper and lower compartment by a (heat) insulating oven plate, so that only one half the oven can be used (and heated) for cooking if desired, with a corresponding saving in cost of electricity. The heating elements are fixed to a detachable frame, one on each side of the oven space, each frame carrying an upper and lower group of heaters; three-heat regulation is provided to both upper and lower groups. Above the oven is a hob with boiling rings and a grill, and various accessories are supplied.



FIGS. 4 AND 5.—FRONT AND REAR OF JACKSON STANDARD HEATER UNIT.

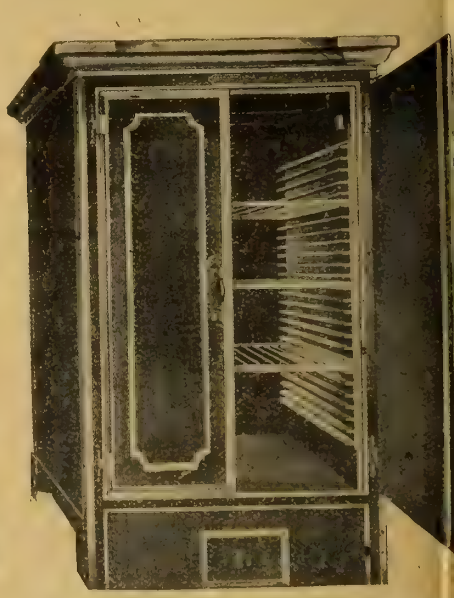


FIG. 6.—LARGE JACKSON COOKING OVEN, SUPPLIED TO PARK PREWETT ASYLUM.

The loadings are: For the oven, 2,000 watts; grill, 1,300 watts; 8-in. hotplates, 1,250 watts; 6-in. hot plates, 850 watts; and with the exception of the grill, three-heat control is provided. The electrical connections from the stove are carried in a flexible metal tube fitted with earthing flanges, to a separate control board, of which several patterns are made, the simplest consisting of Diamond H switches with Zed fuses and one indicating lamp, while separate indicating lamps and a D.P. main switch can be provided.

It may be of interest to record that the firm are fitting up the Park Prewett Asylum, in Hampshire, which is being adapted for hospital purposes, with electric cooking, and installing two very large ovens there, each of them measuring 5 ft. 6 in. high × 3 ft. 6 in. × 2 ft. 10 in., and being capable of taking some 300 lb. of meat.

Lemington Glass Works.—Owing to the continued increase in the demand for Osram lamps, it has been necessary very considerably to extend the Lemington Glass Works, at Lemington-on-Tyne. Further extensions are still actively in progress. The Osram and Robertson lamp bulbs are made there.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Institution and Alien Enemy Members.

I did not intend to write you again for the present in connection with this matter, but, having seen the appreciation of the movement by one of our *associate members* who is *fighting* on behalf of us in France, I think it only right that he should realise through the Press that the pro-alien influence which exists is so great that I am afraid practically nothing could arise from any further agitation.

It is evident that the influence has been so great, both in the Council and outside, that there will be nothing to do now but to wait until such of those members as are fighting (if spared) return, when it is hoped that the Institution will not then be able to turn a deaf ear to men who have offered their life's blood whilst members of alien enemy origin continued to enjoy the privileges of membership.

I think it is a great reflection upon Englishmen that they should be so lacking in force of will and individuality as to allow such influences to outweigh what can only be one's duty at a crisis like this, and that is to realise that all men not British born and of British parents, should, unless born of our Allies or friends, be excluded from all societies, associations or homes where Englishmen exist.

Station Engineer.

December 20th, 1915.

Since there is no hope that the Council of the I.E.E. will make any move to exclude members of alien enemy origin, and the reception accorded to petitions to the Council on this subject is not encouraging, to put it mildly, it is time to call a special meeting of the I.E.E. to consider this matter.

The Secretary is bound by the rules to call a special meeting if ten members sign a request for it, but to make the meeting effective it would be better if the secretaries of the various electrical engineering societies which have been discussing this matter at their recent meetings would get into touch with each other, and make whatever action they intend to take a joint affair.

A very large proportion of the members of societies such as the I.M.E.A., the B.E.A.M.A., the Electrical Contractors' Association, the Institution of Post Office Engineers, the Municipal Tramways Association, the Association of Municipal Electrical Engineers of Greater London, etc., etc., are also members of the I.E.E., and it should be a simple matter for the secretary of one of these societies to invite the co-operation of the others. Never again, probably, will they find a subject on which they can all agree so wholeheartedly, and never again will they have such an opportunity of telling the Council of the I.E.E. what all branches of the electrical industry think of their policy of DRIFT and DO NOTHING.

Another Station Engineer.

[The I.E.E. *Journal* for December 15th states that representations have been made to the Council by certain members to the effect that members of enemy origin or nationality should be excluded from membership of the Institution, and replies have been sent intimating that the Council is legally advised that the only power of expulsion which the Institution or its Council appears to have are those contained in Article 41 of the Articles of Association.

Article 41 reads as follows:—"In case the expulsion of any person shall be considered expedient by ten or more Corporate Members, and they think fit to draw up and sign a proposal for such expulsion, stating the grounds for expulsion, the same being delivered to the Secretary, shall be by him laid before the Council for consideration. The Council shall in every such case investigate and take the matter into consideration, and if in the opinion of the Council it is expedient to appoint a Committee of the Council to make, or assist in making, the investigation, they shall appoint a Committee accordingly, and shall cause such Committee to report to the Council, and the Council may adopt or reject such report, wholly or in part, and the Council shall give such person an opportunity of attending before the Council, or any such Committee, to defend himself and meet any of the accusations made against him, and if the Council do not find reason to concur in the proposal, no entry thereof shall be made in the minutes, nor shall any public discussion thereon take place; but, if the Council do find good reason for the proposed expulsion, they shall direct the Secretary to address a letter, according to the Form B in the Schedule, to the person proposed to be expelled, advising him to withdraw from the Institution. If that advice be followed, no entry on the minutes, nor any public discussion on the subject, shall take place; but if that advice be not followed, the Council shall call a Special General Meeting of Corporate Members and Associates for the purpose of deciding on the question of expulsion; and if a majority of the persons present at such Special General Meeting, provided the number so present be not less than twenty, vote that such person be expelled, the Chairman of that meeting shall declare the same accordingly, and the Secretary shall communicate the same to the person according to Form C in the Schedule. . . ."

Article 79 provides that:—"A Special General Meeting of Corporate Members and Associates may be called at any time by the Council for any specific purpose relating to the direction and management of the affairs of the Institution, except altering or adding to the Articles of Association, and the Council shall at all times call such a meeting on a requisition, in writing, of ten Corporate Members or Associates, specifying the general nature of the business to be transacted."

The number of members whose names and addresses suggest that they are of enemy nationality, on a rough estimate, appears to be of the order of 100.—Eds. Elec. Rev.]

The A.E.G. Meeting.

As you were kind enough to allow me to open this correspondence in your issue of September 17th, I have no doubt that you will, with your usual courtesy, permit me to wind it up.

My original object was to direct attention to the continued existence of the Electrical Co., Ltd., and to find out why, and by whom, it was supported.

I need hardly say that in one respect I have been disappointed. Whilst it does not follow that all those contractors who did not disclaim dealing with this company are unpatriotic, it *does* follow that those who did have shown public spirit. That the number is so few was, alas, only to be expected.

I have to thank "Anti-Humbug" for his energetic letters, and the way he laid about him was evidently not to the taste of Mr. Marryat, whose contributions were like the inky clouds which the cuttle-fish ejects when he wishes to obfuscate the issue.

Unfortunately, "Anti-Humbug" was led away by his momentum into such a vigorous chase of the electrical contractors that, like Montmorency in *Three Men in a Boat*, he suddenly found that he had "overcharged" the cat in the shape of Mr. Leonard G. Tate, who, licking his paws, looked up suddenly and remarked, "It is a fine day; is there anything I can do for you?" Whereupon, Montmorency and the cat found that they were old friends, and had known one another since the days, long ago, when they had, as puppy and kitten, received many of the tit-bits in the larder. So they licked each other's backs and agreed that their aims were identical, and that all the cat's friends were sleek and honest, whilst, as for the other mangy animals and the Electrical Co., Ltd.—well, we should see what we should see.

However, I do not think the correspondence has been in vain, and I find that I merely anticipated Mr. Ian Colvin, whose article in the December number of the *National Review* should be read by everyone—just with a very little grain of salt. And, at last, the Government appears to be "giving the matter their earnest consideration." In Thursday's debate in the House of Commons, the Home Secretary said (I quote the *Times*):—

"Let them in the shortest possible time, by an independent Bill, amend the law which at present empowered the Board of Trade to secure the appointment of a controller or to appoint inspectors in order that a suspected business might be carried on under supervision. Let them add new powers so that the Board of Trade might, by some proper person and in a proper case, where the national interest required it, instead of authorising the business to go on, make provision for the business to stop. (Cheers.) He was not now using technical language, but the substance of the thing was that we should add to our existing powers the power, where the national interest required it, of securing by order that a given undertaking suspected of enemy association might be stopped from carrying on business."

Let us hope that this independent Bill will be passed quickly, and then, so far as certain enemy undertakings are concerned, we may raise our glasses, and say with Omar Khayyam:—

"Another and another glass to drown
The memory of this impertinence."

Inquisition.

December 18*th*, 1915.

The exposure of the above company in the current issue of the *National Review* should be of great assistance to patriotic traders who are trying to break the hold of the German octopus on British trade.

I recently had to equip a medical set with new dry cells—the case was urgent, as a wounded officer's nervous system was giving anxiety to the visiting surgeon—and the set in use, a very elaborate one, required 25 cells, and only one maker on the market supplied the size cells to suit. That firm is of German origin. I was not in a position to wait for a British firm to make up the cells. Other instances occur where the articles are undoubtedly German, but no British substitute is in the market, or else has not been so well advertised as German goods. Certain firms are mentioned in Mr. Colvin's list who are carrying out large Government contracts now. No sensible Britisher believes in the *bona-fides* of these firms, although our weak laws allow them every protection. What is done with the money paid into their banking accounts? Even if no money goes direct to Germany, the account must be a considerable asset to the German shareholders and of assistance to the enemy against ourselves.

Union Jack.

To Investigate the Russian Market.

Russia is extending to us an invitation to secure the forty million pounds sterling imports which Germany has been hitherto supplying her. The invitation is persistent and insistent, and it is urged that we take steps at once to investigate the opportunities and conditions, so that we may be prepared to meet her requirements immediately peace is declared.

A thoroughly exhaustive investigation of the possibilities in different lines of business, the existing productions that can be sold in Russia, and the new lines that can be profitably made and sold, is necessary to a practical solution of the problem. Such an investigation must be made on the spot, and will necessarily occupy considerable time.

To secure this information, and to give practical assistance to manufacturers wishing to enter the Russian markets, or to develop existing connections, a commissioner will probably go to Russia in the early spring. He will make special reports to manufacturers interested in the enterprise, and put them in communication with reliable buyers in Russia, and fully report on the conditions and opportunities existing. Official support of a valuable character has already been promised.

The writer will be pleased to give further particulars to any manufacturer interested.

Wm. Hy. Beable,
Vice-Chairman, Sales Managers' Association.

Aldwych Club, London, W.C.,
December 16*th*, 1915.

Electrolytic Copper.

I read with much interest the abstracts in your issues of November 19th and 26th of Mr. Welbourn's address to the Manchester electrical engineers, and as my name is mentioned in connection with some of the experiments quoted, perhaps I may, without presumption, offer a few remarks on the subject, more especially as the author refers your readers to Mr. Pye's paper published in the *Institute of Metals Journal*, No. 2, 1811, vol. VI, which I ventured to criticise in a contribution printed in the same number of the *Journal*.

I was pleased to see that Mr. Welbourn confirms the figures I gave in contradiction of the surface hardening myth, which was also disputed on theoretical grounds by Mr. F. Johnson, and I should think that this might now be taken as finally disposed of.

With regard to the permanent effect of heating wire, one may remember that the drawing process itself causes a considerable rise in temperature, probably to 250 deg. F. or more, and one would naturally suppose that subsequent heating, if not to a higher temperature, would have no further effect. A few more experiments would be interesting (if anyone could find time to make them) on alternate heating and cooling for long periods under tensile stress.

The author, very rightly in my opinion, attaches great importance to elasticity in hard-drawn copper wire, though I think he places the elastic limit unnecessarily low. The breaking strength *per se* is of no practical interest to anyone, but the desideratum, of course, is the highest strength within the elastic limit, which is obtainable without brittleness and without undue cost in production. In some cases it may be worth while to incur a little extra expense for the sake of special qualities. For instance, in railway electrification, where speeds are high and the overhead conductor is supported at short intervals, it is desirable to obtain the minimum of deviation from a straight line under varying temperatures, and with this object the wire should have strength and elasticity permitting its being normally strained to such an extent that the elastic contraction may, as far as possible, counterbalance the expansion from rise in temperature.

The elastic properties of wire being of such importance for all overhead purposes, no doubt tests with regard to them would be most satisfactory proof of the suitability of any particular wire, but such tests are hardly capable of being carried out rapidly on large numbers of coils in a warehouse, and I think that this is a condition necessary for the adoption of any test as a basis for acceptance or rejection of supplies. I would venture to suggest that if the National Physical Laboratory are good enough to undertake further investigation on this subject, it would be most useful if they could determine whether or no certain elastic properties can be relied upon to be present provided a certain tensile strength and absence of brittleness are shown by simple tests that can be easily and rapidly applied by anyone.

From many tests I have examined, I believe it would be found that this is so, and that the higher the tensile strength for any particular size, the better in proportion are the elastic properties, provided, of course, that brittleness is avoided.

If my surmise proved to be correct, and if the National Physical Laboratory were able to extend their investigation to a complete range of sizes, as suggested by Mr. Welbourn, they might furnish the industry with a table, setting out the complete properties of the most generally suitable qualities of wire of all sizes, and the long-sought-for standard specification might be arrived at by selecting from these properties one or two which are easily tested, but which would ensure the remainder.

Of these, the breaking stress would naturally form one, and for the other the Post Office wrapping test might be found to answer for all except the very heavy gauges where total elongation becomes sufficiently great as to be measurable without dispute.

A specification in the form of a table so drawn up would have the advantage of being correct throughout the whole range; it is in the nature of things impossible to find a formula to fit all sizes, and it would appear to me a great mistake to calculate a table from a formula which is, at the best, only an approximate fit, and so sacrifice quality in some sizes for the sake of academic attractiveness.

The Standards Committee's definition of hard-drawn copper was never intended for a specification, and although Mr. Pye's combined formulæ no doubt form a fuller definition, they do not, to my mind, furnish a good specification.

Thos. Bolton.

London, *December 14th*, 1915.

TRADE STATISTICS OF THE STRAITS SETTLEMENTS.

The following statements, showing the imports (not for transhipment) of electrical and other materials into the various Straits Settlement ports in 1914, is taken from the recently-issued official trade statistics. In compiling these statistics the first port of shipment is generally accepted as denoting the country of production. The values for 1913 are added for purposes of comparison, with notes of any increases or decreases.

IMPORTS INTO SINGAPORE.

	1913. Dollars.	1914. Dollars.		Inc. or dec. Dollars.
Telegraph and telephone materials.—				
From United Kingdom ...	724,000	145,000	–	579,000
,, Belgium	37,000	3,000	–	34,000
,, Germany	5,000	1,000	–	4,000
,, Other countries ...	9,000	10,000	+	1,000
Total	775,000	159,000	–	616,000
Tramway and railway materials.—				
From Belgium	71,000	65,000	–	6,000
,, Germany	8,000	6,000	–	2,000
,, United Kingdom ...	99,000	200,000	+	101,000
,, Other countries ...	3,000	6,000	+	3,000
Total	181,000	277,000	+	96,000
Electrical machinery.—				
From United Kingdom ...	409,000	209,000	–	200,000
,, Germany	40,000	17,000	–	23,000
,, Italy	5,000	6,000	+	1,000
,, Sweden	4,000	3,000	–	1,000
,, Belgium	1,000	1,000		—
,, United States ...	6,000	8,000	+	2,000
,, Japan	7,000	2,000	–	5,000
,, Other countries ...	16,000	17,000	+	1,000
Total	488,000	263,000	–	225,000
Engines, boilers and parts.—				
From United Kingdom ...	267,000	325,000	+	58,000
,, Germany	9,000	3,000	–	6,000
,, Netherlands	14,000	—	–	14,000
,, United States ...	12,000	—	–	12,000
,, Other countries ...	16,000	14,000	–	2,000
Total	318,000	342,000	+	24,000
Machinery, other (except sewing machines).—				
From United Kingdom ...	21,000	671,000	–	150,000
,, Australia	21,000	4,000	–	17,000
,, Belgium	14,000	15,000	+	1,000
,, Germany	60,000	33,000	–	27,000
,, Holland	7,000	2,000	–	5,000
,, United States ...	130,000	60,000	–	70,000
,, Other countries ...	85,000	125,000*	+	40,000
Total	1,138,000	910,000	–	228,000

* Salangor, $55,000.

	1913. Dollars.	1914. Dollars.		Inc. or dec. Dollars.
Lamps and lampware.—				
From Belgium	7,000	8,000	+	1,000
,, Austria	12,000	6,000	–	6,000
,, Germany	239,000	125,000	–	114,000
,, United Kingdom ...	126,000	76,000	–	50,000
,, United States ...	28,000	9,000	–	19,000
,, Other countries ...	31,000	19,000*	–	12,000
Total	443,000	243,000	–	200,000

* Japan, $4,000.

IMPORTS INTO PENANG.

	1913. Dollars.	1914. Dollars.		Inc. or dec. Dollars.
Electrical machinery.—				
From United Kingdom ...	91,000	128,000	+	37,000
,, Germany	41,000	20,000	–	21,000
,, Denmark	5,000	5,000		—
,, Other countries ...	9,000	20,000*	+	11,000
Total	146,000	173,000	+	27,000

* Holland, $7,000; and United States, $9,000.

	1913. Dollars.	1914. Dollars.		Inc. or dec. Dollars.
Engines, boilers and parts.—				
From United Kingdom ...	657,000	328,000	–	329,000
,, Germany	16,000	5,000	–	11,000
,, Belgium	61,000	2,000	–	59,000
,, United States ...	24,000	16,000	–	8,000
,, Other countries ...	30,000	107,000*	+	77,000
Total	788,000	458,000	–	330,000

* Australia, $60,000; and Netherlands, $39,000.

	1913. Dollars.	1914. Dollars.		Inc. or dec. Dollars.
Machinery, other (except sewing machines).—				
From United Kingdom ...	158,000	183,000	+	25,000
,, Belgium	6,000	3,000	–	3,000
,, Germany	10,000	10,000		—
,, United States ...	2,000	16,000	+	14,000
,, Other countries ...	9,000	18,000	+	9,000
Total	185,000	230,000	–	45,000
Lamps and lampware.—				
From Austria	1,000	—	–	1,000
,, Belgium	3,000	2,000	–	1,000
,, Germany	65,000	27,000	–	38,000
,, United Kingdom ...	60,000	36,000	–	24,000
,, Other countries ...	6,000	6,000		—
Total	135,000	71,000	–	64,000
Telegraph and telephone materials.—				
From United Kingdom ...	14,000	1,000	–	13,000
,, Other countries ...	3,000	—	–	3,000
Total	17,000	1,000	–	16,000
Tramway and railway materials.—				
From United Kingdom ...	4,000	13,000	+	9,000
,, Belgium	1,000	8,000	+	7,000
,, Holland	4,000	—	–	4,000
Total	9,000	21,000	+	12,000

IMPORTS INTO MALACCA.

	1913. Dollars.	1914. Dollars.		Inc. or dec. Dollars.
Telegraph and telephone materials.—				
From United Kingdom ...	20,000	12,000	–	8,000
Engines, boilers and parts.—				
From United Kingdom ...	1,000	—	–	1,000
Machinery, other (except sewing machines).—				
From United Kingdom ...	116,000	37,000	–	79,000
,, Other countries ...	18,000	10,000	–	8,000
Total	134,000	47,000	–	87,000
Tramway and railway materials.—				
From United Kingdom ...	—	3,000	+	3,000

N.B.—Dollar = 2s. 4d.

WAR ITEMS.

Trading with the Eenmy.—Lord Halsbury's Bill on "Companies of Enemy Character" passed the Committee stage in the House of Lords on December 16th. The Lord Chancellor intimated that the Government did not propose to take any part in the Committee stage of the Bill. He said that the position of companies in this country which were of a predominant enemy character, strange and unusual though it might be, was a position which, so far as the war was concerned, could produce no evil results. It might well be that when hostilities were ended the whole matter ought to be put upon a sound and reasonable foundation. The position of these companies had been carefully regulated by legislation since the war began, and the Bill of the noble Earl did not really go so far as the existing provisions of the Trading with the Enemy Acts. One thing was plain, and it was that, so far as it was possible to prevent trading in this country by a company of an alien character which was hostile to the interests of this country, there was full power already existing, and no one suggested that that power had not been made use of by the Board of Trade. In these circumstances the Government did not propose to take any part in the Committee stage of the Bill. Lord Halsbury entirely repudiated the notion that there was no harm in alien companies carrying on business and earning dividends in this country while the war was going on. It was not common sense. He should certainly proceed with the Bill, and he hoped their Lordships would carry it. It was perfectly outrageous. What would be said in Berlin if an English company, under the pretence of being a German company, was allowed to carry on business there? He thought he knew what would happen. The Marquis of Lansdowne said that he was assured that no steps had been taken either in Germany or Austria to prevent the trading in those countries of companies which were British in their character.

The House of Commons considered the Trading with the Enemy (Extension) Bill in Committee on 15th inst. In reply to the discussion that occurred, Lord Robert Cecil said that the Government position was that only those firms ought to be allowed to carry on business whose business it was in the national interest to allow to continue. A member had moved an amendment that the Act itself, and not the Executive by Royal Proclamation, should insure the prohibition of trading with enemies whether in neutral countries or in this country. Lord Robert said that a Bill on those lines would be totally unworkable. "To merely strike out all German traders in South America and other countries, where German traders were closely intermixed with our own, would inflict a very severe injury upon the trade of this country. It would very largely diminish our export trade and throw it into neutral hands. The object was to give this country an advantage by injuring German trade. What they wanted to do was to strike out those German firms which were worked as German firms and as part of the German organisation. They must also have the power to put on the black list neutral firms doing German trade yet not technically of German nationality. That was why the words 'enemy association' had been introduced."

In the House of Commons on the 16th inst. the Trading with the Enemy (Extension) Bill was under further consideration in Committee stage. Sir J. Simon said that the intention of the Under-Secretary for Foreign Affairs in introducing the Bill was to make provision solely for cases arising in foreign countries, but it had been pointed out that the language of the Bill was consistent with its application to similar cases in our own country. He had consulted the Board of Trade and the Law Officers, and he urged the Committee to agree to confine the present Bill to its original purpose, the Government undertaking to make provision at once in a separate measure to meet the point raised by the amendment. "As far as this Bill was concerned, direct methods of attacking a suspected firm were not possible. That was the reason why they should make this Bill apply only to the foreign cases, and he would make that clear by an amendment. At the same time, the Committee should have the definite assurance which some members were asking, and he would outline the proposal the Government were prepared to present. He was not at all prepared to take the view that nothing had been done by existing legislation, and he still held the view that in a good many cases the existing practice of appointing controllers and inspectors was the right one. But that was no reason why, if there were cases that ought to be dealt with in different way they should not take power to do so. At present there was no specific power in any Department of the Government to deal with one of those suspected firms by the method of closing it down or winding it up. What he was going to suggest was this. Let them, in the shortest possible time, by an independent Bill, amend the law which at present empowered the Board of Trade to secure the appointment of a controller or to appoint inspectors in order that a suspected business might be carried on under supervision. Let them add new powers so that the Board of Trade might, by some proper person and in a proper case, where the national interest required it, instead of authorising the business to go on, make provision for the business to stop. He was not now using technical language, but the substance of the thing was that we should add to our existing powers the power, where the national interest required it, of securing by order that a given undertaking suspected of enemy association might be stopped from carrying on business. The other night Lord R. Cecil laid down in a single sentence what he thought the principle ought to be, and what he (Sir J. Simon) was now saying was intended to be in strict accordance with that principle. He assured the Committee that the matter was in an advanced state, although not many hours had elapsed. He had consulted the President of the Board of Trade, and they were entirely at one as to the principle. There would be a consequential proposal in the form of an amendment providing that the present Bill did not by its phraseology overlap the ground he had suggested they should occupy by means of the new Bill."—("Times" report).

Sir H. Dalziel said the Committee was greatly indebted to the right hon. gentleman for the plain statement he had made, which he thought was of a very satisfactory character. The Government had at last recognised that there was a serious danger to be dealt with in this country, and that immediate action was necessary. He imagined the distinction that would be drawn between companies would be in the case where a German company was doing anything to help us to win the war, for example, as some of them were, by making munitions of war. In that case he would say that under proper supervision the company ought to continue. Mr. Butcher said that the right hon. gentleman's announcement would give great satisfaction throughout the country, because the public had been somewhat alarmed at the extent to which German firms had been allowed to trade. In the circumstances, he withdrew his amendment.

The title of the Bill was altered to the "The Trading with the Enemy (Extension of Powers) Bill," and the third reading was agreed to.

In the House of Commons on Monday the Prime Minister was asked whether, in view of the fact that German companies had branch companies in neutral countries controlled by the parent boards, such branch companies being able to trade with Great Britain and being outside the operation of British laws, and the Germans were thus still exploiting our market, the freedom of which had enabled them to make war upon us, he would reconsider his decision not to give facilities to Lord Halsbury's Bill. Mr. Asquith, in reply, said that the Bill recently introduced by His Majesty's Government gave full power to proclaim any person or body of persons in a neutral country with enemy associations as an enemy, and to prohibit trade with such person or body of persons. He did not see how the adoption of Lord Halsbury's Bill would give wider powers in this direction.

The President of the Board of Trade, replying to other questions on the same day, said that the new Trading with the Enemy Bill was being drafted, but that he could not yet fix a day for its introduction. He was not aware that any promise was made as to whether it would be introduced before the adjournment. It would be before the end of the session. The drafting was well forward.

Sir J. Lonsdale, on the 16th inst. (says the "Times"), asked in what English statute it was provided that an enemy living in a neutral country was for belligerent purposes treated as a neutral, and that consequently it was no offence for a British subject to trade with a German firm in neutral countries. Lord Robert Cecil, in reply, said that he was not aware that the matter had been dealt with by statute. The principle had been established by a long series of decisions in the Law Courts of this country.

German Confidence in the Future.—At the general meeting of the Haspe Steelworks, the President, Herr Klöckner, said that although the world war had now lasted almost a year and a half, Germany's trade and industry were still holding their own. The nation's industries were supplied for a long time ahead with everything that was necessary for carrying on the war as well as with the commodities needed for the arts of peace. The demands from neutral countries for pig and bar iron were considerable, and ensured plenty of work for the winter. The prospects of the iron industry were still very favourable. What the position would be after the war no one could say for certain. Money would be dear, he feared, but that would check over-speculation. Money was international, and after the war it would find its way back from the centres where it was now accumulating to those where it could be placed with confidence. Germany's prospects for future export trade continued to be good. England had so far not captured any neutral markets. The British works had no opportunity of exploiting the trade-war; they had enough to do at home. That also seemed to apply to America if, as reported, the Steel Trust was retiring from export business owing to pressure of home-work. As a result of the gradual depletion of the large stocks in all oversea markets, a demand would set in for which Germany might successfully compete after peace was restored. Her friendly relations with South America entitled her to entertain the best hopes from that quarter.—"Ironmonger."

A Santiago Rumour.—A telegram from the correspondent of "La Prensa," at Santiago de Chile says:—"Rumours are in circulation to the effect that the British Government proposes to confiscate the tramway and electric light company of Santiago, on the ground that the capital is German and the board is domiciled in London. The matter, however, appears to be a difficult one as the arrangements would have to be conducted diplomatically and judicially in a neutral country."—"Review of the River Plate."

Recruiting Notes.—Out of the total staff of the Isle of Thanet Electric Tramways & Lighting Co., Ltd., 66 enlisted for active service. Of these, one died of wounds in the Dardanelles, and one was accidentally killed in France. Of the remaining staff, 93 per cent. of those of eligible age (including the manager, Mr. J. A. Forde) presented themselves for attestation under Lord Derby's scheme.

The number of employés attached to the Aberdeen Corporation Tramway Department, who attested under the Derby scheme, was 117—practically all the eligible staff. Twenty-eight of the staff of the Electricity Department also enrolled. Twenty-six men from the Electricity Department are already serving with the Colours.

Mr. Dugdale, manager of the Oldham Corporation Tramways, mentioned at a meeting of his committee on the 16th inst. that he had written to the two local M.P.'s asking them to support the effort now being made to secure the inclusion of tramway employés in the amended Munitions Act. Eleven men formerly employed by the department have been killed on active service.

Appeal to "Derby" Recruits.—General Sir H. Sclater, Adjutant-General of the Forces, has approved of the offer of the Central Association of Volunteer Training Corps, on behalf of affiliated Corps, to train men enlisted under Lord Derby's scheme but not called up, and this approval has also been endorsed by Lord Derby. The Commandant and officers of the Post Office Engineering Volunteer Training Corps cordially invite all men who have enlisted in the Royal Engineers under the group system to take advantage of the facilities afforded for acquiring preliminary training in the work of signal companies. The Corps possesses technical equipment which is practically equivalent to that used by the Regular Forces for air line, telegraph, field telephone work, and flag signalling. Times of drills are arranged so as not to interfere with the regular occupation of those joining up. Any application for enrolment or attachment in the Post Office Engineering Volunteer Training Corps should be addressed to the Adjutant, Mr. G. F. Preston, 144a, Queen Victoria Street, E.C.

Fire Brigades and Enlistment.—The British Fire Prevention Committee, having received inquiries as to the position of firemen who have enlisted under Lord Derby's scheme, has submitted the question to the War Office, and states that there is no exemption for firemen of private fire brigades employed by individuals or companies in their own interest. Their employers have the usual right to appeal as to group to the local tribunal accorded to all firms who may desire to urge that individual employés are indispensable. Where private fire brigades are connected with establishments engaged on Government work and are understaffed owing to enlistment, substitutes should be promptly trained from among their employés not eligible for enlistment, including where necessary women, who have been found most helpful in several of the private brigades.

New Lighting Rules.—New orders have been issued relating to lights on vehicles and street lighting, under the Defence of the Realm Regulations. Sidelights have to be further reduced in large towns in the Eastern Counties, and the Order contains an illustration of a thin perforated metal or cardboard disk for fitting over or inside the front glass of electric and acetylene lamps. In regard to street lighting, and the lighting of shops, houses, etc., the Orders are amended, the amendments, according to the "Times," chiefly being of a minor character, and embodying the experience gained during the past half-year by the naval and military authorities and the police.

Prohibited Exports.—The export of material for wireless telegraphy is prohibited to all destinations other than British possessions and Protectorates.

BUSINESS NOTES.

Patent Notices.—Messrs. Heenan & Froude, Ltd., have applied for the restoration of Patent No. 24,949, of 1910, granted to themselves and Fred. Harrison for "Improvements in Dynamometers."

Application has been made for the restoration of Patent No. 27,805, of 1908, granted to Wilfrid Briggs for "Improvements in or relating to brakes for motor-driven road vehicles."

Dissolutions and Liquidations.—Parana Power Syndicate, Ltd.—This company is winding up voluntarily, with Mr. L. Maltby, 5, London Wall Buildings, E.C., as liquidator. A meeting of creditors is called for December 30th.

Apparatus and Accessories, Ltd.—A meeting is to be held on January 29th, at Balfour House, E.C., to hear an account of the liquidation.

Herbert Lewis & Fletcher, consulting engineers, St. Mary Street, Cardiff.—Messrs. H. D. W. Lewis and R. H. Fletcher have dissolved partnership. Mr. Fletcher will attend to debts.

South Wales Electric Welding Co., electric welders, Glantawe Chambers, Wind Street, Swansea.—Messrs. F. W. Bowen and T. J. Lewis have dissolved partnership. Mr. Bowen will attend to debts and continue the business.

Catalogues and Calendars. — Messrs. John J. Thornycroft & Co., Ltd., of Caxton House, Westminster, London, S.W., have issued a wall calendar, with monthly slips for 1916. Pictures in colour show a British war vessel, a motor-boat, and a motor lorry.

The Benjamin Electric, Ltd., 1a, Rosebery Avenue, London, E.C.—Thirty-two page catalogue containing illustrated particulars and prices of a wide range of Benjamin lantern and other fittings and reflectors for half-watt lamps, cluster fittings, semi-indirect fittings, "Marbella" opal reflectors, Goliath screw and "Benco" lampholders, and a number of half-watt accessories. The opening pages contain certain illuminating data. Two small folders have also been issued dealing with "Marbella" opal reflectors, and semi-indirect fittings. An accompanying "addenda" sheet indicates in tabular form the advances in prices that have taken place owing to war conditions

Edison & Swan United Electric Light Co., Ltd., Ponder's End.—Leaflet No. L3,124, describing and giving prices of their new "Pointolite" high efficiency tungsten lamp, which was recently particularised in our pages. Its application for optical purposes is shown and instructions for use are given. A new 10-page illustrated pamphlet (No. F 56,814) has been issued, giving prices of Royal Ediswan drawn-wire filament lamps for many voltages and candle-powers, and in various shapes and sizes of bulb; also "Downlite" lamps and drawn-wire filament half-watt lamps. Customers can have quantities of the list overprinted.

Lawrence Patent Water-Softener and Sterilizer Co., Ltd., Parliament Mansions, Victoria Street, London, S.W.—Leaflet briefly describing their combined water-softener and heater.

The Electric Construction Co., Ltd., of London and Wolverhampton, have sent us one of their Letts's vest pocket calendars and diaries for the New Year. It is in the customary convenient form and contains an insurance coupon.

London and Rugby Engineering Co., Ltd., 36 and 37, Queen Street, London, E.C.—Six-page illustrated price list of "White Star" drawn-wire metal-filament lamps, and "Rugby" carbon filament and radiator lamps.

Trade Announcements.—Messrs. Magic Appliances, Ltd., have removed to 159, Westminster Bridge Road, London, S.E.

The New Destructor Co., Ltd., have this week removed to Walter House, Bedford Street, Strand, London, W.C. Telegrams: "Destructor, Westrand, London"; Telephone No.: "Gerard 1840."

Mr. Alan Williams has recently removed to larger offices at 5, Chancery Lane, W.C., where he will continue to represent the Anderston Foundry Co., Ltd., and the British Electric Plant Co., Ltd., and will carry on his electrical and general engineering business. Telephone No.: "Holborn 2367"; Telegrams: "Alnwilms, Fleet, London."

Bankruptcy Proceedings.—Percy Isaac Raphael, described as of 30, Connaught Street, Hyde Park.—An application for an order of discharge was made last week to Mr. Registrar Brougham, at the London Bankruptcy Court. According to the Official Receiver's report the applicant failed in April, 1914, with provable debts £7,523, and no assets whatever. In October, 1912, he met a Mr. Matthews, the proprietor of an invention for a wireless telephone, to exploit which he had formed a syndicate. The bankrupt provided £934 for the purposes of the syndicate, but the Postmaster-General refused to allow a demonstration to be given of the wireless telephone, with the result that the syndicate went into voluntary liquidation after possession had been taken by the debenture-holders. The discharge was suspended for two years.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. LIV. No. 252. December 15th, 1915. London: E. & F. N. Spon, Ltd. Price 3s. 6d.—This issue contains the following papers:—"Some Difficulties of Design of High-Speed Generators," by Prof. A. B. Field; "Wave Shapes of A.C. Generators under Steady Short-Circuit Conditions," by Mr. A. E. Clayton; and inaugural addresses, by Messrs. P. V. Hunter and H. H. Wright.

"Principles of Direct-Current Machines." By A. S. Langsdorf. London: Hill Publishing Co. Price 12s. 6d. net.

"The Electric Railway." By A. Morris Buck. London: Hill Publishing Co. Price 12s. 6d. net.

"Wireless Telegraphy." By Dr. J. Zenneck, translated by A. E. Seelig. London: Hill Publishing Co. Price 17s. net.

Holidays and Stocktaking.—The Siemens Lamp and Supplies Department, 38-39, Upper Thames Street, E.C., will close down this evening (Friday), until Wednesday morning next. The department will also be closed on Thursday, Friday and Saturday, December 30th and 31st, and January 1st, 1916, but, in order to meet customers' urgent requirements, the counter will be open on Wednesday and Thursday, the 29th and 30th inst.

The British Thomson-Houston Co., Ltd., announce that, owing to the Christmas Holidays, Mazda House will be closed on Saturday and Monday next, and, for the purpose of stocktaking, on Friday, December 31st, and Saturday, January 1st. The counter will, however, be open for business on Friday, December 31st.

LIGHTING AND POWER NOTES.

Argentina.—*La Nacion* states that the Government of the Province of Buenos Ayres has definitely resolved to erect a power house for the generation of electricity in the San Martin Park, at La Plata, for the purpose of supplying electricity for a portion of the public lighting of the City of La Plata, including Government offices and buildings, at lower rates than those now charged by the local lighting company.

It is also stated that the Government intends electrifying the La Plata Railway.

The Government of the Province of Buenos Ayres has authorised the Municipal Commissioner of Mar del Plata to enter into an arrangement with the Compania de Electricidad de la Provincia de Buenos Ayres, for the payment of overdue accounts. The amounts are to be paid by the Provincial Government in instalments of $10,000 m/n. in the months of April and October of each year until extinction, with interest at 7 per cent. per annum.—*Review of the River Plate.*

Barnsley.—The Electrical Distribution of Yorkshire, Ltd., has agreed to the Corporation supplying electricity to residents in Mount Vernon Road, outside the borough boundary.

Brighton.—Price Increase.—Last week the T.C. considered the Electricity Committee's recommendation that the flat rate of 4¾d. be increased to 5½d.; that the special tariff for arc lamps, advertising signs, and large shops, taking a minimum of 15,000 units per annum, the special charge for hotels, public houses and piers taking more than 20,000 units, and the special charge to theatres and other premises taking 20,000 units per annum be abolished, and that the charge for electricity supplied to all premises be the flat rate of 5½d. per unit; that the flat rate of 5½d. per unit for electricity supplied outside the borough be increased to 6½d. per unit, and that the charge for electricity supplied to the tramways undertaking be increased from 1·35d. to 1·4d. per unit, and that the increase take effect at the expiration of the current quarter. In moving the adoption of the recommendation, the chairman of the Electricity Committee stated that the reason for the increase was the unprecedented increase in the price of coal. The old charges were based on their being able to get coal alongside the wharf at 14s. or 15s. a ton, but to-day they had to pay 43s. 9d. per ton. The engineer's report for the first six months of the year showed a loss of over £9,000, partly owing to the increased price of coal and also to the falling off of consumption. The supply to private consumers alone dropped by half a million units, and the falling off in consumption was still growing, and was expected to be greater during the next few months. After considerable discussion the recommendations were referred back with instructions to the engineer to submit a report on the subject together with the Committee's recommendations.—*Sussex Daily News.*

Canada.—It has recently been announced that the hydro-electric rates will be substantially reduced throughout the province of Ontario in the coming year.

Carnarvon.—As the Memorial Association declines to take current to the value of £80 per annum for 10 years, the T.C. has decided not to entertain the offer of the National Electric Construction Co., Ltd., to extend the mains between Bryn Helen and Bryn Seiont, at a cost of £416. It is understood that the Memorial Association proposes to supply its needs by putting down its own plant.

Chester.—The Electricity Committee has decided that it cannot accede to the application of Messrs. Brown & Co. (Chester), Ltd., for a reduction in the price per unit for all power used over 600 units per quarter. The firm stated that owing to supplying electricity free of cost for certain purposes its registered consumption had increased 50 per cent. upon its previous normal requirements.

The Tradesmen's Association has forwarded a resolution of protest against the increased charges for electricity to the Corporation, and the Town Clerk has been instructed to reply that the increase is necessary on account of the higher costs of fuel and other things, and that the charges would have been higher still but for the efficient operation of the hydro-electric works.

Chichester.—Price Increase.—The Electric Supply Co. has advanced the price of current by 1d. per unit.

Coniston.—E.L. Scheme.—The P.C. has consented to the erection of certain overhead and underground mains in connection with the E.L. scheme, but has recommended the insertion of a clause in the agreement with the promoters, giving the Ulverston R.D.C. the option of purchasing the undertaking at certain periods. The latter body has referred the question of an agreement back for further consideration, it being thought that it would be preferable to have the scheme carried out under a prov. order.

Continental.—Russia.—A movement is on foot at Petrograd, on official initiative, to reduce the consumption of electric current for lighting in the theatres, restaurants, moving picture houses, &c. The ground of the proposed reduction is scarcity of fuel.

Coventry.—The T.C. has informed the Standard Motor Co., Ltd., that it is unable to supply electricity for power and light to a factory it is proposed to erect just outside the city boundary. Having applied for the electricity undertaking to be declared a controlled establishment, the T.C. has been informed that at present it is impossible to accede to the request, as the industry is not one which is included in the definition in Sec. 3 of the Act.

Glasgow. — Electricity Showroom Demonstrations.—The Corporation electricity department has commenced a series of daily cookery demonstrations at the new showrooms in Sauchiehall Street, a varying menu of several courses being provided. A neat folder is being issued illustrating the new premises in such manner that the recipients can scarcely mistake them.

Great Yarmouth.—New Tariffs.—The T.C. has decided that after December 31st the price of electricity for lighting purposes shall be 6d. per unit for the first 3,000 units, and 5d. per unit for all in excess of that quantity used during any year ending March 31st, and 5d. per unit net for churches, chapels, hospitals and schools.—*Yarmouth Independent.*

Halesworth.—E.L. Scheme.—The U.D.C. has decided that it will not place any obstacle in the way of the proposed scheme for the supply of electricity by the Halesworth Electricity and Engineering Works. It is proposed to use overhead wires.

Hanwell.—The District Council has refused to entertain the offer of the Metropolitan Electricity Supply Co. to accept payment of its accounts rendered since the commencement of the existing police regulations, less a special discount of 15 per cent., and is to repeat the offer of settlement on the lines of the arrangement with the Brentford Gas Co.

India.—A licence has been granted to the Municipal Committee of Amritsar for the supply of electric energy for all purposes within the municipal area of Amritsar.

Kingswinford.—Street Lighting. — The R.D.C. having asked for a reduction in the charge for public lighting on account of the restricted use of the lamps, the Midland E.L. Corporation has offered an allowance of £1 per lamp (the contract price being £2 14s. 6d. per lamp), the number of lamps affected to be limited to one-half of the present number installed. The Council has decided to negotiate for better terms for the ensuing six months.

Kingston-on-Thames.—L.G.B. Inquiry.—On December 15th an inquiry was held into the application of the Corporation for sanction to borrow £16,792 for the purposes of the electricity undertaking. The electrical engineer stated that in anticipation of the sanction to the loan £507 had been spent. The inspector pointed out the necessity of applying for sanction to excesses as they occurred, and not leaving them to accumulate. Such sanctions were being given by the Board every day. In reply to questions on the cost of coal and oil, the electrical engineer stated that for the complete year ended March 31st last the figures for coal worked out at 1·802d. per unit sold whereas the fuel oil was only costing ·424d. per unit. The inspector pointed out that the sanction to the loan could only be obtained for extensions that were absolutely necessary, and it was finally decided to reduce the application to £3,682, the amount of 18 months' requirements, plus the excess expenditure.—*Surrey Comet.*

Leeds.—Six Months' Working.—The summary of accounts of the Corporation electricity undertaking for the half-year ended September 30th last, shows that 19,849 021 units were sold as against 18,626,358 units in the corresponding period last year. Street lighting and traction supplies decreased, but power units increased considerably. The total revenue amounted to £70,697, and the gross profit to £36,294, both figures being in excess of 1914. Capital contributions, however, amounted to £51,546 as against £45,239 in the previous year, so that for the six months there was a deficit of £15,252 as against £11,686 in 1914. The deficit is usual on the summer half-year, being, of course, much more than made up in the winter half.

London.—Islington.—The Finance Committee of the B.C. has had under consideration the necessity for increasing the price charged for electrical energy, *i.e.*, that the existing prices should be increased either by 12½ per cent. to include public lighting or by 15 per cent. if the charge for public lighting is excluded. For the year ending March, 1917, it was estimated that owing to the substantial increase in the cost of production, a very large deficiency would result if the present charges were continued. An increase of 15 per cent. would approximately meet such deficiency.

Poplar.—Linking-up Scheme.—The Electricity Committee of the T.C. has decided to adopt the draft agreement for giving effect to the proposals for linking up with the Hackney undertaking. In order to give effect to the scheme it will be necessary to lay mains from the Northern sub-station to the Hackney boundary *via* Cadogan Terrace, at a cost of £2,000, and an extra £350 for the cost of E.H.T. panels and switchgear, including telephones and synchronising gear. The Finance Committee recommends the borrowing of the £2,000. It is intended to provide the £350 out of revenue.

Hammersmith.—The B.C. is to make application to the L.C.C. for sanction to the borrowing of £3,000 for mains, services and transformers for the electricity undertakin

L.C.C.—The Finance Committee recommends the Council to sanction the borrowing by the Islington B.C. of £985 for electrical pressure recording instruments; of £15,000 by the St. Pancras B.C. for the provision of a 5,000-kw. turbo-generator, the B.C. having agreed to the acceleration of the repayment of the 42-year loans, and of £3,800 by the St. Marylebone B.C. for mains and house services.

Luton.—Street Lighting.—The Chief Constable thinks that the street lighting is too much restricted, and he has been empowered to make such arrangements as he considers advisable for increasing and extending the lighting.

Manchester.—The Electricity Committee has been informed by the L.G.B. that it may proceed with the acquisition of additional land required at Barton and Chorlton for the erection of the new generating station, and that a L.G.B. inquiry would not be necessary.

Coal Shortage.—According to the local papers a serious shortage of coal is in prospect for the electricity department. The latter is using about 4,500 tons of coal a week, but is only obtaining delivery of between 3,500 and 4,000 tons a week, the deficiency being obtained from its accumulated reserve which originally stood at 20,000 tons. It is stated that the collieries are not so much to blame for belated deliveries as the railway companies, and that unless the position improves the Government will have to take steps to ensure adequate supplies.

Portsmouth.—Price Increase.—The T.C. has decided that the charges for electricity for power, heating and lighting will be increased by 15 per cent., from the December quarter, 1915.

Stafford.—Plant Extension.—It has been reported to the T.C. that owing to the increasing consumption of electricity it is absolutely necessary to take measures to keep up the supply. The time has come when the Council cannot safely continue with the present plant, and the Committee, which has had the matter under consideration, hopes at the earliest possible moment to lay a comprehensive scheme before the Council.

South Africa.—At a recent meeting of the Worcester (Cape Province) T.C., the electrical engineer reported that the lack of shipping from English ports was seriously interfering with the delivery of the plant for the lighting installation. He was afraid that the contractors would be unable to have the work completed before the end of January.

During a recent lightning storm in Johannesburg, the overhead high-tension wires were struck, and, as a result, the automatic switches at the central power station were blown out. A great portion of the town was in darkness for a short period.

Thirsk.—Street Lighting.—Owing to only six of the 74 public lamps having been used during the lighting season, in consequence of the lighting regulations, the Sowerby P.C. has requested the E.L. Co. to grant a rebate from the contract account of £115. The company has pointed out that its working expenses are very little less than before the war, the only small saving being in fuel.

Tynemouth.—The electrical engineer reports that in many cases the consumption of current by motors was very much less than was expected, and he recommends that the 1½d. rate be not charged, unless the consumers, along with any lighting on the same service, take current to the value of £1 in a quarter. The Electricity Committee proposes to make a minimum charge of 5s. per quarter in respect of supplies to garages, such amount to be in addition to meter rent.

West Bromwich.—Price Increase.—The T.C. has decided to increase the price of electricity by 15 per cent. to ordinary power consumers; the question of the revision of the pre-war contracts is under consideration.—*Birmingham Daily Post.*

Weymouth.—The T.C. has applied to the B. of T. and to the R.D.C. for permission to supply current to Radipole Manor, which is outside the borough area.

Wisbech.—Street Lighting.—It was intimated at the December meeting of the T.C. that the Electric Supply Co. had treated the Corporation very liberally with regard to its charges owing to the lighting restrictions.

Woodford.—Prov. Orders.—Both the London Electric Supply Co. and the Periandra Syndicate have informed the U.D.C. that their applications for prov. orders for E.L. in the district have been deferred.

TRAMWAY and RAILWAY NOTES.

Ashton-under-Lyne.—Wages Arbitration.—It is reported that the B. of T. arbitrator has made an award respecting the application of tramway employés in the service of the Corporation, the Stalybridge Joint Board, and the Oldham, Ashton and Hyde tramways, under which drivers and conductors will get an advance in wages of $\frac{6}{16}$d. per hour, and shedmen and cleaners ¼d. per hour.

Australia.—The annual report of the Commissioner of the West Australian Railways shows the financial result of the working of the Perth Government tramways for the year ended June 30th, 1915:—Recepts, £114,021; expenditure, £78,346; interest charges, £23,931; leaving a net profit of £11,742, equal to 2·2 per cent. on the purchase price.—*Commonwealth Engineer.*

The annual report of the electric tramway and lighting department of the Fremantle (W.A.) Council, shows tramway receipts amounting to £34,253, lighting receipts to £22,073, and a total income of £56,326, as compared with £55,386 in 1914, and £50,760 in 1913. The working expenses amounted to £39,906, as against £41,039 in the previous year, leaving a gross profit of £16,419, as against £14,347 in 1914; after providing for interest on loan and bank interest, &c., there was a net balance of £10,055, which has been appropriated as follows:—Sinking fund, £2,850; loan redemption, £79; depreciation, £5,241; contribution to Fremantle and East Fremantle Municipal Councils, £1,885. The number of car-miles run was 561,913; the passengers carried numbered 4,510,619; the average car revenue per car-mile was 13·62d., and the average fare paid per passenger, 1·685d. The estimate of additional capital required for the year ending August 16th, 1915, is as follows:—Additions to power-house plant, £16,073; tramway extensions, less loan funds already raised, £1,050; turnout at railway station, £215; rolling stock, two bogie cars, £4,000; lighting mains, transformers, meters, &c., £1,662; total, £23,000. The total number of consumers connected to the mains of the electricity department was 1,442, as against 1,201 in 1914, and 987 in 1913.—*Com. Engineer.*

Birmingham.—At the adjourned inquest on the three victims of the tramway accident which occurred last month, a verdict of accidental death was returned, the jury holding that the driver misjudged the distance for the application of the brakes. A B. of T. inquiry has also taken place, Mr. Dickinson, engineer to the tramways department, expressing the opinion that the car was travelling at too high a speed, and that the magnetic brake was too fully applied, otherwise at the stated speed, and with unlocked wheels, it should have passed the curve safely instead of running off.

Burnley.—Exciting scenes were witnessed in Church Street, on December 16th, a defect developing in the electric cables and making the road alive. As a consequence, several horses, pedestrians and dogs received shocks of a more or less violent nature. Fortunately, the voltage was not sufficient to inflict injury, those affected suffering mostly from fright.

Canada.—It is stated that the Ontario Hydro-Electric Commission may possibly purchase all the Ontario electric railway lines owned by Messrs. MacKenzie & Mann.

The proposed Hydro-Electric railway between Toronto and Guelph has been endorsed by 15 municipalities interested in the project.

Continental.—Germany.—It is stated that the Berlin Tramway Co. is compelled not only to employ women as conductors, but also as drivers, owing to several hundred male drivers having been called up for army service. Many people are protesting against the employment of women and threaten to boycott the women-driven trams, as they consider the system will be fraught with danger.

Edinburgh.—Mr. J. M. Dick Peddie, a director of the Edinburgh and District Tramway Co., replying to critics who assume that the fact of the city having a cable car system is entirely due to the company, says the cable system was the deliberate selection of the Corporation under the advice of one of the most noted electrical engineers in this country, who decided for the cable owing to the peculiar conditions prevailing in Edinburgh. Continuing, he said when the system was controlled by the Corporation, there might be a considerable reduction in fares, but then the Corporation would not have to pay £113,000 a year in rent, and a Corporation was always in the happy position, when it embarked on a commercial undertaking, that if it were run at a loss it could always fall back on the ratepayers to make up the deficiency.

Halifax.—The Tramways Committee of the T.C. is experimenting with a Ford delivery van, but considerable opposition has been shown in the Council in respect of the purchase of this vehicle on the grounds of the great antipathy which Mr. Ford has shown to Great Britain. The Tramways Committee has, as a result, withdrawn its recommendation in favour of purchase.—*Commercial Motor.*

Hull.—Speed Reduction.—The Tramways Committee has decided to reduce the speed of cars by about one-half during the darkness of the morning and evening.

Hyde.—The proposed through running of cars from Manchester to Hyde formed the subject of an interview which the town clerk had recently with Mr. J. M. McElroy, manager of the Manchester tramways department, and the latter stated that the Corporation would be prepared to run a service of cars to Hyde Market Place, either taking a lease of the portion of the Hyde tramway from the boundary to the Market Place, or undertaking the running on terms. The Stalybridge Joint Board has also made suggestions for using the Hyde tramway, and the Hyde Corporation has decided to ask the Board to appoint a deputation to confer on the basis of one of the proposals that the Board should act as the running authority of the Hyde tramways on terms to be arranged.

Ipswich.—Electric Vehicle.—The Ipswich Industrial Co-operative Society has, we learn, ordered a 2½-ton electric motor delivery van of the "Orwell" type from Messrs. Ransomes, Sims and Jefferies, Ltd., of that town.

London.—L.C.C.—Workmen's Fares.—The Highways Committee has decided that ordinary fares shall be charged on cars scheduled to arrive at or leave the Central London termini up to 3.30 a.m. Under this arrangement ordinary fares will be charged only on the cars specially run as all-night cars, and the fares on cars starting on service as workmen's cars will not be affected.

Women conductors commenced their duties on Monday morning last on the L.C.C. trailer-cars on the South London sections, and it is anticipated that the innovation will shortly be extended to other districts.

The B. of T. has ordered that the time limited by the Central London Railway Act, 1913, for the compulsory purchase of lands and easements shall be extended for one year from August 15th, 1916.

Manchester.—The Bucklow Council, which recently refused to renew the licence to the Manchester Corporation tramway department for the running of motor-'buses into the village of Northenden, has now renewed the licence, following local protests.

New Zealand.—The report on the working of the Christchurch electric tramways for the year ended March 31st last, shows receipts amounting to £142,941, and expenses to £78,072; after deducting interest and sinking fund and reserve fund charges, the net surplus amounts to approximately £10,000; the number of car-miles run was 2,271,996; the passengers carried were 16,828,269, and the average revenue per car-mile 15·099d. The operating expenses have been reduced during the year by ·261d. per car-mile. The report states that an agreement has been entered into with the Government for the purchase of power from the Lake Coleridge hydro-electric station, and it is anticipated that when this supply commences, probably in March next, power costs will be reduced.—*Commonwealth Engineer.*

Northampton.—Female Labour.—Women conductors were introduced upon the Corporation tramways on Monday last. For some time females have acted as conductors of local motor-'buses.

Oldham.—The municipal car service is to be entirely stopped on Christmas Day, this decision having been arrived at in spite of some opposition on the part of members of the Tramways Committee.

Rochdale.—Restricted Service. — The Tramways Committee has adopted a recommendation of the general manager that the car service be curtailed each evening except on Saturdays and Sundays.

Salford.—Women Drivers.—The Tramways Committee has under consideration the employment of a certain number of women car drivers. The female conductors have stood the severe weather lately prevailing very well indeed, the percentage of absences through sickness having been below that of the men.

South Lancashire.—A number of women conductors made their first appearance last week on various routes of the South Lancashire Tramway Co.'s extensive system.

Tynemouth.—The Parliamentary Committee has resolved to empower the Borough surveyor to engage the services of an expert to consult with as to the condition of the Tynemouth Co.'s cars and tramways.

Walthamstow.—The Commissioner of Police has advised the Tramways manager that it would be inadvisable to provide flash lamps for the use of conductors on tramcars. Accordingly no further action is to be taken in the matter.

TELEGRAPH and TELEPHONE NOTES.

Russia. — On November 25th, at the Circuit Court (says a Petrograd paper), the trial took place of a well-organised band of thieves who specialised during the whole year 1913 in cutting down telegraph wires. The band numbered 14, with a certain Bogdanoff at the head as organiser, and included carmen, buyers, &c. Only skilled electric wiremen undertook the cutting, these having been in the employment of the "1886 company." All of them were between 16 and 23 years of age. They carried out in all 40 thefts of copper wire, valued at over 8,000 roubles. This case is typical of quite a number that occupy the attention of the Russian police from time to time.

The Pacific Cable.—The report of the Pacific Cable Board for the year 1914-5 shows that the traffic receipts were £221,280; other sources of revenue brought up the total income to £225,045. The expenditure, including £32,100 paid to the renewal fund, amounted to £146,359, leaving a surplus of £78,686. Interest and sinking fund requirements totalled £86,601, so that the balance to be provided by the Imperial and Dominion Governments was £7,915, a sum which is less than last year's figure by £12,035. The net traffic receipts exceeded those of the previous year by £25,225; there was a decrease of traffic at ordinary tariffs, but the deferred traffic showed an increase of 599,879 words, and the week-end traffic rose from 326,920 to 1,074,252 words. The interruption of the Fanning Island cables caused the suspension of international traffic for two months, resulting in a loss of revenue exceeding £50,000; this loss was more than compensated for by the increase of traffic resulting from war conditions.

The expenditure showed an increase of £14,065, due almost entirely to the war. The renewal fund on March 31st, 1915, was valued at £163,964 investments and £56,282 cash, in addition to cable valued at £51,292.

A fault occurred near Norfolk Island on August 18th, 1914, due to rock chafe, and in repairing it the cable in the vicinity of the fault was found to be extensively corroded, necessitating the renewal of several miles. On September 7th, as reported in our columns at the time, the German cruiser *Nürnberg* wrecked the station at Fanning Island and cut the cables. On September 22nd the staff at Fanning succeeded in restoring temporary communication with Suva by improvised means, and three days later the relief steamer arrived. "In effecting the repair of the Suva cable the members of the staff concerned displayed remarkable ingenuity and skill. In particular, the work of one of the operators, Mr. Hugh Greig, is worthy of special mention. This officer adapted an ordinary pickaxe to the purposes of a grapnel, and succeeded by this means in partially raising the heavy shore end where it was cut. He also dived, and, working under the sea, secured the end by ropes, thus enabling it to be raised above the sea level." Without the least previous experience in handling or repairing cables, and with no proper appliances, Mr. Greig raised both ends of the cable and buoyed them with rafts made of planks and barrels; he then made a connection between the ends with ordinary covered wire. The ends of the cable could not be brought together, as they had been towed widely apart by the German vessel.

Both the Fanning cables were repaired by the c.s. *Iris* in October, but owing to the difficulty experienced in recovering the duplex balances, it was not possible to accept traffic until November 5th. These cables had never previously been interrupted. The repairs cost about £5,000.

A cable laid in August last year has proved useful in providing an alternative route across Vancouver Island, and a special wire between Sydney and Melbourne has been set apart by the Commonwealth Post and Telegraph Department, for the exclusive use of Pacific Cable traffic.

The auxiliary schooner *Strathcona*, which was built for the purpose of maintaining regular communication between Honolulu and Fanning Island, was lost on her maiden voyage in June of this year, whilst sailing from Auckland to Fiji. All the ship's company were rescued by the *Iris*. A Court of Investigation attributed the wreck to the faulty navigation of the master, whose certificate was suspended for six months.

The staff has had to work at high pressure during the war, without rest or furlough, and at Fanning Island without electric lighting or cold storage plant. It has not been possible to obtain sufficient additional operators, but a number of men are being trained for the purpose. A bonus of 10 per cent. has been authorised as from January 1st, 1915. Nine members of the head office staff are serving with the Forces. The Board was unable to accede to applications from operators at the cable stations for leave to join the Colours, but several broke their contracts for this purpose.

The deferred and week-end services have been maintained except during the interruption of the cable, and the week-end service is still available only by the Pacific Cable. Many business telegrams in plain language are sent at the week-end rate, greatly increasing the pressure on the service, at the expense of the ordinary traffic.

The carrying capacity of the Bamfield-Fanning Island cable, the longest in existence, in 1896 was estimated at less than two million paying words per annum. During the current year the cable has frequently carried more than 175,000 words per week, or at the rate of about nine million paying words per annum. The total number of paying words transmitted in 1914-15 was 4,403,098, allocated as follows:—Ordinary, 1,065,431; deferred ordinary, 1,159,890; Government, 405,851; Press, 357,604; deferred Press, 340,070; week-end, 1,074,252.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Adelaide.—January 19th. P.M.G. Common-battery switchboard. See "Official Notices" November 19th.*

January 26th. Deputy P.M.G. Twenty tons of galvanised-iron wire, 400 lb. to the mile.*

January 26th. Deputy P.M.G. Telephone instruments, parts and accessories.*

Brisbane.—February 23rd. P.M.G. Wheatstone apparatus. See "Official Notices" Dec. 17th.

Sydney.—January 31st. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

February 7th. Metropolitan Board of Water Supply and Sewerage. For No. 1 pumping station at Ultimo. Two centrifugal pumps and electric motors (4,000 gallons per minute each), switchboards, starters, &c. Contract No. 1,301.*

February 28th. Municipal Council. Tenders for induction regulators. Specifications (11s. 6d.) from the Electric Light Department, Town Hall, Sydney.

Darlington.—January 12th. Corporation. Coal bunkers, elevators, &c., for the electricity works. Specifications from the Borough Electrical Engineer, Haughton Road.

Liverpool.—December 29th. Electrical supplies, for Toxteth Park B. of G. Mr. R. A. James, Clerk, 15, High Park Street.

London.—St. Pancras.—January 10th. B.C. Steel constructional work (power-house extension) for the Electricity Department. Specifications (£1) from the Borough Electrical Engineer, 57, Pratt Street, N.W.

Hampstead.—January 6th. B.C. Electrical engineer's stores, oils, &c. Particulars from the Town Clerk, Town Hall, Haverstock Hill, N.W.

Manchester.—January 5th. Alterations and additions to pipework and condensing plants for Nos. 13 and 15 turbines, Stuart Street station. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Nuneaton.—December 24th. Corporation. Supply and erection of an overhead line, for the Electricity Department. See "Official Notices" December 10th.

Redditch.—December 28th. Council. Eighty tons per week, for three months, of D S. nuts or rough slack. See "Official Notices" December 10th.

South Africa.—Durban.—January 5th. Corporation Telephone Department. (1) Telephone apparatus and materials; (2) underground cables; (3) 540 c.i. pipes, 9 ft. long, for cables. Messrs. Webster, Steel & Co., 5, East India Avenue, E.C., are the Corporation's London agents.*

Spain.—January 6th. Electrification of seven movable three-ton steam cranes and one fixed 25-ton steam crane on the wharves at Bilbao. Specifications from and tenders to Junta de Obras del Puerto Alameda de Mazarredo, 3, Bilbao. Local representation.—*Board of Trade Journal.*

The municipal authorities of Anguita (Province of Guadalajara) are at present inviting tenders for the concession for the electric lighting of the town during a period of ten years.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Brighton.—The B. of G. has accepted the tender of Mr. H. J. Galliers, of Brighton, for the supply of electric fittings.

Bristol.—The Docks Committee of the T.C. has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for 425 yds. of triple-concentric paper-insulated cable for the diversion of the main cables at the north side of the Royal Edward Dock.

Glasgow.—The Tramways Committee has recommended the acceptance of the offer by the B.I. & Helsby Cables, Ltd., for the supply of copper trolley wire.

Government Contracts.—List of new contracts, November, 1915:—

War Office.

Bridge Meggers.—Evershed & Vignoles, Ltd.
Cable.—Craigpark Electric Cable Co., Ltd.; Macintosh Cable Co., Ltd.
Ebonite rod and sheet.—Alperton Rubber Co., Ltd.; India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Generating sets.—Aster Engineering Co., Ltd.
Works services.—Electric lighting and power in fabric shops at South Farnborough: Hancock & Rixon. Electric light installation at new camp, Grantham: Cooper & Co. Prisoners of war camp, Dorchester: Pinchin & Walton. Royal Flying Corps camp, Norwich: Mann, Egerton & Co. Prisoners of war camp, Alexandra Palace: C. Cooper and Co.

Post Office.

Protective apparatus.—Western Electric Co., Ltd.
Telephone apparatus.—Siemens Bros. & Co., Ltd.
Submarine cables.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telephone cable.—Callender's Cable & Construction Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Telegraph Construction & Maintenance Co., Ltd.
Battery cells.—Siemens Bros. & Co., Ltd.
Fuse mountings.—Taylor, Tunnicliff & Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; B.I. & Helsby Cables, Ltd.; Shropshire Iron Co.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).

London.—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., has been accepted for the supply of Wotan and carbon filament lamps to the Royal Mail Steam Packet Co., during 12 months from January 1st, 1916.

L.C.C.—The following tenders have been accepted for the supply of electric insulating materials:—

L. Andrew & Co., items 7, 8 and 11.
Robert W. Blackwell & Co., Ltd., item 1.
Geo. Hattersley & Sons, Ltd., item 12.
George MacLellan & Co., item 8.
Micanite & Insulators Co., Ltd., item 2.
Siemens Bros. & Co., Ltd., items 5, 6 and 9.

Luton.—The Electricity Committee proposes to accept the tender of Messrs. J. Facer & Son to supply from 100 to 150 tons of coal per month, for a period of 12 months, at 19s. 2d. per ton (18s. 0½d. per ton in Corporation wagons).

New Zealand.—The following tenders have been received by the Public Services Tender Board of Wellington for the supply of 120 miles of copper cable:—

Turnbull & Jones, Ltd.	(accepted)	£3,460
Richardson, McCabe & Co.		3,670
A. D. Riley & Co.		3,635
S. Brown, Ltd.		3,722
P. R. Baillie & Co.		3,933
A. & T. Burt, Ltd.		4,118
Laurence & Hanson Co.		4,269

New Zealand Shipping and Commerce.

Oswaldtwistle.—The U.D.C. has purchased an electric crane from Messrs. Rushworth Bros., Ltd., at £340.

Spain.—The Port Authorities at Valencia have awarded the contract for four electric cranes to the Sociedad La Maquinista Maritima y Terrestre of Barcelona, at £7,780, for delivery in ten months.—*Board of Trade Journal.*

Venezuela.—The "Ministerio de Fomento" has granted permission to Senor Santiago Carcano to construct a telephone line 14 kiloms. (about 8⅓ miles) long in the districts of San Sebastin and Ricaurte, in the State of Aragua.—*Board of Trade Journal.*

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Monday, December 27th. At 7 p.m. At the Royal Technical Institute, Peel Park. Annual Social.

Royal Institution of Great Britain.—Tuesday, December 28th. At Albemarle Street, Piccadilly, W. Christmas Lectures for Juveniles. "Wireless Messages from the Stars," by Prof. H. H. Turner.

Leeds Association of Engineers.—Thursday, December 30th. At 7.30 p.m. At 5, Park Lane. Discussion.

NOTES.

B.E.A.M.A.—The following firms have recently been elected members of the B.E.A.M.A.:—Cole, Marchant & Morley, Ltd., Bradford; Hick, Hargreaves & Co., Ltd., Bolton; Edison and Swan United Electric Light Co., Ltd., London.

Accident.—Aloysious Brady, mechanic, and James Murphy, labourer, employed by Bray (Co. Wicklow) Urban Council, were on Saturday last examining an electric transformer opposite the Town Hall, when the cover apparently touched the live terminal, with the result that they were thrown to the ground with great violence and rendered unconscious. Subsequently they were removed to their homes for treatment.

Electric Heating and Electric Furnaces.—In the concluding lecture of his course at University College, Prof. Fleming drew attention to the electric tire heater, which was described in the Electrical Review of September 24th, 1915. He then dealt with electric cooking, pointing out the importance of this class of load to electricity works, as it required five or six times as much energy as the lighting of a house. Unfortunately, owing to the high specific heat of water, he said, the electrical heating of water in quantity was a very costly matter. On the other hand, the high efficiency of electric heating helped to reduce the expense; whereas the efficiency of a gas boiling ring in heating water was found to be only 58·6 per cent., that of an electric kettle was over 90 per cent. Taking about half a kilowatt, an electric kettle or saucepan would raise two pints of water to boiling point in about a quarter of an hour. Electric heaters not combined with the cooking utensils were not so efficient, and slow heating due to small power entailed losses due to radiation and air convection; thus a small immersion heater showed an efficiency of only 92 per cent., whilst a large one had an efficiency of 85 per cent. The Therol system of heating water slowly had an efficiency of 92 per cent. In order, to compete with coal (used for heating water under efficient conditions) at 20s. a ton, electrical energy would have to be available at $\frac{1}{28}$th penny per unit. But in ordinary cooking operations the heating of water played a minor part, and he considered that electricity at 1d. per unit was practically equivalent to gas at 2s. 8d. per thousand cubic ft., without taking into account the many indirect advantages of electric cooking. The effect of lagging was very important; the thermal resistance of an air jacket being taken as 1·62, that of cotton waste was 2·38, and that of slag wool 3·07. As a rough general rule, Prof. Fleming found that the consumption of energy for cooking worked out at about "one unit per person per day, plus one unit for the oven." Reliability, safety, and low first cost were the principal considerations in the design of electric cooking apparatus; it was impossible to persuade the housekeeper that high first cost might be the cheapest in the long run. Amongst the advantages of electric cooking were the uniform results obtained, the convenience of an oven breast high, less loss of weight of meat, and immensely improved flavour.

Electric cooking apparatus had proved extremely useful also in the laboratory and workshop, and had been largely adopted in the new chemical laboratories of University College. One thing of great moment was to convince supply authorities of the importance of keeping down the cost of energy for heating and cooking; the recent increases in price in some places were an absurd mistake.

Appointments Vacant.—Mains jointer (42s.), for the Rhondda U.D.C.; switchboard attendant (30s.), for Lancaster electricity works. See our advertisement pages to-day.

Fatality.—Fife.—Alexander Martin, an apprentice electrician, was killed in Leven Colliery, in the underground workings; his arm came in contact with a live wire.

Electric Vehicle Committee.—The last issue of the Committee's quarterly journal, *The Electric Vehicle*, contains a number of interesting articles on, and illustrations of, the use of the electric, tending to show that, despite war conditions, the use of this type of vehicle is steadily gaining ground in this country. A short description of the charging station at the Hon. Secretary's own central station at Ipswich is included, as well as some striking views of Messrs. Harrod's fleet of electric vehicles. We note that the total number of electric vehicles in use, or on order, in this country is now over 660, as compared with 150 a year ago, which, under all the circumstances, represents excellent progress.

Electrolysis Extraordinary.—A recent issue of the *Steamship* mentions that the American three-masted auxiliary yacht *Sea Call*, claimed to be the largest fore-and-aft schooner yacht afloat, has been ordered to be broken up after only six weeks' service, as a result of serious corrosion of portions of the steel framework and plating around the stem and stern, due to electrolytic action. She was the first steel ship ever built with a bottom made entirely of Monel metal, although this metal, which is composed of two parts nickel, one part copper, and a small percentage of other metals, has been extensively used for deck fittings, anchors, &c.

Previous experiments in which Monel metal was used in conjunction with steel in the presence of salt water has resulted in corrosion of the steel.

The decision to scrap the vessel is said to have raised a heated controversy between American scientists and naval and technical experts.

Institution and Lecture Notes.—Rugby Engineering Society.—At the general meeting of this Society it was decided that no papers or lectures would be given this session, in view of the fact that the time of the officials and members was largely occupied with war work, and that owing to so many members having joined His Majesty's forces the effective membership was greatly reduced. As far as possible the officials who were elected for the Session 1914-15 will continue to serve for the present Session. The library and reading room of the Society will be kept open as usual.

Society of Engineers (Inc.).—At the annual general meeting on December 13th, it was announced that the President's Gold Medal had been awarded to Mr. Arthur H. Barker for his paper entitled "Some Future Developments in Heating and Ventilation." The following officers were elected:—President, Mr. Percy Griffith; Vice-Presidents, Messrs. H. C. Adams, W. B. Esson, and W. N. Twelvetrees; Hon. Sec. and Treasurer, Mr. D. B. Butler.

The Secretary, Mr. A. S. E. Ackermann, reported that the membership amounted to 588; about fifty were on active service, and many others were engaged on war work. With regard to the effort of the Society to improve the status of professional engineers of all classes, considerable progress had been made in the preparation of a comprehensive scheme dealing with the professional qualifications, fees, and etiquette of consulting engineers, and with the position of salaried engineering officials, particularly those employed by municipal and similar bodies.

Electrical Association of Australia (Victorian Section).—At a meeting of this Association held at Melbourne on October 28th, a paper on "The Electron Theory of Conductivity" was read by Mr. J. A. Erskine, also one entitled "Notes on the use of Half-Watt Lamps," by Mr. W. H. Alabaster.

Liverpool Engineering Society.—On December 15th, Mr. C. E. Jones read a paper on "Electrical Machinery for Marine Use." Among the papers to be read next year, the following are of electrical interest:—

January 26th.—"Recent Developments in Telephony," by Mr. G. C. Morris.
February 23rd.—"Efficiency of Projectors and Reflectors," by Mr. Haydon T. Harrison.
March 8th.—"The Modernising of an Electric Power Supply Undertaking," by Mr. E. M. Hollingsworth.
April 12th.—"Electric Power in Quarry Operation," by Mr. G. K. Paton.

Northampton Polytechnic Institute.—The eighteenth annual prize and certificate distribution of this Institute was held on Saturday, December 18th. The Principal, Dr. Mullineux Walmsley, occupied the chair, and Mrs. Walmsley distributed the prizes; the usual conversazione and exhibition of work were omitted from the programme. The Principal said that enrolments to the day classes had been well maintained (1,748, as against 2,100 in 1913-14), but there was a continuous drain on all senior students for enlistment and for work in munition shops. The evening classes showed 24 per cent. reduction in enrolments directly attributable to the war, and the student-hours for the session fell from 121,000 to 79,000 (70·6 to 48 hours' average per student). The energy with which the Governors had worked to establish courses in technical optics had been fully justified by recent events. In the Faculty of Engineering three students secured honours degrees, and seven passed the intermediate examination; the number of City and Guild certificates was 67 (101), and of St. John Ambulance certificates 96 (28). The Voluntary Aid Detachment had 26 members on active service, and there were 22 of the staff, 226 students, and 119 members of the Polytechnic with the Forces. Courses for drafts of artillerymen had been arranged covering field telephony, range-finding and map reading; 897 men had already taken this course. The Principal urged upon students the importance of concentration and devotion to work; the future of the country industrially, as well as in respect of its present needs, lay with the younger workers.

The Lighting of Trains.—Yet another terrible railway disaster, accompanied by a furious conflagration, has been added to the long list of tragedies that might have been alleviated by taking warning from experience. The accident took place at St. Bede's Junction, on the North-Eastern Railway, two trains and a light engine being involved; three coaches caught fire and blazed fiercely, rendering attempts at rescuing the passengers futile. Seventeen persons lost their lives, many of them by fire. The outbreak of fire is attributed to the escape of gas from the storage cylinders under the coaches, and one of the passengers who escaped from a burning coach states that the compartment was filled with gas, with which he was almost overcome.

The Board of Trade inquiry was opened on Tuesday. An engine driver stated that the fire began above a gas cylinder, and the flames spread rapidly.—Mr. A. C. Stamer, acting chief mechanical engineer of the company, said the coaches were lighted by flat-flame gas, carried in three cylinders in the case of the leading vehicle and four cylinders in the second vehicle, which was partially burned. After the accident one cylinder was found knocked off and lying at the rear of the engine; it was burst at both ends. All the pipe connections of the leading vehicle were broken away from the cylinders. Other cylinders on that and the down train were burst. The cylinders were not fitted with safety valves. The company had experimented with safety valves with the object of preventing a rush of gas from the cylinders in the case of severed pipe connection; the result of the trials was unsatisfactory, but they were still experimenting.—The inquiry was closed, and the Inspector intimated that he would reopen it when the engine drivers were able to give evidence.

Inquiry.—British makers of electrical riveting hammers are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—When the Middlesbrough Corporation was asked (December 14th) to confirm a recommendation of the Electricity Committee that Mr. R. Scotson, under-manager, should be appointed manager in succession to Mr. Taylor (resigned), Coun. Scholes asked for facts concerning "the past robbery and jobbery which had been going on at the electricity works for a number of years." Coun. T. Thomson declared that the sub-committee had satisfied itself that Mr. Scotson had had nothing to do with those irregularities. The Mayor (Coun. Calvert), who is Chairman of the Committee, said that he had come to the conclusion that, however capable their chief engineer, the brains and genius of the department lay in their second electrician, and he urged the Council to confirm Mr. Scotson's appointment as chief. The recommendation was approved.

Mr. Edward Lafferty, traffic manager at Preston since 1904, has accepted the position of traffic manager of the Edinburgh tramways, at £300 a year.

Mr. W. G. Snell, Corporation tramways manager at Perth, enlisted under the Derby scheme.

Mr. Whitworth, shift engineer at the Barnes U.D.C. electricity station, has resigned his appointment.

The Walthamstow U.D.C. is recommended to appoint Mr. W. J. Bachelor, of Hendon, to the position of station superintendent, at a salary of £150, rising by annual increments of £10 to £200 per annum.

Mr. R. E. Armstrong, charge shift engineer at the Greenwich generating station of the L.C.C. tramways department, has resigned his position.

The Falkirk T.C. on Monday approved of a recommendation to appoint Mr. R. A. Brown to the position of electrical engineer at £200 per annum. Mr. Brown has had full charge of the works since Mr. Harold Ranson left, three months ago, to join the Forces, in which he holds a commission. It is stated that by a re-arrangement of the office staff a saving of £150 per annum will thus be effected.

The following members of the staff of the Bispham-with-Norbreck U.D.C. electricity works are serving in H.M. Forces:—Chief assistant Mr. G. Ollier (R.N.D. at the Dardanelles); junior assistants, Messrs. H. and P. Robinson (8th (Liverpool) Irish); temporary assistant, Mr. H. Sharples (Motor Transport Section). Out of the original staff of five men, three joined the Forces, and an assistant died.

General.—The following announcement appears in the *London Gazette*, December 14th:—"Captain Ernest A. Pells, R.E. (T.) to be Major, R.E. (T.)." Major Ernest A. Pells, who was in the Hampstead Borough Council electricity department at the outbreak of hostilities, was gazetted to the 1st London Divisional Signal Company, R.E. (T.). He is also well known for his untiring energies in the Boy Scout movement. His previous campaigns include the Red River Expedition, Matabeleland, also the South African.

Councillor STAMPER has been appointed chairman and Alderman JOHNSON vice-chairman of the Hammersmith B.C. Electricity Committee.

Mr. ARTHUR T. COOPER, consulting engineer, is after the 7th prox. changing his address to 3, Clement's Inn, Strand, W.C. Telephone No.: "Holborn 6369."

The *London Gazette* for December 17th contains the following announcement:—*Territorial Force. London Electrical Engineers.* The undermentioned Lieutenants to be temporary Captains. Dated December 18th, 1915:—Herbert A. Cope, Harold F. Haworth, Egerton B. Hunter. The undermentioned Second Lieutenants to be temporary Lieutenants. Dated December 18th, 1915:—John Gibson, James R. Birch, John B. S. Gabriel, Guy S. M. Taylor, and to remain seconded, Hubert F. G. Roose, and to remain seconded, Reginald Engelbach, and to remain seconded.

Mr. H. V. SADLER has resigned his position as works manager to Messrs. Wm. Sanders & Co. owing to the dissolution of partnership, and has been presented with a silver cigarette case and holder by the workmen. He will be pleased to hear from his friends at Wychbury, Lichfield Road, Walsall.

Roll of Honour.—Private GEO. LEIGH, of the 2nd Royal Warwickshire Regiment, who was prior to the war engaged with Messrs. Taylor, Tunnicliff & Co., of Eastwood, Hanley, is reported from France to be missing.

Private A. SMITH, of the 3/4th Battalion Loyal North Lancashire Regiment, who was on the staff of Messrs. Dick, Kerr and Co., Ltd., at Preston, has died from consumption of the brain whilst in training at Blackpool.

Amongst those upon whom the King has conferred the Territorial Decoration is Major FRED COUTTS, of the 5th Black Watch. At the time of mobilisation he held the post of tramway manager at Paisley.

Corporal W. H. TOWNLEY, of the 6th Battalion King's Own Scottish Borderers, formerly an electrician employed by the Calico Printers' Association, Manchester, has been granted the Croix-de-Guerre for gallantry under heavy fire in carrying out repair work to wires.

Lance-Corporal GEORGE J. COWLEY, of the 7th Service Battalion Rifle Brigade, who has been killed in action in France, was 31 years of age, and prior to the war was employed by the British Westinghouse Co., Trafford Park.

Private ALEX. WYCHE, of the 1st Battalion Lancashire Fusiliers, who has been killed in action at the Dardanelles, was formerly employed at the works of Messrs. W. T. Glover and Co., Trafford Park. He was 22 years of age.

At Hull, on 17th inst., CHAS. WILLIAM JEFFREY, formerly a wireless operator in the Navy, was presented with the Distinguished Service Medal for meritorious services in the Dardanelles.

Second-Lieutenant JAMES FORBES, R.E., who was killed at Suvla Bay on December 12th, aged 26 years, received his engineering apprenticeship with Messrs. Caird & Co., of Greenock, and subsequently took up a position with the British Thomson-Houston Co., Ltd.

Obituary.—MR. J. T. SHELLSHEAR.—The death is announced of Mr. Joseph Thornhill Shellshear, foreman of the overhead wire department of the Liverpool Corporation Tramways.

SIR HENRY ROSCOE.—We regret to record the death of Sir Henry Enfield Roscoe, F.R.S., the celebrated chemist, which occurred on Saturday last at Leatherhead in his 83rd year. At the age of 24 years he was appointed to the Chair of Chemistry at Owens College, Manchester, and for thirty years he was heartily devoted to his excellent work there. Subsequently he entered Parliament, and later sat on the Royal Commission on Technical Education, his services in that connection being rewarded with a knighthood in 1884.

NEW COMPANIES REGISTERED.

Productive Engineers, Ltd. (142,401).—This company was registered on December 14th, with a capital of £1,000 in £1 shares, to carry on the business of mechanical and electrical engineers and contractors, manufacturers of machinery, tools, ordnance and munitions of war, brassfounders, metal workers, machinists, smiths and merchants, etc., and to adopt an agreement with J. Lawson. The subscribers (with one share each) are: C. E. Booth, Gerangamete, Harrogate, gentleman; J. Lawson, 26-30, Eyre Street Hill, E.C., engineer. Private company. The number of directors is not to be less than two or more than five; the first are C. E. Booth and J. Lawson (both permanent, subject to holding 250 shares each). Remuneration is fixed by the company. Solicitors: Ward, Bowie, Porter & Co., 7, King Street, Cheapside, E.C.

Copper Depositing and General Engineering Co., Ltd. (142,418).—This company was registered on December 16th, with a capital of £1,000 in £1 shares, to carry on the business of copper depositors, refiners, and workers of copper and other metals by electric or any other process, makers and suppliers of all kinds of copper or other metal [illegible] apparatus, machinery and plant, ironfounders, mechanical engineers, etc. The subscribers (with one share each) are: C. T. Woodsman, 25, Bovill Road, Honor Oak Park, S.E., clerk; A. J. Woods, 78, Dumbreck Road, Eltham, S.E., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Solicitors: Maddison, Stirling & Humm, 33, Old Jewry, E.C.

Anglo-Russian Engineering Co., Ltd. (142,379).—This company was registered on December 11th, with a capital of £5,000 in 4,000 10 per cent. pref. shares of £1 each and 20,000 ord. shares of 1s. each, to carry on the business of electricians, mechanical engineers, suppliers of electricity for the purposes of light, heat, motive power, or otherwise, manufacturers of and dealers in electrical apparatus, etc. The subscribers (with one share each) are: T. J. Edwards, 42, Crutched Friars, E.C., merchant; E. C. Hoegerstaedt, 78, Turnmill Street, E.C., engineer. Private company. The number of directors is not to be less than three or more than seven; the first are T. J. Edwards, E. C. Hoegerstaedt, J. S. Aplin, and J. B. Webb. Qualification, 50 shares. Registered office: 78, Turnmill Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

New St. Helens & District Tramways, Co., Ltd. (59,426).—Capital, £150,000 in £5 shares (20,000 pref.). Return dated November 12th, 1915. 15,980 pref. and 9,000 ord. shares taken up; £125,410 paid (including £510 paid on 1,020 shares forfeited). Mortgages and charges: Nil.

Lithanode, Ltd. (64,823).—Capital, £3,000 in £1 shares. Return dated November 5th, 1915. 3,000 shares taken up (of which 225 have been forfeited); £2,340 paid (including £65 paid on forfeited shares); £500 considered as paid. Mortgages and charges: £1,600.

W. Sanders and Co. (1915), Ltd.—Particulars of £1,000 debentures, created December 1st, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees.

Liverpool Electric Cable Co., Ltd. (71,099).—Capital, £20,000 in £1 shares. Return dated July 22nd (filed September 10th), 1915. All shares taken up; £7,833 paid; £12,167 considered as paid. Mortgages and charges: Nil.

Barsi Light Railway Co., Ltd. (44,589).—Capital, £300,000 in £10 shares. Return dated November 2nd, 1915. 26,000 shares taken up; £260,000 paid. Mortgages and charges: £140,000 deb. stock and £123,100 4 per cent. Latur extension debs. (part of £125,000 issued, £1,900 having been redeemed).

Pacific and European Telegraph Co., Ltd. (36,683c).—Capital, £100,000 in £10 shares. Return dated November 23rd, 1915. All shares taken up; £4 per share called up; £40,000 paid. Mortgages and charges: £68,400.

Newtons, Ltd. (48,936).—Capital, £40,000 in £10 shares. Return dated October 5th, 1915. 3,265 shares taken up; £18,650 paid; £14,000 considered as paid. Mortgages and charges: £14,000.

National Conduit and Cable Co., Ltd. (59,251).—Capital, £1,000 in £1 shares. Return dated October 14th, 1915. All shares taken up; £7 paid; £993 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Manx Electric Railway Co., Ltd.

THE directors' report for the year ended September, 1915, shows that the gross receipts were £7,512 and the gross expenditure was £11,273. The state of war entirely destroyed the holiday season in the island, and the summer traffic on the railway was practically no better than the ordinary winter traffic. A comparison with former years is therefore impossible. Working expenses had been reduced to the lowest possible limit, and, in fact, they amounted to £6,100 less than in 1914. The passengers carried during the year were only 104,224, as against 496,568 last year, and 704,188 the year before.

The annual meeting was held on December 16th at 3, Finch Lane, Cornhill, E.C., Sir W. H. VAUDREY presiding. The CHAIRMAN said that the year had been a very critical one for them. The visitors to Douglas from May to September totalled only 33,786, as against 404,481 in the same period in 1914, and 615,726 the year before. As a consequence, the traffic receipts were very insignificant; in fact, during the whole year they hardly exceeded the usual winter traffics in normal years. The expenditure, £11,273, was the minimum at which they were able to run the line at all. They made drastic reductions in the staff and in the number of trains run, these being the result of very anxious and careful consideration on the part of the board as to what would be the least ruinous way of proceeding. Their charter compelled them to run a certain number of trains per day; had they reduced the traffic down to the minimum they could not have done with a smaller staff than they were now employing, whilst some of the traffic, such as season-ticket holders, schools, etc., would have been lost to them. They, therefore, decided to run a somewhat more frequent service, which still enabled them to keep all their permanent island traffic, and they felt that by this policy they had not only saved money for the shareholders, but studied the convenience of the inhabitants of the island. The mileage this year was 111,372, as against 305,731 in 1914 and 364,717 in 1913. They earned 10.86d. per mile run, as against 19.16d. in 1914 and 21.11d. in 1913, and they carried 0.91 passengers per mile, as against 1.62 in 1914 and 1.93 in 1913. The receipts per passenger were 11.89d., as against 11.98d. in 1914 and 12.52d. in 1913. The difference of expenditure over receipts for the twelve months amounted to £3,761, and, after [illegible] brought in at the beginning of the year, namely, £3,325, there was a deficit of £436, to which had to be added the debenture interest, amounting to £9,000 per annum; total £9,436. They paid the interest for the first six months of the year, viz., £4,500, and as regarded the interest for the second half, they called the debenture holders together and were authorised by them to issue to them second debentures carrying interest at the rate of 5 per cent., in lieu of cash. Future interest accruing during the war would be treated in the same manner. He could only hope that the war and its disastrous consequences might terminate as soon as possible, so that the company could again carry on its business under normal conditions. In the meantime, to meet past and future deficits, they had borrowed the necessary funds against the security of their investments.

Mr. Ernest Remnant seconded the motion, and the report was adopted without discussion.

Cordoba Light, Power & Traction Co., Ltd.

Mr. Geo. A. Touche, M.P., presided on December 16th, at Winchester House, E.C., over the annual meeting. In moving the adoption of the report (see Elec. Rev., p. 758), the Chairman said that the outlook was distinctly better than when he last addressed them. Business was adjusting itself to new conditions, and confidence was returning. The recent crop reports were favourable. The indications were that the present improvement would be maintained. It was not until August, 1914, that they experienced any actual decrease in takings. From then to the end of last March there was a falling off in receipts. In the first half-year it was not nearly so serious as that experienced by other similar undertakings in South America, but it resulted in a decrease of 6 per cent. in the combined gross receipts of their two subsidiary companies. From the beginning of April an improvement set in, with the result that gross receipts for the whole year fell short by less than 2 per cent. For the year to September 30th, 1915, the gross receipts of the combined businesses amounted to £157,590, compared with £160,420 in 1914 and £154,060 in 1913. The operating expenses were £1,360 higher than last year, and the net receipts showed a decrease of £4,190, or 4¾ per cent. The net receipts were £83,320, compared with £87,510 in 1914 and £80,830 in 1913. The percentage of expenses to the gross receipts of the two undertakings was as follows: 1913, 47.5 per cent.; 1914, 45.4 per cent.; and 1915, 47.1 per cent., an increase over 1914 of 1.7 per cent., and a slight decrease as compared with the year 1913. In the circumstances, the results were better than might have been expected, and reflected credit on Mr. C. C. Lewis, the manager in Cordoba, and on the staff. Taking the Light & Power Co. independently, in spite of the adverse conditions a small improvement was shown over the results of last year. This improvement arose in the second half of the year. The gross receipts were £88,530, or £3,010 better. The expenses were £30,910, an increase of £1,920, the percentage of the expenses to the gross receipts being 34.9 per cent., compared with 33.8 per cent. last year. The net receipts were £1,090 up at £57,640. The number of customers for light and power at the end of September showed an increase of nearly 5 per cent., while the number of lamps connected had increased by 48 per cent. The improvement was most marked in the latter part of the year. Taking the whole year, the number of units sold showed an increase of nearly 8½ per cent. over last year, but the income per unit was a little lower. The Light & Power Co. spent £15,743 during the year on improvements, practically two-thirds of it being expended on the reconstruction of the overhead mains in accordance with a municipal decree. About £2,500 remained to be spent to complete this work. Of the balance of the expenditure made during the year, nearly £2,000 was for extensions of the street lighting of the city. The remainder was for the extension of their distribution system, and for connecting up and supplying meters to new customers. The position as regarded the competing company remained practically the same as at this time last year. A verbal arrangement was in force whereby each company respected the customers of the other. The latest figures they had of the business of their competitors indicated that the growth of their business was not nearly so great as theirs, even in proportion to its size. The stagnant condition of business during the first half of the year bore more heavily upon the Tramway Co. than upon the Light & Power Co., and the tramways were taking longer to recover. Although they had 31 miles of track open to service, or one mile more than last year, the car kilometres run by the cars in the year were very nearly the same as in the previous year. The passengers carried were only 7,507,065, compared with 8,161,626 in 1914, and 7,755,800 in 1913. This meant that the population was carried only 62½ times, against 68 times last year. The gross receipts were £69,040, a decrease of £5,840. The operating expenses were slightly lower at £43,360, against £43,920 in the previous year. The net receipts were £25,680, a reduction of £5,280. The percentage of expenses to gross receipts was 62.8 per cent. in 1915, 58.6 per cent. in 1914, and 60.5 per cent. in 1913. Of the decrease in both the gross and net receipts less than one-fifth related to the latter half of the year, the remaining four-fifths having accrued in the half-year to March 31st, 1915. The Tramways Co. expended £13,413 in improvements and extensions; £4,193 was spent on paving in accordance with the paving programme of the municipality. After allowing for certain charges against the profits of the subsidiary companies, such as reserve for bad debts, loss on exchange, New York expenses, and depreciation of certain materials, the revenue brought into the accounts of the parent company was £78,151, compared with £81,040 last year. With two exceptions the expenses were approximately the same. Last year their profit and loss account contained a charge of £2,131 for engineers' fees. Under present conditions it was a somewhat onerous charge, and was payable under an agreement with their consulting engineers which was not terminable until March 31st, 1917. At the last meeting he informed them that they had already approached the engineers with a view to seeing whether some modification could be made. The engineers met them in a very fair and reasonable spirit, and, he was glad to say, an arrangement was ultimately come to for the cancellation of the agreement, which had resulted in the elimination of this heavy charge from the accounts. Another charge, however, appeared this year, namely, £2,062 for interest on loans from the bankers, and the total expenses were £59,421, against £60,230 last year, leaving the balance of profit at £19,035, against £20,819 last year. At the last two annual meetings, shareholders expressed curiosity, if not anxiety, as to the manner in which it was proposed to deal with the issue of promissory notes, the shadow of whose maturity on December 1st, 1915, began to trouble them. The total issue was £500,000, of which £405,000 were held by investors, and the balance had been utilised for purposes of temporary finance. It was a formidable sum to have to face in days like these. They were perfectly frank with the Treasury Committee as regarded their position and needs, and they dealt with them very fairly, and in a businesslike manner. They insisted on satisfying themselves that their needs made a new issue necessary, and after full and careful inquiry they sanctioned the issue of £500,000 of new notes. But it was one thing to get the Treasury sanction, and another to place the notes. Nevertheless, they had placed £500,000 new notes. The task of doing so was made possible through the admirable manner in which the trust investment companies and other large holders of existing notes co-operated to make the issue a success. The unwillingness to authorise new issues arose from the fear that capital might thereby go out of the country. In their case, the issue had actually brought capital into the country, for no less than £20,000 of new money was subscribed by Mr. Theodore Vail, of New York, the largest shareholder and a member of the board. The transaction had been carried through with great skill by Mr. Whitmee, and the old issue was redeemed on the date of maturity, namely, the first day of the present month, and the loan from their bankers had been repaid. The new notes were for three years, with an option to the company to renew for a further two years, making five years in all. These were not times when it would have been wise to attempt to place a permanent security. They thought it a matter for congratulation that a heavy obligation, maturing at a most inconvenient season, had been provided for.

Mr. C. M. Rose seconded the motion, which was carried without discussion.

The election of Mr. Geo. Balfour as a director was confirmed, and, on the motion of Mr. Poole, a hearty vote of thanks was accorded the board and the staff.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.

The accounts for the year ended September 30th, 1915, show a profit of £10,050, compared with £18,063 in 1914, and £21,636 in 1913. Owing to the absence of visitors and to the restrictions on lighting, both the tramway traffic and the sale of electricity suffered severely. The receipts, which were £48,507 in 1912-13, the last complete financial year before the war, fell last year to £31,588, a difference of £16,919, while the saving in expenses was only £5,333, owing to standing charges which could be only gradually reduced and to the increased price of coal. The directors expect to reduce the expenses further during the current year. Notwithstanding the unfortunate conditions prevailing, the profits proved sufficient to pay all the interest charges, and to allow of £974 being carried forward. In view of the continued depression, the directors did not find themselves justified in making the payment of 2½ per cent. on the preference shares foreshadowed in their last report. The prospects of the undertaking were most promising when they were suddenly affected by the outbreak of the war. They had just completed large extensions of generating plant, and were in an excellent position to meet the growing demands for light and power and the increasing traffic on the tramways. The directors look confidently to an immediate restoration of the progressive business which they enjoyed before the war whenever peace is proclaimed.

Mr. A. R. Monks presided on December 16th over the annual meeting, held at Winchester House, E.C. He said that they had had to carry on the company under very trying conditions. All seaside resorts had suffered severely owing to the war, especially East Coast towns; but none more so than the Isle of Thanet. The raids had the effect of keeping people away and of driving home those visitors who were there. They had spent £805 on their electric light installation for the accommodation of 50 new consumers, the return upon which was quite satisfactory. Financially, the company was intrinsically better than it had been for many years past. Coming to the revenue, there had been a loss in traffic receipts of £11,028, and on sales of electricity of £3,637, which with other small amounts, gave them a total decrease of

£15,081, which was equal to a reduction of 33 per cent. The management had had great difficulties in keeping the service going, as 63 of the men had gone to the Front, and 93 per cent. of those remaining, including Mr. Ford, the manager, had since attested under Lord Derby's scheme. As against the decreased receipts, there had been a saving of £2,038 in general expenditure, and £2,766 in power station costs. They generated some 600,000 less units of electricity during the year, the number generated being the lowest in the history of the company. They would have to look forward to an increase in the fuel bill for the current year. As directors, they had only taken half fees. Against the decrease of £15,181 in receipts, there had been a total saving in expenses of £7,068, which gave them a difference of £8,031. Interest on loans had increased by £500. The bank rate had been 5 per cent. throughout the year, and they had to pay an additional ½ per cent. The result was that they carried £924 to the revenue account, and to the credit of the balance sheet £8,166. They regretted that they could not pay the dividend of 2½ per cent. which they earned last year, but they must conserve that money to pay the creditors for new plant.

Lord Arthur Butler seconded the motion.

Dr. Moody said he thought that the figures disclosed in the balance sheet might have been a great deal worse than they were. He was a director of a tramway undertaking not many miles from the Isle of Thanet, and he knew the difficulties under which they had suffered owing to the war. He had always been a believer in the company, but it had always been unfortunate. He must say he did not like to see such a large floating loan, and he thought it would be much better finance if the directors were to put that loan on a permanent basis, even if they had to pay 6 per cent.

The Chairman remarked that he quite agreed with Dr. Moody as to the desirability of getting rid of the floating debt to the bankers, and perhaps they would be able to do something to that end at the conclusion of the war.

The report was adopted.

Adelaide Electric Supply Co., Ltd.

Mr. J. B. Braithwaite presided over the eleventh annual meeting, held on Tuesday, at Finsbury Pavement House, E.C. He congratulated the shareholders on the result of the working for the past year. This time last year they met shortly after war had been declared, and the outlook was somewhat uncertain. He did not think if any of them had been asked to prophesy this time last year that they would have anticipated such a satisfactory result as had actually occurred, and, in spite of the war and the consequences connected with it, they would see they showed a satisfactory increase in every item of the business. The units sold had risen to over 7,000,000; the connections in kw. were now close on 20,000; the motors, rated in h.p., had gone up nearly 1,000; even the lighting had gone up 400 kw., and the number of consumers had increased by 2,200, which was a very satisfactory result. With regard to the balance sheet, the further expenditure during the year had been £79,198, and that had been provided for by the issue of a further number of preference shares and £25,000 additional debenture stock, so they now had £250,000—that was, 50,000 6 per cent. cumulative preference shares of £5 each—and 50,000 ordinary shares of £5 each, making a total capital of £500,000 issued. The board had recently authorised the creation of a further amount of shares, and of these they were issuing 20,000 ordinary shares at a premium of 30s. a share. That was an issue being taken up in Australia, the Treasury not having given their permission for the small number of shares required in England. This would be reserved, he took it, until after the war, so that English shareholders, he hoped, would not be prejudiced ultimately. They had extended their mains to Semaphore, which practically completed all the suburbs of Adelaide which were within reach. Although, as the auditors rightly pointed out, they had put nothing to depreciation specifically, yet, as he had frequently had occasion to point out, the peculiar circumstances of the company, viz., that they were liable to purchase by the South Australian Government at recurring intervals of two years, provided special reasons why they did not want to accumulate a large and useless fund specifically ear-marked for purposes of depreciation. Their policy was, and had always been, to keep their undertaking up to the fullest possible efficiency, both as regarded plant and mains, and, indeed, in the case of overhead mains, such as theirs, they were bound to keep them in a high state of efficiency or they could not continue their supply. With regard to their plant, they were always superseding any plant which ceased to be up to every modern standard, by plant of the latest possible type. Then there was the large amount they put to the debenture service fund, £9,000, which, of course, was all for the benefit of the shareholders ultimately, as it redeemed that amount of debenture stock which stood ahead of them and automatically reduced the capital by that amount. There was one item of which no doubt they all approved, which was what they called their patriotic and war contributions. Seventy of the staff had enlisted in the Australian Expeditionary Force, which represented 20 per cent. of their total staff in Australia. In regard to the outlook for the coming year, they had a cable that morning from the chairman of the local board which was certainly of an encouraging character. He said: "Harvest returns of wheat and wool most favourable. Expect large increase of business after the war." He was not a prophet or the son of a prophet, but he had no doubt he had not put those words in without some good reason. In the meantime, even during the war the increase in their business was entirely satisfactory. The results they had to hand for the first three months of the current financial year entirely bore out the local chairman's optimistic forecast, as they showed very substantial increases both in gross and net profit for the period. So, although they reduced the carry forward by about £3,000, they still carried forward £7,000 or £8,000, and left the dividend equalisation fund at £25,000 absolutely intact. The success and the prosperity of the company were very largely due to the efforts of the local board of directors in Adelaide, and also to their excellent technical staff. They had about 300 men employed at Adelaide, and it was due to their loyalty to the company, and to their efficient work, that they saw the satisfactory commercial results which they had achieved, and he had no doubt they would wish, in the usual way, to pass a special resolution acknowledging their services and expressing their appreciation of them.

Mr. P. Sellon seconded the motion, which was carried without discussion.

On the motion of Mr. A. F. Farish a hearty vote of thanks was passed to the local board and staff in Adelaide, and on the proposition of Mr. Brookman thanks were accorded to the chairman and board and secretary in London.

Blackpool and St. Annes and Lytham Tramways Co., Ltd.—The annual meeting was held at Blackpool, on December 16th, Mr. George Nicholson (Liverpool) presiding. The directors, in their report, called attention to the gratifying increase in receipts, and reported that the trustees for debenture holders had intimated their intention of distributing 4 per cent. interest on account of arrears upon the debenture stock. Traffic receipts were £34,872, and the net receipts £29,159, the balance of profit being £7,594. The Chairman described the balance sheet as the most satisfactory since the inception of the company. The receipts showed an increase over last year of £4,300, due to the fine weather in September and October. The receipts during September were the highest ever taken for that month. Some 63 of their staff had joined the Forces, and three had been killed in action and six wounded. In consequence, they had been employing girl conductors to the number of 30, and they had given every satisfaction. Their wages came to rather more than those of the men, because they only worked 8½ hours per day against 10 by the men. The report was adopted.

Marconi's Wireless Telegraph Co., Ltd.—In a circular just issued the directors express regret that they have not yet been able to obtain from Government departments a basis of settlement in respect of either remuneration or compensation for services rendered for the use of their stations since the commencement of the war, nor in respect of other matters in which the Government is indebted to the company. However, without taking into account the considerable sums which are estimated to be due to the company in respect of these matters, the business which has been actually completed for the current year has been satisfactory, and the directors, without departing from the policy, which was approved at the last general meeting, of husbanding their resources, feel justified in declaring the 7 per cent. preferential dividend upon the cumulative participating preference shares and an interim dividend of 5 per cent. on the ordinary shares.

Marconi Wireless Telegraph Co. of Canada, Ltd.—The directors report that message traffic to and from ships, which forms an important source of the company's revenue, and which prior to the war was showing a gratifying increase, has naturally been adversely affected by the severe censorship imposed, the general dislocation of passenger traffic and the placing of important stations at the disposal of the Government. The directors (says the *Financier*) have submitted appropriate claims to the Naval authorities for compensation in respect of the reduced revenue of the various coast stations as compared with the corresponding period anterior to the war. This matter is still in abeyance, but the directors have reason to believe than an equitable settlement will be duly arranged.

Companies Struck off the Register.—The names of the following companies have been struck off the register and are dissolved:—

Collieries Electric Power Development Syndicate.
Consolidated Superheater Co.
Dimming Switches.
Engineering Equipment.
Engineering Union of China.
Homer Earphone Co.
Horsfall Destructor Co.
Hydro-Electric Lift & Crane Co.
London Electric Treatment Co. (1911).
Magnet Galvanizing & Plating Co.
Universal Patents Bureau.
Wilkeson Fuel, Light & Power Co.

Victoria Falls and Transvaal Power Co., Ltd.—The directors have declared a ten months' dividend at the rate of 6 per cent. per annum, less income-tax, on the preference shares, thereby making the cumulative dividend paid up to February 28th, 1915.

Fuller Accumulator Co., Ltd.—The directors are able again to report a satisfactory year's working. The sales of the block accumulator continue to increase both at home and abroad, and there is sufficient work on hand to keep the factory busy for months to come. A new patent has been acquired which enhances the value of the existing patent. The balance of the preliminary expenses in the last balance sheet, £600, has been written off to profit and loss account. The net profits of the trading for the year ended October 31st, 1915, amount to £9,960, which, including £3,344 placed to reserve fund last year, makes a total of £13,304. A dividend on the preference shares at the rate of 10 per cent. per annum (including interim dividend already paid) absorbs £1,500, a dividend on ordinary shares at the rate of 10 per cent per annum (including interim dividend already paid) requires £4,500, there is to be put to reserve fund £1,656 which (added to £3,344 placed to reserve fund last year) makes a total reserve of £5,000, and £2,304 is to be carried forward.

British Columbia Electric Railway Co., Ltd.—The directors' report for the year ended June 30th, 1915, states that the result of the operations is exceedingly unsatisfactory. Although there is no immediate prospect of sufficient profits being earned to pay the dividend on the 5 per cent. cumulative perpetual preference stock, the financial position is considered to justify the payment of the dividend for the current year out of the reserve fund. The directors are unable to hold out any hope that they will be able to recommend any dividend on the preferred ordinary or deferred ordinary stocks for the current year. We shall deal with the report further in our next issue.

Bombay Tramways and Income Tax.—The Calcutta correspondent of the *Daily Telegraph* says that shareholders on the Indian register of the Bombay Electric Supply and Tramways Co. have held a meeting to consider means of obtaining relief from English income-tax. The chairman (Sir Sassoon David) said legal opinion, both in England and in India, was to the effect that the only means by which the company could escape from liability to pay the English tax was by transferring the management to Bombay. Resolutions providing for alterations in the constitution of the company were adopted.

Municipal Tramways Trust, Ltd., Adelaide.—We have received a Christmas greeting folding card giving the "vital statistics" concerning the operations of the above organisation for the years 1909-1915. It gives the figures of capital receipts and expenditure, revenue receipts and expenditure, reserves and general statistics in six years, from which the progress of the undertakings may be traced out with ease.

Burmah Electric Tramways & Lighting Co., Ltd.—A dividend of 5 per cent. on the 6 per cent. preference shares is announced for the period from February 1st, 1906, to November 30th, 1906, leaving 52 per cent. in arrear; £2,000 is put to depreciation account, and £842 is carried forward.

New Russian Electrical Companies.—The Caucasian Electrical Co. is being formed (capital, 150,000 roubles) to exploit electricity in the Caucasus; also the Electrical Equipment Co. (capital, 2,000,000 roubles) to exploit electricity, gas, etc.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets are considerably more subdued in spirit than they are as a rule at this time of year. Strength is exhibited in most departments. The issue of Exchequer Bonds had the competitive effect of lowering Consols and the War Loan, and the unexpected news with reference to the withdrawal of troops from Suvla Bay and Anzac led to a slight dullness in the general tone. But once more, on the whole, the surprising part of the Stock Exchange is that prices should keep up so well as they do, the reason for this being the really extraordinary absorption of stock which is going on—evidencing that some people, at any rate, are saving their money, in accordance with the official admonitions directed to the exercise of thrift.

For the first time in many years, the Stock Exchange is to close on Christmas Eve; a reminder, this, of the fact that all dealings are for money, and that the fortnightly settlements no longer give the extra work twice a month that used in times gone by to place an effective bar upon any lengthening of the Christmas recess. Throgmorton Street reflects the somewhat subdued spirit of the City generally. There are no shilling toys to tread upon—and, incidentally, to be charged half-a-crown for, by way of penalty to clumsiness. The non-treating order certainly makes a difference to seasonable joviality; and, above all, the Stock Exchange has not had a good year. The Bank of England considerately posted its commission on the War Loan to stockbrokers so that the cheques arrived on the first day of this week, but even this little *douceur* cannot wholly eradicate the memory of the bad months of the first half of the year. The industrial market is quiet, and business in Home Railway Stocks has dwindled to a minimum.

Metropolitan Electric Supply ordinary shares achieve the distinction of affording the only movement in the list, and this takes the shape of a rise of 2s. 6d., there being one or two buyers about, attracted by the low price to which the shares have fallen. For some time past, the market in Metropolitans has been a poor one, with a good many shares offering and no support; but just lately the floating supply has been taken, and the price is once more on the mend. There will be little move in the London list on this side of the dividend declarations, and if we had to venture into the region of prophecy, we would hazard a guess that the announcements will make no great difference to most of the shares, although they may confirm the market in the condition of quietude that has been its customary characteristic for the past two months.

Marconi's Wireless Telegraph shares have strengthened slightly in tone as the result of the declaration of dividends at the rate of 7 per cent. on the preference and 5 per cent. on the ordinary. Both of these are in accordance with anticipation, although some of the pessimists were inclined to think that the dividend on the ordinary shares might be cut. The Marconi International Marine dividend is also at the rate of 5 per cent. on the ordinary, and the shares have hardened a trifle—in this case to 25s. Canadian Marconis emerged from their long state of inanition by improving to 5s. 6d. on the appearance of a report which spoke more hopefully than had been expected. It is a little surprising that the Marconi market, which not long ago was the centre of activity and mild speculation, should have fallen on such dull days, interest having died out almost completely for the time being.

The Mexican group leans to the easier side, and a few small falls have occurred in the bonds of the industrial companies—less from any pressure to sell than from the nature of the recent news. General Villa is variously reported as bestirring his forces and surrendering! What is more serious, some of the internal obligations of Mexican companies are being met by payments which work out at a pitiful threepence to the dollar. Such a rate of exchange the Mexico Tramways Co. dwelt upon in the report that it issued four or five months ago; and the advertisement of internal bonds being actually repaid at such a rate of exchange is an unpleasant reminder of what a revolution really means. On the other hand, private cables arrived over the week-end which took a cautiously-hopeful view of the situation; so that the general position is about as contradictory as ever. Wall Street professes to have favourable news, on the strength of which the Americans bought a few Mexican industrial issues.

Brazilian Tractions have eased off to 51½, the shares having fallen consistently for the past three weeks, on the uncertainty which is felt with regard to the dividend outlook. The preferred shares, however, hold their price with a good deal of tenacity, and are by no means easy to buy at the current price of 91 xd.; and it would not be surprising to see a twist upwards in Tractions after the turn of the new year. For the time being, the rate of exchange is weak, and this reacts unfavourably upon Brazilian issues generally.

No changes worth mentioning have occurred in the Home Railway section. Underground Electric income bonds keep steady at their somewhat reduced figure of 77, and business in them has become quiet again. It is said that the curtailed service on the new South-Western electrified system is due to interference between the power current and the Post Office telegraph system, but this, of course, will mean no more than a trifling delay. Passengers seem to appreciate the altered system very considerably, and the change to electric traction bids fair to become as great a success as it was in the case of the Brighton Railway when that company electrified part of its suburban lines.

Globe Telegraph & Trust shares of both classes are marked down ¼, of which 2s. is due to the dividend in the case of the ordinary shares, and 3s. in that of the preference. It will be noticed that the yield on the ordinary shares now comes to 6⅝ per cent. on the money, allowing for the fact that the income-tax is paid net. Eastern Extensions are ⅛ better at 12½. The only change in the Anglo-American group is ½ decline in the preferred stock of the Anglo-American Telegraph Co. India-Rubber shares retain their big rise of last week on the splendid report and dividend, and Henleys at 13¼ show a rise of the fraction. The rest of the miscellaneous group is firm, and in most cases there is not much supply available. The rise of 5 points in Edison & Swan 4 per cent. debenture stock is well maintained, and Castner-Kellners are changing hands freely over the middle price of £3.

The rubber market is decidedly robust. Business is active—almost ridiculously so, considering the season of the year. The public are taking large quantities of the 2s. shares that stand in the neighbourhood of par, while of the £1 shares the difficulty is to get enough to supply the continually increasing demand. The buying movement is justified on the ground that rubber will be strong for a long time to come. Considerable curiosity is evinced in the possibility of there coming to market the 8,000 lb. seized in the mail bags of a neutral steamer, the intended destination of the produce being shrewdly surmised as Germany—in which country, we hear, by the way, the price of the raw stuff is called 30s. per lb., which, in other words, means that there is practically no supply. The armament division keeps steady, and within the past day or two a little quickening of interest in copper shares caused most of the leading issues to harden.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Dec. 21, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	7½	—	£6 13 4
do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	3½	—	7 2 10
do. do. do. 4½ Pref.	4½	3¾	—	6 0 0
do. do. City Pref.	4½	3	—	7 10 0
do. 4 Deb.	4	78	—	5 2 7
Chelsea	5	4¼	—	5 17 8
do. 4½ Deb.	4½	83	—	5 8 6
City of London	9	12¼	—	7 7 3
do. do. 6 per cent. Pref.	6	11	—	5 9 1
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10	—	7 0 0
do. do. 6 per cent. Pref.	6	10¼	—	5 17 8
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	83	—	5 8 0
Kensington Ordinary	9	6	—	7 10 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4¼	—	7 1 2
do. do. 4 Deb.	4	75	—	5 4 0
Metropolitan	3½	2⅜	+ ⅛	7 7 4
do. 4½ per cent. Pref.	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	85	—	5 6 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6¼	—	8 0 0
do. do. do. 7 per cent. Pref.	7	6	—	5 16 8
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2¾	—	7 5 6
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6¾	—	6 13 6
do. 4½ Pref.	4½	4⅛	—	5 9 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	100½	— ½	5 19 6
do. Def.	1½	22⅞	—	6 11 3
Chile Telephone	8	6½	—	6 3 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	12½	+ ⅛	*6 8 0
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord.	7	128	—	*6 4 0
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	10⅜ xd	— ⅛	*6 12 2
do. Pref.	6	10⅜ xd	— ⅛	5 15 8
Gt. Northern Tel.	22	33½	—	6 11 4
Indo-European	13	48 xd	—	6 15 4
Marconi	10	1⅞	—	5 6 8
New York Tel. 4½	4½	101	—	4 9 1
Oriental Telephone Ord.	10	1⅞	—	5 6 8
do. Pref.	6	⅞	—	6 17 2
Tel. Egypt Deb.	4	80	—	5 0 0
United R. Plate Tel.	8	6	—	*7 12 5
do. Pref.	5	4¾	—	5 8 1
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12⅝	—	*6 7 0
do. 4 Deb.	4	80	—	5 0 0
Home Rails.				
Central London, Ord. Assented	4	72½	—	5 10 6
Metropolitan	1½	24½	—	6 2 0
do. District	Nil	15½	—	Nil
Underground Electric Ordinary	Nil	1⅝	—	Nil
do. do. "A"	Nil	5/6	— 8d.	Nil
do. do. Income	6	77	—	*8 17 6
Foreign Trams, &c.				
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	95 xd	—	5 5 0
Anglo-Arg. Trams, First Pref.	5½	4	—	6 17 6
do. 2nd Pref.	5½	3½	—	7 17 2
do. 4 Deb.	4	75	—1	5 6 8
do. 4½ Deb.	4½	79	+3	5 14 0
do. 5 Deb.	5	81	—	6 4 0
Brazil Tractions	3½	51½	— 2	6 16 0
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb.	4½	85	—	5 3 0
British Columbia Elec. Rly. Pfce.	5	60	—	8 6 8
do. do. Preferred	—	40	—	Nil
do. do. Deferred	—	40	—	Nil
do. do. Deb.	4¼	64	—	6 12 10
Mexico Trams	Nil	42	—	Nil
do. 5 per cent. Bonds	—	49	—	Nil
do. 6 per cent. Bonds	—	43	—1	Nil
Mexican Light Common	Nil	30	—	Nil
do. Pref.	Nil	42	—	Nil
do. 1st Bonds	—	46	— 2	—
Manufacturing Companies.				
Babcock & Wilcox	14	2 5/16	—	6 1 9
British Aluminium Ord.	5	22/6	—	4 9 0
do. Pref.	6	18/-	—	6 13 4
British Insulated Ord.	15	10½	—	7 2 10
do. Pref.	6	5⅜	—	5 11 7
British Westinghouse Pref.	7½	88/6	—	7 16 0
do. 4 Deb.	4	70	—	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	10½	—	7 2 10
do. 5 Pref.	5	4¼	—	5 17 8
do. 4½ Deb.	4½	90	—	5 0 0
Castner-Kellner	20	3	—	6 13 4
Edison & Swan, £3 pd.	Nil	9/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	62	—	6 9 1
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	14/-	—	8 11 6
do. do. Pref.	7	19/9	—	7 1 4
Gen. Elec. Pref.	6	9¾	—	6 3 1
Henley	20	18½	+ ½	*8 12 6
do. 4½ Pref.	4½	4¼	—	5 6 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	10	9	—	*12 8 2
Telegraph Con.	20	34½	—	*8 1 0

* Allowance made for dividends being paid free of income-tax.

Dublin Electricians' Wages.—Sir John Griffiths, as arbitrator, has decided that the Dublin Corporation's Stanley Street workshop is a "contract shop," and that the electrical engineers employed there are entitled to the increase of 2s. 6d. per week given by other employers in the city.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, December 22nd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a „ Nitric	„	..	..
a „ Oxalic	per lb.	1/2	..
a „ Sulphuric	per cwt.	..	..
a Ammoniac Sal	„	..	..
a Ammonia, Muriate (large crystal)	per ton	£50	..
a Bleaching powder	„	..	..
a Bisulphide of Carbon	„	£23	..
a Borax	„	£25	..
a Copper Sulphate	„	£43 10	..
a Lead, Nitrate	„	..	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	..	..
a Potash, Caustic (88/90 %)	per ton	..	..
a „ Chlorate	per lb.	1/5	..
a „ Perchlorate	„	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers	„	£11 10	..
a „ Recovered	„	..	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %)	„	..	..
a „ Chlorate	per lb.	1/4½	½d. inc.
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	8½d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	..	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	..	..
b „ Sheet, in ton lots	„	..	..
p Babbitt's metal ingots	„	..	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/1⅜ to 1/1⅝	⅜d. dec.
c „ Tubes (solid drawn)	„	1/2½ to 1/2¾	..
c „ Wire, basis	„	1/1⅝ to 1/1⅞	⅜d. dec.
c Copper Tubes (solid drawn)	„	1/2½ to 1/2¾	¼d. inc.
g „ Bars (best selected)	per ton	£112	..
g „ Sheet	„	£112	..
g „ Rod	„	£112	..
d „ (Electrolytic) Bars	„	£101	£2 10 inc.
d „ „ Sheets	„	£119	£2 10 inc.
d „ „ Rods	„	£108	£2 10 inc.
d „ „ H.C. Wire	per lb.	1/0⅞	¼d. inc.
f Ebonite Rod	„	8/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	3/3½	4d. inc.
l Iron Pig (Cleveland warrants)	per ton	73/-	..
l „ Wire, galv. No. 8, P.O. qual.	„	£28	..
g Lead, English Pig	„	£29 10	15/- inc.
g Mercury	per bot.	£16 15	..
e Mica (in original cases) small	per lb.	6d. to 3/-	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 14/- & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	..	..
p „ „ rolled bars & rods	„	..	..
p „ „ rolled strip & sheet	„	..	..
o Platinum	per oz.	210/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	„	£167 to £169	£2 to £3 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/8	..
p White Anti-friction Metals	per ton	..	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

A Manchester Dispute.—The *Manchester Courier* reports that the Committee on Production has been asked to arbitrate between 20,000 workers in the engineering trades of Manchester and district and the employers, on the question of increased wages. The dispute has arisen between the British Labour Amalgamation, the National Union of Gasworkers and General Labourers, the Workers' Union and the Engineering Employers. Both sides have agreed to put the matter before the arbitrators and to accept the decision. The trouble concerns the labourers and unskilled workers in the engineering trade, and it has been brought to a head because a three years' agreement on the wages question has almost expired.

It is not expected that any steps regarding arbitration will be taken until after the Christmas season. The trouble will, if it materialises, affect firms in Manchester, Salford, Warrington, Newton-le-Willows, Altrincham, Stockport, Hyde, Denton, Ashton, Bredbury, and other local areas. The men's claim is for an increased wage of 6s. per week, independent of, and in addition to, the war bonus of 3s. obtained in March, for all the workpeople engaged on time rates, and 17½ per cent. on piece rates. In addition, certain concessions are sought with regard to overtime pay, the object being to secure the same overtime terms for the labourers and the unskilled workers as are paid to the skilled engineers.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING NOVEMBER, 1915.

Whatever may be the reason, the last four monthly returns of the exports of electrical goods from this country show progressive increases in value of a very satisfactory kind. Thus, the November total reached £522 059 in value, as compared with £406,132, £374,418, and £346,318, the respective totals of the three preceding months—October, September and August.

After a considerable falling off in October, a marked revival has occurred in the electrical import business, the November value reaching a total of £250,343, which is considerably in excess of either of the two previous months' totals, and a similar comparison may be made as regards re-exports, which were valued at £30,560 in November, as against only £20,122 in October.

In the case of the exports, the bulk of the increased business was traceable to the cable, telegraphic and telephonic sections; the former, indeed, reached a record value, £163,566, which compares with the previous highest value of approximately £140,000 recorded for November, 1912. Machinery exports fell away, as compared with October.

The feature of the exports was the large Russian business during the month, amounting to over £100,000 in value, although in other directions business was fairly good.

The considerably-increased imports total was due almost entirely to the activity of the United States, from whom we received electrical goods valued at £178,000—£97,000 representing machinery and £28,000 telegraphic and telephonic material.

Dutch lamp imports were on a smaller scale, but from France we received £24,000 worth of battery material, bringing up the battery and accumulator imports to £35,900 for the month.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	6,881	48,236	1,233	3,495	3,122	2,503	33,455	825	56	616	11,177	22,691	134,290
Germany	...	...	...	...	...	...	...	...	...	...	...	...	...
Netherlands, Java and Dutch Indies ...	646	10,993	557	63	...	175	808	658	1,043	1	2,154	335	17,433
Belgian Congo...	10	...	...	...	...	14	...	25	...	...	...	...	49
France	1,018	...	1,554	1,515	247	70	5,711	1,142	2,081	119	5,954	11,367	30,278
Portugal	268	2,664	72	170	...	281	930	88	98	...	284	4,657	9,512
Spain, Canary Isles and Spanish N. Africa...	129	65	83	28	...	362	1,445	265	71	66	2,081	738	5,333
Switzerland, Italy and Austria-Hungary ...	418	308	195	...	...	410	8,654	...	89	42	1,838	7,156	19,110
Greece, Roumania, Turkey and Bulgaria ...	...	...	236	31	...	...	...	...	...	...	1,309	200	1,776
Channel Isles, Gibraltar, Malta and Cyprus...	148	8,386	398	34	...	63	66	...	47	18	...	7,939	17,079
U.S.A., Philippines and Cuba	1,021	...	241	...	...	...	4,620	...	20	16	75	753	6,746
Canada and Newfoundland	133	38	163	55	60	1,411	1,877	13	234	...	43	1,389	5,416
British West Indies and British Guiana ...	56	11	135	126	30	69	114	...	36	16	285	32	910
Mexico and Central America	...	247	57	24	...	151	34	...	...	...	...	...	513
Peru and Uruguay	64	317	19	17	...	...	272	2,532	60	...	6	17,753	21,040
Chile	439	316	153	163	...	134	741	67	...	375	207	32	2 627
Brazil	164	522	415	262	132	919	1,803	629	1,357	110	21	242	6,576
Argentina	557	5,517	1,200	173	...	858	9,633	4,089	589	3	3,437	1,803	27,859
Colombia, Venezuela, Ecuador and Bolivia...	423	51	30	87	...	...	381	...	...	...	7	...	979
Egypt, Tunis and Morocco	365	2,162	296	110	11	...	1,229	9	493	28	292	247	5,242
British West Africa	107	77	13	45	...	70	90	17	70	...	19	115	623
Rhodesia, O.R.C. and Transvaal	137	968	896	494	...	18	1,180	...	165	25	140	51	4,074
Cape of Good Hope	550	1,031	610	369	...	47	671	432	1,415	26	72	463	5,686
Natal	629	40	164	63	...	99	1,830	37	46	...	...	10	2,918
Zanzibar, Brit. E. Africa, Mauritius & Aden	75	38	167	149	31	...	476	36	13	...	7	80	1,072
Azores, Madeira and Portuguese Africa ...	...	50	45	111	...	78	244	...	141	...	...	79	748
French African Colonies and Madagascar...	...	...	...	...	...	...	144	...	...	...	...	...	144
China and Siam	103	1,046	879	393	38	718	922	323	58	61	30	812	5,383
Japan and Korea	77	21,353	...	66	10	940	2,487	...	785	...	8	548	26,274
India	2,582	18,869	3,363	2,852	36	1,726	6,986	1,664	2,841	289	3,611	3,323	48,142
Ceylon	58	393	97	10	...	10	784	...	164	3	510	55	2,084
Straits Settlements, Fed. Malay States and Sarawak	1,029	888	921	171	10	13	2,358	777	111	...	594	5,530	12,402
Hong Kong	660	8,027	469	13	18	684	1,060	...	146	87	187	134	11,485
West Australia	35	1,090	983	287	...	...	854	...	431	...	166	125	3,971
South Australia	146	691	262	...	...	187	1,343	275	164	67	1,569	12	4,716
Victoria	759	8,954	2,385	1,245	...	645	2,252	827	678	30	3,782	1,728	23,285
New South Wales	703	8,481	1,498	1,279	66	1,522	6,503	955	1,565	577	489	163	23,801
Queensland	89	384	18	395	...	...	449	1,736	234	...	547	...	3,852
Tasmania	81	285	20	233	...	...	261	...	...	45	45	...	970
New Zealand and Fiji Islands	898	11,068	2,907	602	73	399	3,425	1,141	36	...	6,786	6	27,341
Total, £	21,458	163,566	22,734	15,130	3,884	14,576	106,092	18,562	15,337	7,123	53,194	80,453	522,059

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
ussia, Norway, Sweden and Denmark ...	...	346	...	...	539	...	3,084	3	1,691	456	2,601		8,720
ermany	...	...	...	...	...	...	...	...	...	...	...		...
olland...	62	835	81	8,541	296	...	156	...	1,207	...	64		11,242
elgium	...	...	...	...	...	...	...	...	...	...	...		...
rance	790	...	518	107	214	2,160	33	942	24,428	1,662	115		30,969
witzerland	1,598	...	7	240	...	1,829	4,550	...	199	1,702	1,088		11,213
aly	...	2,484	...	...	...	...	3,332	...	...	34	70		5,920
ustria-Hungary	...	...	...	...	...	...	...	...	...	...	...		...
nited States	7,112	702	17,447	1,866	5,699	471	11,291	85,844	8,380	10,673	28,435		177,920
Total, £	9,562	4,367	18,053	10,754	6,748	4,460	22,466	86,789	35,905	14,527	32,373		245,984

dditional imports.—Japan, glow lamps, £112; Canada, electrical goods, £38; telephone and telegraph, £1,017; Spain, carbons, £3,192.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
rious countries, mainly as above... ...	1,399	613	...	1,569	...	176	3,937	...	188	3,224	19,454		30,560

Total Exports: £522,059 Total Re-Exports: £30,560 Total Imports: £250,343

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

AFTER THE WAR.

Discussion in the House of Lords.

A certain measure of mild ridicule has been poured upon the efforts of those who are anxious that while we are at war we shall be making preparations for the new international trade position that will arise when Peace is declared. To our minds it is curious that those who belittle such efforts should be foremost among those who criticise the Government because the nation was unprepared for war. It is quite right to prevent the problems of the future from unfitting us for a concentration of all necessary energies upon securing an absolute and unquestionable victory on the battlefield, but after seeing that there is no neglect in that connection, the British nation and the Allies have thousands of industrially and commercially wise men available for devoting their time and experience to after-the-war problems. In our opinion, after all that has been revealed, we shall afford the world an object lesson of the completest folly if the nation is to be led or dictated to by short-sighted, non-industrial or uncommercial minds who hold that, because the outlook is not clear, we should leave the new problems to be considered when they actually arise. There may be differences of opinion as to the precise lines along which our investigations should take place, but we agree with Mr. Asquith when he states, as was reported in these pages last week, that "not even our pre-occupation with the immediate and paramount task of ensuring victory ought to prevent us from taking measures to ensure that these problems should be carefully explored by skilled experts in advance." We, therefore, welcome most cordially the discussion which took place in the House of Lords on Tuesday last week.

From the report of the speeches appearing in the *Times* we gather that Lord Parker asked the Government to appoint a joint committee of the two Houses to report upon the problems that will arise when citizen soldiers return to industrial pursuits, and upon the reorganisation of our industries upon a Peace footing. It could be seen in this time of crisis how heavily a nation might be handicapped if we failed to think out in advance measures suitable for some particular emergency, and to prepare an organisation for carrying those measures into effect. Whatever excuse we might have had for unpreparedness for war on such a scale, we should have none if we were unprepared for Peace. The evils for posterity might be equal to or greater than those following upon the war itself. "We should have to deal with industrial workers who had been diverted to military life and the production of munitions, industries would need reorganising when capital was scarce, and we should have to face a competition in the markets of the world keener than anything we had yet known. He was not sure that for this competition we should not in some respects be worse off than Germany herself. Germany's export trade had been stopped, and it was not improbable that she had been able to accumulate stores of merchandise with which to commence the new industrial campaign." As one step in the direction of avoiding friction, Lord Parker advocated the classification of labour that was likely to return to industrial work, and the industries that would require labour. We should also confer with Colonial Governments regarding the prospects of employment in our Dominions beyond the seas. The most difficult problem, he thought, would be the position of women workers who were doing work previously done by men. They would not return to pre-war conditions, and they would have to be organised as well as the men. The war had taught us the danger that lay in our depending upon foreign sources for such things as munitions and the necessaries of life. Herein lay a financial weakness—were we reorganising our industries taking these matters into account? Would it not be wiser to depend upon our oversea Dominions rather than upon foreign nations? If new industries were to be started and certain others kept alive, we must give up Free Trade and consider how to avoid those political difficulties and abuses which were so often incident to a financial system in which a tariff played a part.

If we were to embark upon strenuous competition for the markets of the world we must consider the reduction of the cost of production by increasing the efficiency of labour, by revising our patent laws, by encouraging invention, by providing new and more adequate machinery, and by abolishing artificial rules and regulations which restricted output. Nobody desired to reduce wages below the pre-war level, and by profit-sharing or some other means a way might be found which would make it to the advantage of labour to agree to the abolition of the artificial restrictions upon output which were to be reimposed after the war. If it was impossible to appoint a joint committee of both Houses of Parliament, the Government might form a committee on the lines of the Imperial Defence Committee, which could map out the various subjects for inquiry and could refer them singly or in groups to sub-committees appointed for the purpose.

The Marquess of Crewe, who replied to Lord Parker on behalf of the Government, said that competent members of the Civil Service had been closely inquiring into the subject of demobilisation for more than a year. He referred briefly to an inquiry made respecting the return of soldiers to the land, and he considered that in respect to emigration, which he would not wish to go on at a greater rate than was absolutely necessary, we should act in conference with the Colonies. Populated as these islands were to-day we could not be a self-supporting country, and he did not think our fellow-citizens would wish us to aim at the establishment of works parallel in character to those of Krupps, though they might make us self-supporting in the matter of military munitions. These matters would, however, have to be considered. In regard to the demobilisation of war industries, the release of very partially skilled or unskilled labour for which openings would have to be found, the question of the proper employment of women (having regard to health and child-bearing)—these were parts of a complex question which became more complex by the difficulties which existed in regard to male and female labour. Nearly all the instances cited by Lord Parker raised ancient controversies or led to new ones hardly less violent. "It was quite evident that at a public inquiry people would be unable to resist the charm of advocating their general opinions, and the Government desired to avoid public discussion." The Marquess continued (we quote the *Times* report):—

Much had already been done departmentally in the preparation of material for facilitating the return of soldiers to civil life, though the results had not yet been submitted to any body. With regard to the labour side, a great deal of work had been done by the Board of Trade in the collection of material. There were about three million men and women engaged upon war work, and it was therefore easy to see the magnitude of the problem. The Board of Trade had also, with the help of skilled financial advisers from outside, been endeavouring to put together the necessary material for considering commercial and financial problems. Obviously questions of policy were so much involved in the consideration of these matters that it was impossible for a Government Department to do anything more than the mere collection of material, and the question now arose what further steps should be taken for the purpose of getting that material into some kind of shape. He agreed that consideration should not be postponed, though few now supposed the conclusion of the war might be speedy, or that it might be sudden. At the same time it was impossible to be too well prepared for the conditions which would arise. The Government were not prepared to appoint a joint committee to consider the matter in public, but the noble lord's other suggestion was of a more hopeful character. It was that a body should be appointed to examine the question of Imperial reorganisation as a whole and working largely through sub-committees with the ultimate view of conducting many of the necessary operations through local committees. He hoped that something of that kind could be done. He was not in a position at the moment to speak with any certainty, but they were all as convinced as the noble and learned lord of the necessity for action as prompt as was compatible with the examination of the large amount of matter relating to a great many subjects.

Viscount Haldane was the next speaker, and he prophesied that when peace came we should be found less prepared for it and its problems than we were for war. He advocated the appointment of a committee or Royal Commission to consider the problems which peace would bring. A committee could distribute the inquiry and elect sub-committees to carry it out, but such a body could not settle controverted political questions—Parliament would go on discussing such matters. The thorny and perplexing subject of re-employment of men coming back from the war should not be left to merely departmental consideration.

Viscount Bryce said that a great deal would depend upon the end of the war and the treaties that would follow; many of the problems could not be approached until we knew what the end of the war would be. We might have to retain enormous armies if the war were not conclusive. We should not revive controversies, but there were non-controversial questions which might be considered by a small committee of nine, which, upon the material prepared by the Board of Trade, could work out a scheme along lines upon which they thought we should proceed, and could consider the difficulties which might arise.

Lord Newton stated that the War Office and the Board of Trade had long been in consultation regarding the return of soldiers to the labour market—a process which would be of a gradual nature. Whatever proposals were arrived at would be submitted to a committee or tribunal of some kind.

The debate was brought to a close by the Marquess of Lansdowne, who hoped that women now doing war work would not have to be permanently provided with other industrial work. The place of the English woman was in her home.

A B.E.A.M.A. Discussion.

What was said during a discussion held by the B.E.A.M.A. on the 15th inst., at the Connaught Rooms (Mr. Rosling in the chair), has mostly been said a thousand times before, but the whole tone of the meeting was satisfactory in that it indicated a recognised need for action. About 55 members and visitors were present, and the discussion was opened by Mr. T. C. Elder, who had something to say on the vital importance of making adequate preparations for peace. Victory in the field, said the speaker, would give us a firm foundation of industrial confidence and prosperity. All that was needed was plenty of active optimism, but the engineering industry must get to work to help itself. British engineering had given an amazing instance of industrial development. Its productive capacity had been increased enormously during the past fifteen months, and the shock of peace would be staggering if the industry did not make timely preparations. The capital invested, the plant laid down, and the workers trained, to meet war needs, must all be utilised. If they were employed as intensely in peace as in war, the cost of the present struggle would soon be wiped out. But it was useless to expect the Government to have any policy regarding what should be done to maintain our engineering productive power. Engineering manufacturers had a clear idea of what was wanted, but they must secure the co-operation of labour and of voters. A new organisation was required to address, on behalf of the engineering industry, the people of this country and the commercial communities of other countries, and to impress on public and private buyers the positively racial importance of supporting British industries, of increasing our turnover, and of securing more comprehensive production. Such an organisation—not "out to do business," at any rate directly—should secure all-round support; indeed, it had a "constituency" ready at hand in the million or so of munition workers and the several millions of soldiers, who realised what our engineering industries had been worth to us during the war. The directors of the engineering industry would justly be held culpable were no plans made for the vigorous resumption of business on the conclusion of peace. The duties of the new organisation would include action in support of our interests abroad, and would consist, in fact, in securing full utilisation of our former and additional engineering capacity after the war, and the most efficient application of industry to Imperial service.

In continuing the discussion, Mr. Percival Marshall emphasised the importance of forming an organisation which should be as broad and influential in composition and scope as practicable, without losing strength by lack of concordant interests. It was very important that British firms should secure as high and wide a reputation in the production of cheap goods as they had already secured in the production of first-class output. There was nothing undignified in catering for cheap markets. On the contrary, the latter represented a very profitable field, and one giving ample scope for the ability of our designers and the employment of our spare labour and plant. Neither living costs or wages could possibly return to pre-war level for years to come, and the sound policy appeared to be to hold and extend markets by improved design, methods, and organisation, so that high wages could be afforded. Firms who acted on this principle would get the pick of the labour market and be free from many of the troubles which were likely to arise in other cases.

Mr. Lee Murray asserted very emphatically that it was useless "to wait for other people to do something." Individual effort was essential. Having got the equipment, it was necessary to get the foreign market. The secret of German success in this direction was not simply representation by men conversant with the language of the country; not catalogues in metric units and quotations in c.i.f. prices; not long credit, bribery, corruption or general sharp practice. The Germans had *earned* the foreign trade which they had built up. In the Colonies, for instance, they employed Colonial staffs, and they saw that their representative knew both the goods and the market. To know one without the other was useless. In emphasising the importance of publicity in neutral markets on behalf of British trade, Mr. Wile said that all neutral markets were still being exploited energetically by German agents. He suggested that a B.E.A.M.A. meeting might be devoted very profitably to bringing together employers and representatives of labour in the electrical industry in order that the workers might present, without prejudice, their views on "the war after the war." These men should be consulted now, and such a discussion might prove unique in the tortuous history of the industry. This suggestion was received most favourably by subsequent speakers, and an informal gathering of representatives of the two "sides," whose interests are really identical, may be expected at an early date.

The Chairman (Mr. Rosling) pointed out that, as the official returns showed only 3½ per cent. unemployment in the engineering and shipbuilding trades during the period 1911-14, there was little scope for increased output unless trade unions abandoned their policy of limitation. Workers must be educated to the idea of "getting much by doing much." Work must be made attractive by its wages and conditions. In future we must work double shifts if we would capture and hold German trade. Personally, he believed that our industry was thoroughly well organised, but the Press could render sterling service by teaching the working classes the advantage of doing their utmost and thus securing better pay. Limitation of output was ruinous, and it was attributable on the one hand to ignorance of workpeople, and on the other to fear that piece-rates would be cut if wages rose above a certain level. A protective tariff alone would give us that security of prospect which would justify bold development and, given the Imperial market, we should be able to add to it the market of the world.

Mr. Dunlop struck a warning note. After the war, he said, we should be faced by decreased "investible" capital, high rates of interest, and reduced industry. A French Commission was in America arranging for the transfer of many millions sterling worth (annual) of machine tool business from Germany to the States; the commercial discussion in progress between Germany and her Allies would exclude us from the markets of our enemies; and by seizing the Chinese railways, Japan had secured virtual control of Chinese internal trade. Success in co-operation was dependent on individual initiative, and it was most important that our many small and medium-sized firms—successful within their limits, but not equipped for foreign trade—should take on a more strenuous existence and get together in groups to take full advantage of the information provided for them, whether by a more efficient Consular service or by private enterprise. We had gone to sleep in our success and in our imagined security. We had not realised that eternal vigilance was required. The tariff question must be faced—no longer as a "party" problem—and we must have a tariff as an "instrument of negotiation" with other Powers.

After sixteen months of war, said Mr. Longbottom, we had labour organised for production and for employers to do their equal share; all trades must organise themselves. A committee from both Houses, strengthened by the assistance of active business men, was required to study the new problems of international trade and the formation of a Ministry of Commerce. The tariff question was no longer one of politics. Some of the best men from our industries should be now at work, and it would pay us to secure their whole energies for the task, in getting well ready for peace. We needed co-operation in *all* industries, and we needed a Ministry of Commerce *now*. In his opinion restriction of output had gone for ever. Its suspension had meant a great increase in earnings, and the worker would not consent to go back to pre-war wages.

Nitrogen Fixation in Russia.—It is reported from Petrograd that an important company has been formed in that city for the purpose of manufacturing nitrates from the nitrogen of the air in accordance with the well-known Birkeland-Eyde process. The new undertaking will, it is understood, work in conjunction with the Norwegian company owning the patents in connection with the process, and the necessary plant is to be established in the north of European Russia, near the White Sea.

ELECTRIC HEATING.

By GEORGE WILKINSON, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS *at Edinburgh, December 14th*, 1915.)

THERE is probably no branch of electricity supply in a more flourishing condition to-day, or receiving greater attention from both electrical engineers and the public, than that of electric heating as applied to dwelling-houses and business premises.

Over two years ago the ELECTRICAL REVIEW* commenting on the enterprise of the "Point Fives" concluded its remarks as follows:—"One might suggest that there is still scope for the 'point-five,' who feels inclined to become fractionally smaller still, to consider some scheme of heating at 'so much per room' during the winter months. Small heaters suitably placed and automatically controlled by a thermostat . . . adjusted so as to maintain a temperature of about 60 deg. F., might meet the case; but, of course, it needs a really simple and reliable method of temperature control and a relatively low charge per unit, neither of which may materialise just yet."

Since the above comment appeared there has been little, if any, change either in tariffs or economy of usage; nevertheless, the development of electric heating has made rapid progress, the rate of progress at the present day being greater than ever. This is largely due to improvements in the electric radiators themselves, these improvements having developed concurrently with a reduction in the prices of the apparatus. Radiators of modern design known under the generic term of "electric fires" have proved themselves to be reliable and satisfactory, while the prices at which they can be obtained are more reasonable than formerly.

Electric heaters to be permanently satisfactory must be capable of quickly raising the atmosphere of the apartment to a comfortable temperature during the coldest day of winter and under the most unfavourable weather conditions. This entails a rating of not less than 1½ watts per cubic foot of room space. In apartments with abnormal window area, an exposed aspect, or subject to draughts and traffic, the rating should be at least 2 watts per cubic foot. Assuming a rating of 1½ watts per cubic foot as being sufficient for the coldest day of winter, this rating is obviously too high and, therefore, wasteful for every other day of the year.

The crude regulation obtained by providing only one or two switches for an electric fire, whereby its power can be reduced to two-thirds and one-third of its full output, does not in any case furnish the required control, first, because such switches are seldom used, or are not used at the right time and for the correct period; and secondly, because the external temperature and the weather conditions are constantly varying at irregular intervals, so that no simple combination of hand-operated switches can meet the case or prevent considerable waste of current.

It follows, therefore, that all apartments heated by electric fires of adequate power are at the present time (except in the few instances where thermostatic control is employed) costing substantially more for electric current than they should do, while such apartments are not so comfortable as they might be owing to the constant fluctuation of temperature ensuing on the unstable weather conditions.

Mr. W. A. Gillott has already demonstrated that an apartment is heated more economically by means of a high-power heater or heaters, suitably controlled, than by a heater or heaters of lower power in the aggregate continuously in operation.

Another promising field open to electric heating with automatic temperature control is in the almost numberless cases where coal fires or hot-water radiators are in use. It is well known that both these methods of heating are subject to wide variations of temperature due to the vagaries of combustion. It is not possible to co-ordinate the rate of combustion with the constantly varying weather conditions, consequently the apartments are frequently too hot for comfort and at other times dangerously cool. The application of temperature-controlled electric radiators as an auxiliary method of heating will automatically remove these cool periods at little expense for current and with no trouble or attention, thus producing the ideal condition for comfort and health.

For long periods during the spring and autumn, and occasionally in the summer, there are days when the mornings and evenings are cold while the rest of the day is warm and comfortable. The only economical and effective way of dealing with the heating problem during these periods appears to be by means of thermostatically controlled electric heaters ready for duty at all times, for long or short periods, and requiring no attention.

These considerations led the author to give serious attention to the production of a suitable automatic temperature controller.

The apparatus used until the autumn of this year, which is absolutely silent in its operation, has no mechanical moving parts, the only moving element being mercury.

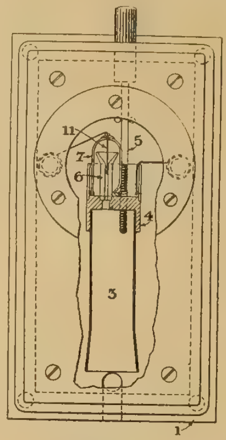
The apparatus consists of two parts:—

(*a*) The thermostat, shown in fig. 1.

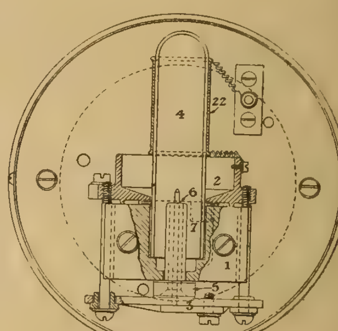
(*b*) The circuit breaker, shown in fig. 2.

A diagram of connections is shown in fig. 3.

The thermostat is constructed with a steel tubular body (3), terminating in a faucet at the top (4), surmounting which is a fine-bore glass tube (6) enclosed by an inverted glass dome (7). The steel tubular body is charged with mercury which, due to expansion and contraction under the influence of heat variation, rises and falls in the fine-bore glass tube into which the mercury chamber vents. Within this glass tube a platinum wire (11) is suspended, which makes and breaks contract with the mercury as the latter rises or falls. Such a thermostat should operate without oxidisation of the mercury or destructive sparking, on the pressures used by electricity-supply authorities. This is achieved by surrounding the "make and break" contact by an inert gas, by carrying the platinum wire through the top of a superimposed glass dome into which it is hermetically sealed. The rim of the glass dome is closed round the bottom by a mercury seal in the faucet, thus forming a permanently gas-tight chamber of sufficiently flexible dimensions to allow the mercury column to travel freely the whole length of the fine-bore tube. The glass dome is filled with a suitable inert gas, preferably hydrogen. The temperature at which the instrument operates can be controlled by screwing or unscrewing the adjusting screw (5) protruding through the top of the cover. Thus the thermostat can be readily set to any desired temperature. Due to the protection afforded by the inert gas, the thermostat is capable of breaking an alternating or continuous-current circuit conveying 30 watts or over at 250 volts without destructive sparking or discoloration at the point of "make and break." This is about five to six times its normal duty.



Front Elevation—Part Section.
FIG. 1.



Elevation, Part in Section.
FIG. 2.

The circuit breaker is formed by two bodies of mercury concentrically arranged and forming the two poles of the electric circuit. The point of "make and break" is on the top rim of the hollow porcelain insulator (5) separating the two concentric mercury poles (6) and (7). The "make and break" takes place in an inert gas which is impounded by the superimposed glass tube (4) carried in the earthenware fixing block (1). The outer pole of mercury (7) also fulfils the function of a permanent gas-tight seal to the tubular glass chamber. The inner mercury pole makes contact with the bottom insulated metal bar (3) to which one line wire is attached. The outer mercury pole makes electrical contact with the metal dish (2) surmounting the earthenware fixing block, and to this metal dish the other line wire is attached. The "make and break" is effected between the two poles by the slow rise and fall of the concentric ring of mercury. Notwithstanding this slow rise and fall, however, both the "make" and "break" are instantaneous owing to the surface tension of the mercury, and the breaker can be depended upon to interrupt a current of 20 amperes at 250 volts without oxidisation. The breakers have successfully dealt with a current of 30 amperes at 200 volts (6 KW.), but the standard rating is fixed at 15 amperes.

A small coil of enamelled high-resistance wire (22) is wound upon the cylindrical glass chamber of the breaker. This coil, which takes approximately 8 watts, is connected through the thermostat to one pole of the supply, as shown in fig. 3. When the mercury rises to a point corresponding with the temperature for which it is set, contact is made in the fine-bore tube with the platinum wire and the circuit is thus completed through the coil upon the circuit breaker. This coil quickly becomes warm and causes the inert gas within the glass cylinder to expand, thus expelling a portion of the outer concentric column of mercury through a connecting duct into the surrounding receiver until the connection with the centre pole is broken, thus opening the circuit and putting the radiator out of action.

After the radiator circuit has been broken, the thermostat, due to cooling, also breaks the heating-coil circuit. The heating coil on the circuit breaker now cools and the gas contracts, causing the mercury forming the outer pole to rise until it stands well above the centre mercury pole; gradually the surface tension of the mercury is overcome, when it rolls over the edge of the concentric insulator and forms a complete contact over the whole surface, thus putting the radiator to work once more. The cycle is repeated from time to time as the temperature of the apartment reaches the maximum and minimum temperature variation allowed.

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* ELECTRICAL REVIEW, Vol. 71, p. 687, 1912.

It is obvious that the mercury within the circuit breaker is always subject to change of level due to barometric effect. The effect of this is slightly to vary the time of the operations of "making" and "breaking" circuit; but this is negligible in actual working.

An unusual feature in the equipment is that the instruments require charging with inert gas after they are fixed in position and charged with mercury. This may sound formidable, but is in practice a simple operation which can be carried out by any man of average intelligence.

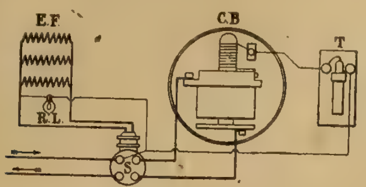

Fig. 3.—Diagram of Connections.—c.b., Circuit breaker; t., thermostat; s., four-terminal plug switch; e.f., electric fire or convectors; r.l., red lamp or luminous radiator, not controlled.

The setting screw (5) is withdrawn until the mercury in the capillary tube and the platinum wire are well apart. After the radiators have raised the apartment to the required temperature the setting screw is screwed in until the mercury just touches the platinum wire, when the instrument is set. Variation in temperature up or down can be readily obtained by screwing the setting screw further out or in.

It is obvious that the thermostat can be put to other useful purposes. For instance, in the summer it can be connected to a 30-watt fan at 200-250 volts, and set so that the fan automatically starts when the temperature of the room rises above, say, 65 deg. F., and stops when it falls below, say, 62 deg. F.; thus the fan requires no attention and cannot waste electric current. An electric fan so controlled has been in use in the author's office all last summer with excellent results.

Again, the author is of opinion that switches for high-tension circuits can be made on the lines of the circuit breaker, which would present advantages both in cost, safety, size, and convenience over the well-known oil-break switches. In such cases the "make" and "break" would be controlled by raising and lowering the gas chamber in the mercury seal.

There are also many cases where a reliable electric contact is required which is used at long and indefinite periods only; such, for instance, as fire-alarms and alarms for other purposes. In such cases the ordinary contacts are liable to fail owing to dirt, roughness, or oxidisation. Mercury in hydrogen makes a reliable contact which can be depended upon for all time notwithstanding absence of attention and long periods of disuse.

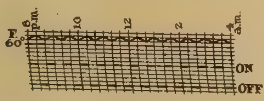

Fig. 4.—February 6th, 1915.

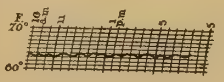

Fig. 5.—January 12th, 1914.

The author has experimentally applied thermostatic regulation to a gas stove of modern type for heating his study.

Fig. 4 shows a 6-hour temperature chart taken in an office, with a corresponding pressure chart showing the periods when the electric radiator is on and off. The size of the radiator was 2 kw., equivalent to a rating of 1½ watts per cubic foot.

Fig. 5 shows a temperature chart taken in the same office with a 6-kw. radiator in use, which is equal to a rating of 4½ watts per cubic foot. The circuit breaker was carrying 100 per cent. above its rated load and the circuit was broken and re-made approximately every ten minutes. The periods during which the radiator was "on" were short, and the "off" intervals were long.

The controller already described has been unfavourably criticised due to the fact that both the thermostat and the circuit breaker require charging with inert gas after fixing. Again, their field of application is limited due to the type of circuit breaker used; for instance, it is obvious that it cannot be used on board ship or on a train.

Both these objections have been successfully met in the more recent types as follows:—

The thermostat is now made with a very small glass dome surmounting the capillary tube and having a gas space of less than one-sixth the capacity of the earlier pattern. The small amount of air impounded therein by the mercury seal is not expelled, but the oxygen it contains is allowed to combine with the mercury at the point of "make and break" while the thermostat is at work. After working for a short time the mercury absorbs the small amount of oxygen in the impounded air and a film of mercurous oxide gradually forms in the upper part of the capillary tube, thereby making the temperature regulation less accurate. This oxide is then expelled and washed over into the mercury seal by screwing down the adjusting screw, thus again providing clean pure mercury at the point of "make and break" and restoring the sensitiveness of the instrument. After the wash-over the thermostat is again set to the required temperature point and the mercury then continues to "make" and "break" without deterioration.

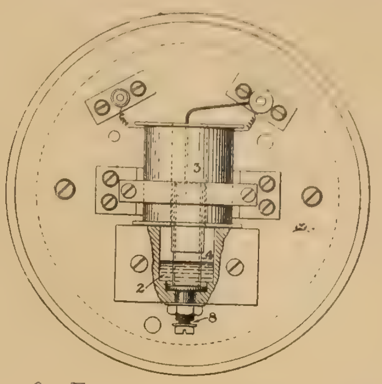

Fig. 6.—Elevation of Circuit Breaker.

The circuit breaker is of the magnetic class and has a light moving element of the simplest type. Fig. 6 shows the circuit breaker with the cover removed. The energy absorbed by the shunt coil (3) when the heating circuit is broken is about equal to the loss in a modern electricity meter, viz., approximately 2 watts. The split iron tube (4) performs the double function of armature and conductor; it falls by gravity into the mercury bath (2) and rests upon the terminal (8) at the bottom of the mercury bath, thus completing the heating circuit. The "break" is very quick owing to the light moving element, while the spark on breaking is most effectively blown out by the strong magnetic field set up by the shunt coil on the end of the armature.

This type of circuit breaker has operated continuously at from 15 to 20 breaks an hour on a circuit loaded to 3.25 kw., and has aggregated over 10,000 interruptions with little or no wear on the end of the armature; thus it can be depended upon to operate for years without attention.

Alternatively, a large radiator may be split up into two parts, the smaller part being continuously in use while the major portion is put under the control of the temperature regulator.

Judging from observation made last winter, the author is led to believe that a considerable economy in current consumption for a given result can be obtained by the use of a small "uncontrolled" radiator in the hearth—for cheerful effect—together with a convector or convectors of greater power, thermostatically controlled, the latter forming the main source of heat. Rough comparisons between this method and the use of a thermostatically controlled all-radiant fire used in the same apartment point to a small saving in current in favour of the combined arrangement.

The problem here involved is common to all methods of heating and is by no means a settled question, viz., to what extent should the air of an apartment be heated, and to what extent should radiant heat be supplied. The question will be answered differently by different individuals, but probably some mean can be arrived at. There is reason to think that experiments on radiant electric heaters in conjunction with electric convection heaters would be the easiest way to arrive at some general basis for the correct proportion of heat in each form.

THE DESIGN OF HIGH-PRESSURE DISTRIBUTION SYSTEMS.

By J. R. BEARD, M.Sc., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *December*, 1915.)

The general distribution of electrical energy to individual consumers at high pressures is of comparatively recent introduction, but the last decade has seen an enormous development both in the number and in the size of such systems. Similar methods were found essential for the various railway electrification schemes, and also for the larger tramway systems. Up to the present, the method of distribution for lighting has not been radically altered, but owing to the ease with which a sub-station—unlike a power station—can be installed in almost any position, there is a growing tendency to split up the more extensive low-pressure networks into sections, each fed by a separate sub-station. As the use of electricity for lighting and other domestic purposes increases, there is little doubt that these sections will gradually decrease in area, with a consequent increase in the number of high-pressure feeding points, so that in this, as in other branches of electricity supply, the distribution will eventually be at high pressure practically to the consumers' terminals.

Not only is the cost of distribution at high pressures considerably less than at low pressures, but also it is thus possible for a single power station to supply economically over an enormously greater area than that which was previously practicable, and in consequence by better diversity factor and larger and more efficient generating plant great reductions have been effected in the cost of electricity. The maximum economy from these advantages is still far from being obtained, and there is, therefore, every prospect that in the future the growth of high-pressure distribution systems will be equally as rapid as it has been in the past. The growth should, however, be in size and not in number, since in order to reap the full benefit of improved diversity factors and increased efficiency of generation it is essential that each system should supply the whole of the demands of the area which it serves, and also that the area served should be as large as possible.

A well-designed distribution system is that which secures the following essential characteristics at a minimum total annual cost:—

(*a*) Safety in operation both as regards the operating staff and the public generally.

(*b*) Suitability of the supply for the purposes for which it is required.

(*c*) Freedom from interruption of supply.

The chief items which make up the annual cost are the following, and it is the sum total of these which should be a minimum:—

1. Interest on capital expenditure.
2. Repairs and provision for depreciation.
3. Switchgear attendance.
4. Energy losses in the mains.

1. It is unnecessary to say anything as to the desirability of keeping down capital expenditure; the chief danger is usually lest this point should receive too much attention at the expense of other items. There is, however, a further way of reducing interest charges, namely, by a low rate of interest, and this can only be secured by a permanent and steady business. This is a further argument for extending and consolidating the area of supply so that the revenue of the undertaking is less subject to trade fluctuations.

2. A low cost of repairs goes hand in hand with low depreciation charges, since both depend on the permanence of apparatus and its freedom from breakdown. Money is doubly well spent on these points since it not only reduces repairs and depreciation, but helps to ensure security of supply.

3. Particularly in the case of static sub-stations, attendance is often very difficult to arrange for, and there is, therefore, a strong reason for reducing it as much as possible by closer localisation of breakdowns so that the only part of the system which is affected is that in the immediate neighbourhood of the fault. Cheaper labour can be employed if apparatus is designed to prevent automatically the more serious mistakes in operation. Such design tends to increased safety in operation.

4. Loss of energy in the mains can be reduced by increased capital expenditure, and it is, therefore, a question of the correct balance between the two. It can also be reduced by linking up the various parts of the system in order to utilise the diversity of their loads, a process only rendered possible by using means for localising the effects of breakdowns.

The essential characteristics of the system are not incompatible with designing it on the basis of minimum annual cost, since, though they may in a few cases increase the capital expenditure, this is discounted by savings in other ways.

The object of this paper is to endeavour to indicate on the basis of the preceding general principles the most suitable choice of apparatus and the means whereby that apparatus can be used to the greatest advantage.

Mains.—Overhead mains are necessarily more subject to breakdowns than underground mains, so that from the point of view of security of supply the latter are to be preferred, unless special circumstances, such as liability to serious subsidence, increase the risk of damage to cable. It is found from extended experience that per mile of main the average number of serious breakdowns of overhead mains is only about double that on underground mains. Overhead mains are, however, more liable to cause temporary interruptions of supply by being automatically disconnected on transitory short-circuits which do not cause permanent damage. The advantage of overhead mains is their lower capital cost, more particularly at higher voltages; this is readily seen by glancing forward for a moment to fig. 6, which shows comparative annual costs per mile for various voltages, allowing a slightly higher figure for the maintenance of overhead mains and including a reasonable figure for wayleaves. For low voltages and small sizes there is not much to choose on the score of cost, and underground mains are therefore preferable on account of their other advantages. As the voltage and size increase, however, a considerable saving is effected by the use of overhead mains; and such saving is often increased by the difficulty of finding direct routes for cables in the open country where roads are few and winding.

While it will be seen from the foregoing that the use of overhead lines in open country is frequently fully justified, they have further disadvantages which must always be borne in mind, viz.:—

(*a*) They usually require a special wayleave.

(*b*) The inductive drop is much greater than that of an equivalent cable.

(*c*) If overhead lines are run in parallel with cables neither can be operated at their maximum economy.

(*d*) They tend to lower the power factor of the system as a whole.

(*a*) The objection to wayleaves is not so much their cost as the trouble and delay in obtaining them, and the fact that they can seldom be bought outright.

(*b*) The inductance of a 3-phase circuit, other factors remaining constant, varies as the logarithm of the distance between the conductors; the higher inductance of overhead lines is, therefore, inherent in their construction, since this distance must be many times the corresponding distance in a cable. The increase in voltage drop with lagging power factors is quite serious in the case of heavy-section lines, and consequently the use of overhead mains means either a reduced radius of transmission for a given voltage, or extra capital cost in providing additional copper.

(*c*) If a cable and overhead line of equal section are connected in parallel the higher inductance of the overhead line causes the total current to divide unequally between the two circuits. This not only prevents the two circuits being run at their most economical current density, but also, owing to the resistance losses being dependent on the square of the current, they are greater than if the current were divided equally. Further, owing to the difference in the inductance of the parallel circuits, there is a phase difference between the currents in the two branches. This results in the arithmetical sum of the currents in the branches being greater than the total current, thus causing additional resistance losses and a reduction in the carrying capacity of the circuits. To take a concrete example, assume that 300 amperes at 6,000 volts and 50 cycles is to be transmitted through a 0.15 sq. in. cable and a 0.15 sq. in. overhead line in parallel. The actual current in the cable will be 210 amperes, and in the overhead line 105 amperes, while the resistance losses are increased by 24 per cent. as compared with the losses if both circuits were either cable or overhead line.

(*d*) So far as the power station and the mains are concerned, the wattless current produced by the extra inductance of an overhead line will be as deleterious as if it were produced by consumers' apparatus.

Switchgear.—The primary use of switchgear is to isolate faulty apparatus, and consequently to interrupt or prevent heavy short-circuit currents. This is the determining factor in its design. As the tendency is for distribution systems to supply a denser load, it follows that the maximum short-circuit current is continually increasing: for not only is there a larger kilowatt capacity of running plant on the system, but also a greater number of feeds into a fault. The conditions are further aggravated by higher distribution voltages.

The breaking of a heavy short-circuit can be best likened to the detonation of an explosive, and if the switch is badly designed the tank will be blown off and the whole switch wrecked. It seems probable that the chief explosive effect is to be found in the rapid generation of gas beneath the surface of the oil. Switches for heavy duty are usually designed with air cushions and vent pipes open to the atmosphere in order to remove the gases, but these measures do not materially relieve the pressure in the tank, as apparently the inertia of the liquid causes an exceedingly high local pressure which is transmitted hydraulically to all parts before the oil has an opportunity to move at its free surface. It is, therefore, necessary either to reduce the intensity of the explosion or to build the switch strong enough to withstand it. Recent practice tends towards quickening the break by decreasing the inertia of the moving parts and by accelerating their movement by means of powerful springs. Attempts have also been made to use the magnetic forces of the current for this purpose, since such an arrangement has the advantage that the more severe the short-circuit the greater is the speed of break.

Perhaps the most obvious way of reducing the violence of the explosion is to cut down the short-circuit current by reactance coils. Except in connection with generators the use of these coils is attended by many disadvantages, and they should only be looked upon as an extra precaution kept in reserve to deal with unforeseen difficulties.

In practice, the only means of circumscribing the effects of a bus-bar fault are to divide the system into a large number of isolated networks, thereby involving uneconomical working, or to divide the system into sections by means of graded overload gear, which can seldom be relied upon to discriminate properly. It is, accordingly, imperative to make the switchgear a sound job, and any saving in capital expenditure is dearly bought if it in any way increases the risk of breakdown, particularly as the cost of switchgear is relatively small compared with that of the mains. One very common error is to save money by proportioning switchgear according to the capacity of the apparatus which it controls; this entirely overlooks the primary duty of switchgear, namely, that of dealing with short-circuits, the severity of which may be as great on small apparatus as on large.

Faults on switchgear fall into three categories:—

1. Faults under short-circuit conditions.
2. Failure of apparatus under normal conditions.
3. Faults due to mistakes in operation.

1. If for any reason a switch is unable to operate properly, an explosion may occur when breaking a short-circuit; it should therefore be isolated from other apparatus on the panel, and all the leads to it should be insulated in order to prevent them being short-circuited by the products of the explosion. Current transformer primary windings should always be of heavy section.

2. Potential transformers should not only be most carefully constructed, but their number should be strictly limited, and under no circumstances should they be connected to the bus-bars without the intervention of an oil switch.

3. Mistakes in operation probably account for more switchgear faults than any other cause, and are liable to be made even by the most careful operator, so that so-called "fool-proof" arrangements should not be considered as disparaging to the operating staff, and undoubtedly justify their slight extra expense, quite apart from the increased safety for operators and other persons who may be working on the switchgear.

The first and most obvious precaution is an interlock between each oil switch and its corresponding isolating switches in order to prevent the isolating switches being either opened or closed unless the oil switch is open, thus preventing any possibility of making or breaking circuit on an isolating switch.

The second precaution is an arrangement to facilitate the routine earthing of feeders, which is responsible for numerous mistakes owing partly to the fact that the person who is carrying out the earthing cannot be at both ends of the feeder at once. It is difficult to protect against earthing a feeder which is alive from the far end, and all that can be done is to operate the earthing switches from a safe distance and to make the earth as quickly and definitely as possible.

The third precaution is to guard all live apparatus either by screens or by making the switchgear ironclad. It is a simple matter so to interlock the guarding arrangements with the switchgear mechanism that it is quite impossible to obtain access to live conductors or to make any such conductors alive while access can be obtain to them.

(To be continued.)

DISCUSSION IN LONDON.

Mr. P. V. **Hunter**, in opening the discussion, expressed his appreciation of the large amount of work and great care involved in preparing the paper. The author's main theme was a justification of the complicated system of distribution adopted on the N.E. Coast, and the paper had an intense practical basis. He (the speaker) had always felt that an interconnected system must be economical if it could be realised. He felt sure it was not generally realised that the copper losses could have such a widely different load factor to the load factor of the system, as shown in fig. 3. Another surprising thing was the shape of the curves shown in fig. 4; they fell lower than one would expect, but the author had assumed a high-load factor. He thought some people would be inclined to argue against ¼d. per unit for losses; and he would not have put the figure so high—it cost more than it did to generate energy for the consumer allowing for the bad effect on the load factor.

Mr. **Partridge** said he was glad to see that the author referred to the early work of Dr. Ferranti and the Deptford scheme—he (the speaker) had been associated with that scheme for 27 years, and was naturally very much interested in the progress made. He was rather disappointed that the author had not gone more fully into the use of underground cables for over 20,000 volts, as these would undoubtedly be used in the future; he was himself considering a system of underground mains to work up to 60,000 volts. For low periodicity work, he thought there was a great future for single lead-covered cables when such high pressures came into use. It was most important that switchgear should be kept proportional to the capacity of the generating station; often the latter was increased as much as ten times, but the old oil switches and fuses were still retained, and sooner or later caused a shut-down. He was at present installing oil switchgear capable of dealing with over 200,000 KW. Generation of gas in oil switches was one of the principal causes of failure; such switches should have a quick break and as many breaks as possible. It was essential to have a good head of oil above the break—a good head of oil and a short break representing the best conditions. It was also essential that such switches should be strongly built, on account of the high gas pressures generated—he had known of one case where the explosive pressure had blown the switch contacts together again. It was most important to cover up every particle of conducting metal in the neighbourhood of an oil switch; he recalled a visit to America, during which he witnessed the experimental destruction of two oil switches, with 36,000 K.V.A. behind them. In the case of the first switch experimented with, the gases short-circuited all the terminals and the switch burnt up. The bus-bars should be insulated if possible throughout their length, and, if possible, built in; it was a great mistake to only place them on insulators, as under heavy short-circuit conditions they might move and short-circuit themselves. It was also a necessary precaution to interlock the oil switch and its isolating switches. He was inclined to agree with the author that reactances should be avoided, unless the system was working with a large amount of power, and apart from the generating plant, where they were essential. As regards the magnetic switch referred to, he had had one designed on the lines suggested, but had not, so far, had the opportunity to test it. His experience was that it was a bad thing to open a switch too soon; a time lag was better in all switches, but when they did open, they must do so quickly. From inspection, he came to the conclusion that American switchgear was better than anything he had seen on the Continent; German switchgear, he thought, was much too light, but he hoped they would not see any more of German switchgear here—or of the Germans themselves!

Mr. B. **Welbourn** thought the author could have said a good deal more on the subject of wayleaves, but he was glad he had mentioned it. Only recently two cases had come to his notice, one farmer in each case holding up the work of crossing some land, resulting in increased costs of £600 and £300 respectively in construction. The author appeared to have erred on the low side in the life of cables; the L.G.B. had recently had the considered opinion of engineers in favour of a 30-year life, and all types of underground work were now given 25 years life. He had always considered the life of an overhead line as equivalent to the life of the pole, and a good creosoted pole would last 30 years—the Post Office average life of poles had been stated as 22 years. In Table 4, the author had taken 6,000 volts, when no step-up transformers would be required, but these were required, and he thought should be included in the 11,000 and 20,000-volt calculations for mains. He asked what was the maximum KW. load per cable which it was safe to transmit at the present time; he knew of one system where it was proposed to transmit 15,000 K.V.A. at 33,000 volts per cable.

Mr. W. B. **Woodhouse** said no one was likely to dispute that the interconnected system was an economical one, but, in considering any system, a most important factor was its suitability for development on commercial lines. They had piecemeal development, and it was, therefore, important to take into account time and growth, so as to get the minimum expense during development. In looking at the N.E. Coast distribution system, it appeared that about 100 sub-stations were dependent on single mains, and this was commercially necessary; such mains would form part of the network as it developed. In regard to the author's diagrammatic lay-outs, it was necessary to consider the effect of more than one generating station in the system. Progress was so rapid that to the ordinary intermediate pressure distribution there might be added later a high-pressure large-mesh system over the area. He considered that the criterion should be the cost of energy delivered *from* the sub-station, not to it.

Mr. **Brazil** was in general agreement with the speakers, but pointed out the widely differing conditions in a metropolitan area like London, where a few large sub-stations of up to 3,500 or 4,000-KW. capacity were adopted in preference to a number of smaller ones. They would get admirable security with the interconnected system combined with what he would call the interleaved system and with large batteries.

Mr. **Wedmore** said the moral of the paper was to err on high side in cost of mains and switchgear. He wished the author would extend his investigations to all classes of plant, as standard apparatus obviously could not be the best to use under all conditions, and it was important to know when increased expenditure was justified. It was clear that to tie the network sodidly required good oil switches. There had been many wrong conclusions drawn as to the behaviour of such switches; the high pressure feature had been understood for some years, and the engineer was tempted to try to stop an "irresistible force" by an "immovable body"—but the real solution was to set up a body which could be easily moved. No doubt the light oil tanks were a good thing; if such tanks bulged it allowed the "irresistible force" to expend itself. In addition to the inertia of the oil, one had to allow for the energy of the moving oil. Many switches would be improved by taking oil out of them, though a sufficient head of oil was important, as also was high speed, though there was a limit to that, and he did not think much more was to be gained in that direction. He thought the explosion feature in switches as a limit was not sufficiently appreciated by the author.

Mr. J. R. **Beard**, in replying to the discussion, said he had calculated the curves in fig. 4 for a 40 per cent. load factor, as well as for 50 per cent., and found very little effect on the result. Switchgear and other apparatus was not sufficiently standardised above 20,000 volts to enable reliable data for higher pressures to be given. He had been criticised previously for taking the capital charges on the cables too low, and was, therefore, interested in the suggestion now made that they should be allowed a longer life. The cost of step-up transformers had not been included in calculations for high pressures, but he doubted whether this would affect them materially. No one not used to the interconnected system would realise the ease with which additions were made to it. He would be interested to find out whether two distribution systems would pay. As regarded the question of moving oil in switches, the top plates were often damaged, presumably due to this cause.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SPAIN.—The Spanish Government have prohibited the exportation of manufactured graphite, and wolfram or tungsten.

FRANCE.—The French Government have decided that asbestos, unmanufactured or manufactured, may be exported or re-exported without special authorisation when consigned to the United Kingdom, the British Dominions, Colonies and Protectorates, Belgium, Japan, Montenegro, Russia, Serbia, or the United States.

PHILIPPINE ISLANDS.—A circular, recently issued by the Insular Collector of Customs, directs Customs officers to use due diligence to prevent violation of the provisions of the Philippine Islands trade marks legislation, which lays down that no article of merchandise shall be imported into the Islands if it bears a name or mark calculated to induce the public to believe that the article is made in the Philippine Islands, or which copies or simulates the name of any domestic manufacture, manufacturer or trader, or copies or simulates a domestic trade mark or trade name which is legally registered. The circular further prescribes conditions under which domestic or foreign trade marks or trade names may be registered in the Philippine Islands, and thus receive legal protection in the Islands. Such marks or names are to be recorded in a book for that purpose in the office of the Customs Appraiser at Manila, and facsimiles of such marks and names are to be furnished to, and filed by, the Collectors of Customs at the sub-ports of entry.

COLOMBIA.—A recent decree provides that where goods dispatched for Colombia from a foreign port are to be transhipped *en route*, at another foreign port, the relevant invoices shall be presented for legalisation to the Colombian Consul at the port from which the goods are originally shipped. The Consul is immediately to notify the Consul at the port of transhipment, by official letter, particulars of the goods, viz., the number, marks, and total weights of the parcels, the value of the goods, the Colombian port for which destined, the name of the consignees, shippers and consignors, and other particulars which it may be convenient to notify.

A new decree imposes a tax on commercial travellers in the Department of Cundinamarca in respect of each of the business houses they represent. The tax amounts to 25 pesos (£5) per month during the first year of residence, and 20 pesos (£4) per month during the second year, but after that no further payment will be required. Travellers who can prove that they have resided in the territory of the Department as representatives of foreign firms for two years previous to the date of decree (July 22nd) will be exempt.

UNITED KINGDOM, &c.—The Board of Trade have issued a supplement to the *Board of Trade Journal* giving the latest information as to the articles prohibited to be exported from the United Kingdom and certain foreign countries, viz., Denmark, France, Greece, Italy, Japan, Netherlands, Norway, Portugal, Roumania, Russia, Serbia, Sweden and Switzerland. Copies of this supplement, dated October 28th, 1915, may be obtained from Messrs. Wyman & Sons, Fetter Lane, E.C., at a cost of 3d.

RUSSIA.—The Board of Trade are informed that the Russian Minister of Finance has decided that, as a temporary measure, and for the period of the war, owners of goods may obtain certificates of origin from the competent Consuls of Allied or neutral countries resident in the country through which the goods pass, or from which they have been obtained, for dispatch to Russia. These certificates, however, as well as the accuracy of the declaration of the origin of the goods made therein, must be further certified by the local Russian diplomatic or consular officer.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

17,116. "Electrical table lamp." J. Heiberg. December 6th. (Convention date, January 9th, 1915, Norway.) (Complete.)

17,128. "Electrically-driven vehicles." British Thomson-Houston Co., Ltd. December 6th. (General Electric Co., U.S.A.)

17,155. "Electrical rotary converters." G. Schroeder. December 6th.

17,160. "Accessories for use with telephones." J. G. Statter & E. C. St. John. December 7th.

17,168. "Incandescent electric lamps." A. A. Canton. December 7th.

17,169. "Illuminating elements for electric lamps." A. A. Canton. December 7th.

17,172. "Magneto driving and adjusting mechanism." R. Bell. December 7th. (Complete.)

17,185. "Thermo-electric couple." C. E. Foster. December 7th.

17,191. "Magneto-electric ignition machine for internal-combustion engines." O. Heins. December 7th. (Convention date, January 22nd, 1915, United States.) (Complete.)

17,195. "Electro-magnetic switches." British Thomson-Houston Co., Ltd. December 7th. (Electric Controller & Manufacturing Co., U.S.A.) (Addition to 20,534/11.)

17,228. "Electric bomb-dropping airships." F. B. Kavanagh. December 8th.

17,229. "Telegraphy." E. S. Heurtley. December 8th.

17,247. "Talking machines and driving mechanism therefor." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). December 8th.

17,260. "Apparatus for reversing the polarity of electric circuits for telegraphic and other purposes." A. Orling & Orling's Telegraph Instruments Syndicate, Ltd. December 8th.

17,265. "Means for effecting remote control of electrical apparatus." F. N. Pickett & Igranic Electric Co., Ltd. December 8th.

17,302. "Electric lampholders." E. A. Welch. December 9th.

17,317. "Electrically-controlled travelling mine, aerial, submarine, or trench torpedo, or the like." W. G. Grattan & J. M. Echavarria. December 9th.

17,319. "Electric heaters." C. R. Belling. December 9th.

17,328. "Anodes for electro-plating." G. Jones. December 10th.

17,333. "Joint boxes for electric cables." W. Cairns & J. Steel. December 10th.

17,335. "Electric light bulbs or lamps." A. Speight. December 10th.

17,349. "Electrical signalling devices." E. A. M. Reid & Callender's Cable & Construction Co., Ltd. December 10th.

17,366. "Electric heating and cooking devices." J. Sayers. December 11th.

17,368. "Support for wires or cables." W. D. Reid. December 11th.

17,374. "Trolley heads of electric tramways." R. H. Hollingsbee and W. H. Cottee. December 11th.

17,386. "Telephone systems." Relay Automatic Telephone Co., Ltd., and H. J. Herink. December 11th. (Complete.)

17,389. "Synchronous wave transmission motors." G. Constantinesco and W. Haddon. December 11th. (Complete.)

PUBLISHED SPECIFICATIONS.

1914.

20,146. Prepayment Electricity Meters. Landis & Gyr, S. A. September 24th. (September 25th, 1913. Addition to 18,464/14.)

22,871. Regulating Devices for Mixed Pressure Turbo-compressors. Warwick Machinery Co. (1908). (General Electric Co.) November 21st.

22,927. Apparatus for Operating Electrical Devices at a Distance Siemens & Halske, Akt. Ges. November 23rd. (November 21st, 1913.)

22,940. Measurement by the use of Sound Waves. R. A. Fessenden. November 23rd. (April 2nd, 1914.)

22,950. Cooling of Turbo-dynamos and like Electrical Machines. Allgemeine Elektricitäts Ges. November 23rd. (November 21st, 1913.)

23,072. Illumination of Surfaces. British Thomson-Houston Co. & H. C. Wheat. November 25th.

23,113. Electric Incandescent Lamps. E. Terry. November 26th.

23,122. Vapour Electric Devices. British Thomson-Houston Co. (General Electric Co., U.S.A.). November 26th.

23,236. X-ray Apparatus. H. W. Cox & Co. and H. E. Donnithorne. November 28th.

23,321. Control of Switches for Electric Lighting or Heating Systems. Electric & Ordnance Accessories Co. and J. Etchells. November 30th.

24,589. Attachment for Connecting the Plug-tester to the Sparking Plug in Internal-combustion Engines. F. Sirett. December 24th.

1915.

1,173. Tilting Electric Furnace for Melting and Refining Metals. F. Bassanese. January 25th.

1,609. Electric Regulating Devices. A. G. Bloxam (Robert Bosch, firm of). February 1st. (Addition to 27,961/12.)

1,715. Incandescent Electric Lamps. W. Sanders & Co. and W. Sanders. February 3rd.

1,740. Electric Radiator. Majestic Electric Development Co. February 3rd. (February 3rd, 1914.)

2,386. Electric Switches, Circuit-breakers, and the like. British Thomson-Houston Co. (General Electric Co., U.S.A.). February 15th.

2,883. Conduits for Electric Cables and the like. W. Oates. February 23rd.

3,984. Controlling Systems, particularly applicable to the Control of a Telegraph Strip. A. F. Dixon. March 13th. (March 16th, 1914.)

5,629. Electric Signalling Apparatus or Indicators. B. L. Bobroff and Universal Indicator Co. April 14th.

5,673. Contact Breakers for Magneto-electric Machines. C. C. W. Simpson. April 15th. (April 15th, 1915.)

5,943. Electric Switches. G. Giles. April 20th. (April 24th, 1914.)

8,458. Means for joining up the ends of Electrical Conduits. F. W. Uren & A. Gamble. June 7th. (June 18th, 1914.)

9,158. Electric Cooking. Jackson Electric Stove Co., R. C. Griesbach, H. H. Holmes, C. H. Smith, & F. H. Williams. June 22nd.

10,957. Electric Railway Systems. Rt. Hon. H. L. Samuel, W. Slingo, H. C. Gunton, & C. H. Douglas. July 28th. (Addition to 14,984/14.)

10,958. Electric Railway Systems. Rt. Hon. H. L. Samuel, W. Slingo, H. C. Gunton, W. H. Powell, & J. R. Kingston. July 28th. (Addition to 15,539/14.)

12,267. Electric Controller and Circuit-making and Breaking Device having a Closed Field. L. Renault. August 25th. (August 26th, 1914. Addition to 24,121/14.)

Japanese Electrical Exporting.—Messrs. Bagnall and Hilles, of Yokohama, who have also branches in Tokio, Osaka, and Moji, announce that the manufacture of electrical supplies in Japan is assuming such large proportions that they are now prepared to negotiate with foreign import houses with regard to the supply of Japanese electrical goods in all branches.

THE
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ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: December 31, 1915. [No. 1,988.

Page
1915 ... 833
Aircraft Insurance ... 834
British Co-operation in Russia ... 834
The Decimal System ... 834
The Monopoly Question in Germany ... 835
Rubber ... 735
Direct-Current Motor Maintenance, by S. Lees (*illus.*) ... 836
Electrolytic Alkali Manufacture in Canada (*illus.*) ... 838
Coke as a Boiler Fuel (*illus.*) ... 839
Reviews ... 839
Some Difficulties of Design of High-Speed Generators (*illus.*) 841
Electrical Fittings on Leasehold Premises ... 842
Correspondence—
The Institution and Alien Enemy Members ... 843
War Items ... 843
Legal... 843
Business Notes ... 845
Notes ... 849
City Notes ... 852
Stocks and Shares ... 855
Share List of Electrical Companies ... 856
Control Gear for Electric Lifts, by A. L. Hawes ... 857
The New Plant of the China Light and Power Co., Ltd. (*illus*) 858
The Magnetic Testing of Bars, by A. Campbell and D. W. Dye (*illus.*) ... 859
Electric Lifts ... 861
The Design of High-Pressure Distribution Systems, by J. R. Beard (*continued*) (*illus.*) ... 861
The French Electrical Industry ... 863
New Patents Applied for, 1915 ... 864
Abstracts of Published Specifications ... 864
Contractors' Column ... Advertisement page xviii

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NOTICE.

IN view of the recent Increase in the Postal Charges, our Subscription Rates for Great Britain and Canada will until further notice be increased to £1 1s. 8d. and £1 3s. 10d. respectively.

1915.

THIS issue of the ELECTRICAL REVIEW appears on the last day of the year—a year, we think, whose demise will be observed without regret by the vast majority of our readers, for truly it has been marked by few auspicious events, but many failures, reverses, misunderstandings, and the like. Of the war we shall say nothing, lest, like the military "experts" whose forecasts are daily falsified by the event, we trespass beyond the limits of our knowledge; we shall content ourselves with uttering the fervent hope that 1916 will see the end of it, and the forces of the Allied nations crowned with victory, crushing and complete.

In accordance with our custom, however, we propose briefly to review the events and tendencies of the past year so far as they affect the engineering industries in general, and the electrical industry in particular; and foremost amongst these we are disposed to place the evidences that the nation is being gradually aroused to a sense of the importance of adopting scientific method in every branch of industry. The appointment of an Advisory Council on Industrial Research by the Board of Education, which was followed by the institution of committees to report on inventions for the Admiralty and the Ministry of Munitions, was an epoch-making event, and though no striking results have as yet been manifested openly, we know that the Council is busily engaged in the preliminary work which is indispensable to the success of its future operations. As we have pointed out, the necessary reform cannot be effected purely by the fiat of the Government; the support of the nation to the new policy is essential to success, and not a moment should be lost in completing our preparations for the return of peace and the outbreak of the industrial war.

The inexorable demands of the War Office for soldiers, and the Ministry of Munitions for skilled workmen, have weighed heavily upon the engineering industries, and have clashed with the call for maintained exports on the part of the Board of Trade; the question whether to comply with the one or the other has been the subject of anxious consideration on the part of electrical manufacturing companies. "Business as usual" has proved to be impossible, and work is being carried on under very unusual conditions indeed. The directors, however, are in close touch with the authorities concerned, and every effort is being made to fulfil all three of these conflicting demands; women, who have played a most unexpectedly prominent part in the maintenance of industry, have been very largely employed, and the skilled men have been "diluted" by the increased use of unskilled labour, with the grudging and suspicious assent as a rule of the members of trade unions, many of whom, with a remarkable narrowness of vision, seem more concerned as to their personal welfare than as to the safety of the Kingdom.

An unforeseen feature of the war work has been the extraordinary activity of the electricity supply stations of the country, at any rate those engaged in supplying industrial areas; their output has increased by leaps and bounds, new plant has had to be installed as quickly as possible, and temporary stations —including one of 10,000 KW.—have been erected and put to work in order to provide motive power for factories manufacturing munitions of war. The extreme importance of our electricity works in this emergency has compelled recognition, and it is certain that the extended use of electricity during the war will have a permanent beneficial effect upon the supply industry.

Another consequence of war conditions is the shortage of arc lamp carbons, which has compelled many street lighting authorities to install half-watt lamps in place of their existing arc lamps, thus giving an unexpected impulse to the adoption of the new lamps. In this connection, though quite apart from the influence of the war, we may again refer to the introduction of the Ediswan tungsten arc lamp, a product of British research from which important developments may result.

The linking-up of the various undertakings supplying electricity to the Metropolitan area has made considerable progress during the year, and will in normal times result in a more reliable service at lower cost; the war, however, indirectly led to the abandonment of the scheme of the London County Council for the unification of the supply to London, the necessary majority being unavailable owing to the absence of members on military service.

In the department of electric traction, the most notable event was the successful inauguration of the electrified system of the London and South-Western Railway Co. on part of its suburban lines; additional sections will soon be in running order, and it is hoped that next year the London and North-Western Railway will be added to the list of electrically operated undertakings. The Manchester-Bury line of the Lancashire & Yorkshire Railway Co. is also practically complete.

Lastly—for space is limited—we may permit ourselves a note of gratification with regard to the splendid progress that has been made by the electric-battery vehicle in this country during the past year. For many years, in season and out of season, we urged upon our readers the practicability and desirability of fostering the adoption of the commercial electric vehicle in British towns; eventually the Municipal Electrical Association awoke to the prospects in this field, and appointed a committee which has done admirable work; and now we are able to say that the number of electric vehicles in use or on order is approaching 700, as compared with 150 a year ago. It will not be many years before we announce that the number is approaching 7,000.

Aircraft Insurance.

We read that the Committee on War Damage, which is backed up by nearly a hundred municipalities, is memorialising the Prime Minister, strongly condemning as unjust, as well as inexpedient, because it is wasteful in time and energy, the present Government scheme for insurance against damage by aircraft or by bombardment. The memorialists hold that individual citizens should not be held responsible for damage inflicted upon them by the enemy, but that the nation, as a whole, through the responsible Government, should give a fair compensation to owners of properties of all kinds. We believe that this sentiment is subscribed to by very large numbers of public and private individuals, who consider that the present scheme operates unfairly, because it throws upon certain sections of the community—namely, owners, lessees and occupiers of business and residential properties—burdens and responsibilities which should be shared by all. It was stated a few weeks ago that arrangements had been made to compensate, out of the Prince of Wales's Relief Fund, some of the poorest people who were the victims of the last raid by enemy aircraft. Failure to pay insurance premiums involves the penalty of non-compensation so far as the State is concerned, but if you are poor or deserving enough you may be assisted from a voluntary source, which is, in reality, a National Fund. It is not to be supposed that owners of large works or mansions outside the imagined range of enemy aircraft will pay premiums purely for the sake of assisting those whose geographical ill-luck brings them within the danger-zone. They may, perchance, discover that their imaginations as to the real range are incorrect, and, having failed to insure, will reap disaster. On the other hand, if the range does not extend, one part of these islands must bear the burden alone. The risk and the loss are those of the entire nation at war, and the financial obligations should be distributed amongst us all. We hope that the Committee will be able to demonstrate to Mr. Asquith the inequity, the inexpediency, and the unpopularity of the present system.

British Co-operation in Russia.

We welcome very heartily the registration of the Electrical Manufacturers' Co., of Great Britain, Ltd., which is announced in another part of this issue. It has been clear for a long time past that co-operative action between a number of our firms was needed if the British electrical industry was to be in a position to benefit to any particular extent from the unparalleled opportunity opened out for us in Russia by the war. We congratulate the seven well-known firms who have launched this joint enterprise for carrying on business in that vast market. Other organisations which have adopted the co-operative principle in other branches of engineering trade have enjoyed excellent success in Russia already, and we believe that there is a splendid opening for the seven concerns which have representatives on the board of this new company. We wish them every success, and expect to witness the further application of the same policy of combined action both in the Russian market and in others as well, as one of the good results of the war. The capital is not large when one considers it in comparison with that of Teutonic organisations, but we have to remember that it is but a beginning, and we trust that the effort will lead to very substantial profit and developments.

The Decimal System.

We have received from M. H. Planchon a further (very long) letter with regard to the adoption of decimal coinage in this country, in which he raises objections to the retention of the pound, and champions the cause of the shilling divided into 100 parts; Mr. Turnbull also has sent us a lengthy communication on the subject, advocating the adoption of a coin equivalent to the franc. We are very much indebted to our correspondents for their very practical support of our main contention—namely, that the adoption of decimal notation throughout our systems of coinage, measures, and weights is a question of most urgent importance to the future welfare of our industries—support which we cordially appreciate.

We have to bear in mind, however, that this is a technical journal, and we cannot pretend that the detailed discussion of rival systems of coinage is within our legitimate sphere of operations. We have stated that the adoption of the metric system—which is a matter closely affecting engineers—is, in our opinion, far more important than the coinage question, and while we have devoted many pages to the former, we have only briefly set forth our views on the latter. In accordance with this policy, we are regretfully obliged to decline to open our pages to a general discussion on decimal coinage systems.

In two new specifications just issued by the British Engineering Standards Committee, we note with interest and pleasure that the metric equivalents of all the British standard dimensions are given, in parentheses. This practice has been followed for some years by the American Institutes of Electrical and Mechanical Engineers, by way of preparation for the change-over, and might be copied with advantage by British engineering institutions.

Mostly, the equivalents are carried to the nearest hundredth of a millimetre, which, as we have shown, affords an ample degree of accuracy far beyond what can be attained under workshop conditions, the maximum departure from identity being only $\frac{1}{5}$ mil; but, in some cases, the Standards Committee carries the figures out to thousandths of a millimetre, *i.e.*, to an accuracy represented by 0·00004 in. or $\frac{4}{100}$ of one mil. The National Physical Laboratory states that an accuracy of half a mil, or nearly 13 times the value suggested by the Standards Committee's figures, is rarely attained in the workshop, even by its own experts. Moreover, these exiguities of measurement occur only in connection with the definition of limits between which the dimensions may be varied at pleasure—ranges of two to five mils! With due respect to the Committee, we suggest that the needs of the case would have been more than covered with the nearest hundredth of a millimetre throughout—the maximum possible error in that case being beyond the range of workshop practice.

Some indication of the growing demand for the early adoption of the metric system will be found in a Note elsewhere in this issue.

The Monopoly Question in Germany. THIS question was referred to at the recent meeting of the Berlin A.E.G., when Dr. Walter Rathenau remarked that he did not consider himself sufficiently competent to give a definite opinion as to whether an electricity supply monopoly would, or would not, be brought into existence. In his view, however, the monopolisation of electric power, as such, was out of the question and impracticable, as electric power must remain the first power for working in the future. But a monopoly of electricity supply for lighting was also scarcely probable, and, he might say, not practicable. On the other hand, approval could be given to the principle upon which the kingdom of Saxony was proceeding in connection with the Government scheme for the utilisation of electric power. This principle aimed at the supply of electricity being left in the hands of the State for the working of the main railway lines, whilst the requirements of the secondary railways and the tramways were to be reserved for private industry. The kingdom of Bavaria had also expressed itself in favour of this principle, and the speaker hoped that the measures to be expected in Prussia would likewise be conformable to the principle, and that the price of electric supply would not become dearer as a result of future legislation. On the other hand, reports issued from Dresden since the meeting of the A.E.G. declare that the local authorities in Saxony, which own electricity works, are disturbed at the proposal of the Government to nationalise the supply of electricity as they apprehend that their independence in the supply of light and power would be endangered. The local authorities have therefore given united expression to their distrust of the proposal, but they are prepared to combine with the State in the supply provided that the State does not have a preponderating position in such an association. It appears, moreover, that the Union of Municipal Electricity Works in Saxony has had plans prepared for some time past for meeting the requirements of the kingdom by the erection of large overland stations.

Rubber. THERE has been a decidedly good undertone lately in the rubber market, and there has been some tendency, indeed, towards an improvement in values so far as plantation descriptions are concerned, while there has been rather a better demand for Brazilian grades, although the quotation for fine hard Para is, of course, at a fair discount compared with the best plantation material. The tone has undoubtedly been assisted by the situation of shipping in the Mediterranean and the risks to which vessels are exposed in navigating those waters. Consumers have purchased rather more freely, and it is believed that there is a fair amount of buying yet to be done in connection with orders for finished material which have been placed upon the books. The inquiry has been pretty general both for early and forward deliveries, and the outlook for every description remains good. It is possible that there may be a slackening off in new inquiries with the turn of the year, but this is regarded merely as a seasonal feature. America has within the last week or two been inquiring for big quantities, and this has naturally tended to assist the firmness of the market. The arrivals coming to hand have been quite moderate, and the statistical position is regarded as satisfactory. Last month the stocks were further reduced by 228 tons, to a little over 7,000 tons, against about 5,000 tons a year ago, and 6,000 tons in 1913. American consumption is proceeding at a very high rate, and this point should not be disregarded in considering the possibilities of the future. There was a good deal of talk a short time ago about Germany buying large quantities of rubber in America, but a good deal of this seems to have been without substantial foundation, though it is a fact that the parcel post between North America and certain of the European neutral countries has been very extensively used for the conveyance of rubber to the Central Powers. Steps have been taken, however, which will probably put a stop to this, except upon any but the smallest scale. An official cablegram received from Kuala Lumpur reports that the export of plantation rubber from the Federated Malay States during the month of November amounted to 4,636 tons as compared with 4,120 tons in October and 2,889 tons in the corresponding month last year. The following is a comparative table showing the export for three years.

	1913.	1914.	1915.	
January	2,131	2,542	3,473	tons.
February	1,757	2,364	3,411	"
March	1,737	2,418	3,418	"
April	1,626	2,151	2,777	"
May	1,225	2,069	2,708	"
June	2,005	2,306	3,403	"
July	1,781	2,971	3,687	"
August...	2,363	1,850	3 796	"
September	2.000	2,879	3,984*	"
October	2.160	2 897	4,120	"
November	2,062	2,889	4,636	"
Total	20,847	27,336	39,413	"

* In the original statement for September, the total exports were returned at 3,334 tons, or 650 tons below the actual amount, as now corrected.

DIRECT-CURRENT MOTOR MAINTENANCE.

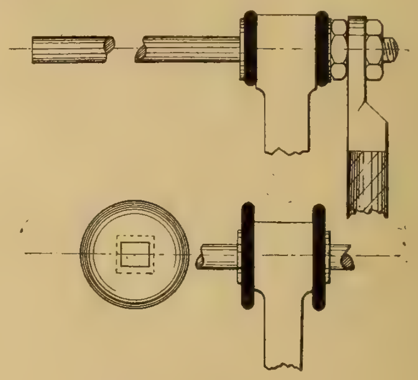
By S. LEES.

The successful operation of direct-current machinery may be summed up in two words—*efficient maintenance.* Cleanliness is of course an important factor, although it is not impossible to interpret the meaning thereof too liberally, as in the case of the over-zealous attendant who, in his laudable endeavours to make the bright parts shine, applied the polishing medium so lavishly that the brush-holders became jammed fast with the superfluous mixture. Nor does the term apply only to those parts that are always visible to the eye, to the neglect of those which are not quite so conspicuous, such as the brush-gear on the underside, that comes to grief through the cumulative effects of deposited grease and carbon dust.

In the majority of cases of breakdown and failure the principal operating cause is very simple—namely, "dirt." In its present application the word "dirt" is meant to cover any foreign substance or matter which by its presence or proximity may have a deleterious effect on the working of electrical apparatus. As an example: ordinarily one looks upon milled cereals as being of clean and impeccable character. Now, motors working in a flour mill will in the ordinary course of things get coated more or less with dusty matter floating in the atmosphere, which, contrary to the generally accepted notions of maintenance men, is positively harmful to the well-being of electrical machinery. Grain, especially in the milled state, is a notoriously bad heat conductor, and even a comparatively thin deposit of such flour-like dust may cause a motor armature or field coil to become dangerously over-heated. Again, such conditions sooner or later become favourable to the leavening action which takes place under hygroscopic or oleific combination. Slowly, it may be, but surely, the insidious deterioration of the protective insulation goes on until the inevitable breakdown happens. So may we for our purpose classify clean edible flour as "dirt."

Similarly in woodworking shops, dry sawdust in itself is harmless enough, but, nevertheless, this substance must be regarded as more than a potential foe. An unheeded accumulation of grease-soaked sawdust that had subsequently become carbonised, has proved to be the undoing of many a good motor. The presence of dry coal-dust also augurs ill for the good working of either motor or switchgear; in combination with oil it is certain to cause trouble quickly, the effect of such a mixture on insulation being exceptionally destructive.

The writer has observed that plant in engineering works, including central stations, is peculiarly prone to trouble due to breakdowns and failures of various kinds. More shabby makeshifts and temporary expedients are to be found in high than in lowly places. The ubiquitous grease lump inseparable from the shop or station ought to be shunned like the plague. It seems strange that while the storekeeper guards waste, wipers, and the like, with mint-like vigilance, requisitions for comparatively valuable stock and material are commonly honoured with surprising ease. Lubricating oil comes within the latter category, and the oil-can or feeder, like the widow's cruse, never need run dry. Those so-called minor insulation troubles, such as breakdown of brush-holder insulation, failure of mica or mica substitute between commutator-bars or clamp-rings, perishing of field-coil connections, and "shorting" of outer turns of field windings, which develop later into absolute breakdowns, oftener than not have their origin in the thoughtless use of the oil-feeder or greasy wiper. In addition to the deleterious effect of oil on insulation, an oily surface acts as an excellent dust-arrester on the fly-paper principle. Then does insulation become measureable by a different arithmetic, not so much the volts necessary to puncture a given thickness, as the comparatively low pressure (backed by power) required to break down the surface security of an otherwise good enough insulator. The insulation of brush-holder spindles and brush arms, especially the bottom or underside sets, is commonly attacked and broken down in the manner described. Closer attention might with advantage be given to the mechanical features of brush-holder insulation by designers. Motors, especially those of the protected or enclosed type, are notable examples of weakness in this detail. It is quite a common thing to find only a very small fraction of an inch of insulating surface separating "live" metal from the earthed carcase of a high-voltage motor. It is very rarely that failures of insulation due to pure puncturing occur on direct-current up to 600 volts, the trouble, even with the best classes of material, being almost invariably due primarily to surface leakage. A commonly-used form of insulator for a brush-holder spindle is shown in fig. 1. (*a*) Usually, the flanges are almost surface flush with the metal brush rocker, thus providing a very short and easy path for leakage. A larger flange (fig. 1*b*) is a simple but effective improvement giving, as it does, greater security against breakdown from "creeping." Curiously, though, a really adequate size of flange is the exception rather than the rule. The type of brush rocker represented at fig. 2 is extensively used. The open slot provides facility for the insertion and withdrawal of the brush-spindle and its insulation, and allows of the use of some form or other of moulded insulator, which has the additional advantage of cheapness. It is evident that the tightening of the spindle-shank by means of its nuts comes, after a certain point of compression is reached, wholly upon the insulator itself, particularly at some point or other of the sharp-angled junction between the core and flanges. Consequently, trouble is common at this point, as the insulator being of a more or less brittle and friable nature fractures, and thus becomes an easy prey to the insidious action of oil and carbon or copper dust. Built-up insulation, preferably of sound mica, with allowance provided on the core for the necessary tightening of the spindle, should always be used instead of the moulded variety, and the importance of extremely close-fitting joints cannot be over estimated.



Figs. 1*a* and 1*b*.

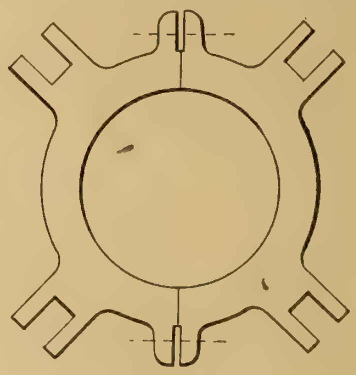


Fig. 2.

Whilst on the subject of brush-holder insulation, a few remarks about the brush-spindle itself may not be out of place. Formerly, spindles of round section throughout were used by practically all makers, but as the disadvantages of the round shank came to be better realised, the square spindle came into favour. Considering that the older practice in now obsolete, the writer was surprised some little time back to see an otherwise modern installation of big-powered multipolar motors, all of which were fitted with brush-spindles of round section throughout their whole length. Each spindle carried about a dozen sets of carbon brushes in separately-attached holders, and owing to the great length of the spindles a special insulated steadying ring was necessary for ensuring alignment of the inner ends of the spindles. The introduction of this feature rendered the design unusually bad, as the steady ring, of necessity, occupied space already none too commodious, with the result that the whole of the brush gear was very cramped, making inspection and adjustment difficult, if not impossible, at some points. As if to crown all, the brush leads were attached to the spindles, as shown in fig. 3. Obviously, the removal of a lead would prove an awkward operation, as it means the dismantling of the whole of one section (at least) of brush-holders before disconnection could be effected. It is, indeed, hard to see what useful object the designer could have had in his mind when passing such an inconvenient arrangement. A weak design still in vogue is outlined in fig. 4. The insulation used is mica or its substitute, loosely bent or pressed round the iron bolt which is nutted at both sides of the brush-rocker arm. The *earthed* spindle in itself is enough to warrant condemnation of this design of gear. In the large sizes of motors the design of brush-gear closely follows that of the generator type, of which the bracket construction, or some modification thereof, is representative. The brush-holder arms or brackets are usually made of cast-iron, and attached to a divided bracket ring, which is carried in journals or similar guides fixed to the machine yoke. Trouble is often experienced from failure of the insulation between the brush arms and bracket ring. The part usually attacked first is the edge of the insulating plate, and the cause is surface leakage due to the presence of grease and carbon dust. The simple expedient illustrated at (*a*) fig. 5, is an excellent insurance against trouble of this sort. Many years ago, Messrs. Siemens used a form of brush-holder and arm which was totally encased in a moulded envelope of insulating material. The writer had some experience of this gear, and does not remember a single case of failure or trouble of any sort resulting from its use, even where the working conditions were unusually severe. More recently, another well-known firm has adopted a modification of this construction. In this case the end of the brush-spindle, where attached to the brush-rocker, has an insulating sleeve or block moulded solid on its metal shank. This arrangement makes a strong mechanical attachment, and provided the insulating material is right, results in a thoroughly sound job.

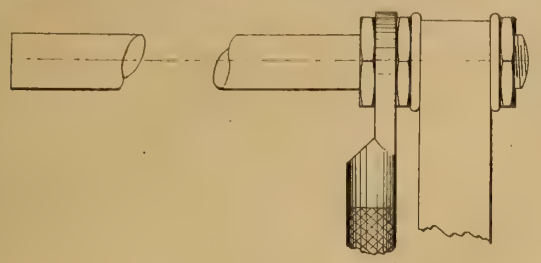


Fig. 3.

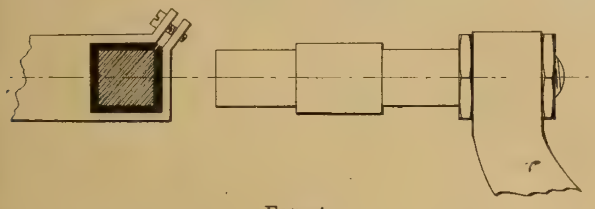


Fig. 4.

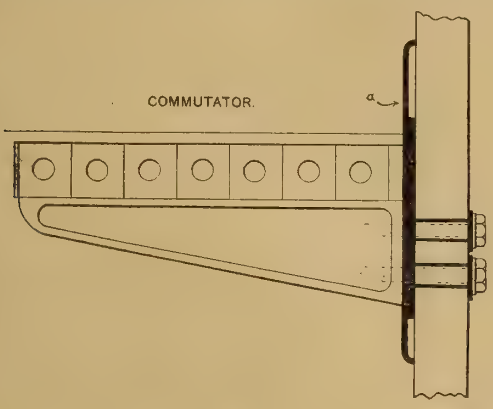


Fig. 5.

Probably in no auxiliary detail of the modern motor does greater diversity of design and fixture exist than in the arrangement of cable terminal attachments. Thus we find terminal blocks fixed to the outside of the yoke shell in all manner of places; others have simply binding post screws protected by thin apologies for insulation bolted directly to the motor case; many are located beneath the commutator, and whilst some are hidden away inside the inner recesses of the motor, in not a few designs the cable leads are simply connected through, the conventional pot-ware or wood terminal block being altogether dispensed with. Undoubtedly, the worst place to thread through cables in an electric motor is at the bottom side of the commutator end cover or bearing bracket. Oil and grease invariably accumulate at this point, and attack the insulation alike of cable and terminal block. One well-known make of motor has its terminal binding posts located in the channel-shaped recess formed at the bottom of the commutator end bracket. Trouble from breakdown of insulation is so common that, in a recently issued design of this make, the arrangement of this detail has been radically altered. Comment is, perhaps, unnecessary on the too-frequent practice illustrated at *a* in fig. 6.

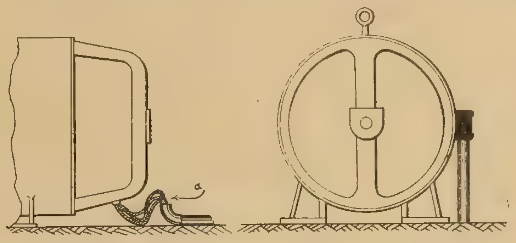


Fig. 6.

The highest possible class of wiring system, properly erected with protective devices *ad lib.*, avails but little if the safety of the whole job depends on the integrity of a few inches' run of uncovered cable. The practice of leaving a bundle of exposed cables between the end of the service leads and the connected apparatus is to be condemned. Of course, a few spirals of wire symmetrically disposed may give a nice finish to a job, but this sort of adornment is better confined to bell-wiring and the like. If it is impracticable to attach the conduit itself mechanically to the motor, then some other equally suitable method should be devised. A strong and neat substitute is available in the numerous forms of flexible metallic tubing, one adaptation being represented in fig. 7. A flagrant case of exposed leads was met with by the writer quite recently. A modern totally-enclosed, type of motor, with a name, had its connecting cables (unarmoured) between the external terminal block and the windings *outside* the case. Another machine, similar to the last-mentioned, had a specially arranged aperture cast in the commutator end cover through

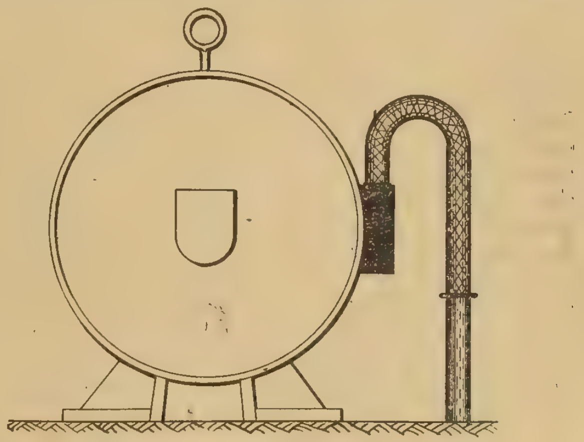


Fig. 7.

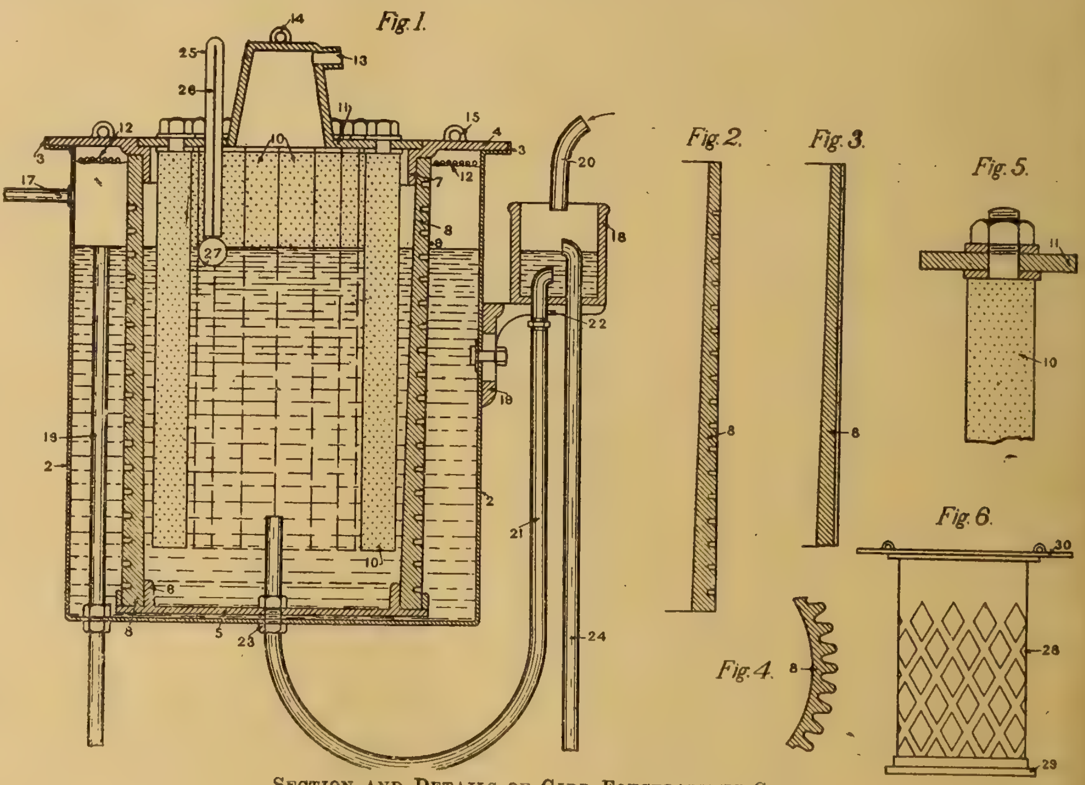
which the armature and field leads were threaded after leaving the terminal box attached to the side of the motor shell. The still prevalent practice of placing jointed and similar connections in awkward or inaccessible positions cannot be too strongly condemned. With modern designing resources there can be no necessity for this, and, in fact, every connected (electrical) detail can, by suitable disposition, be located so as to be accessible for handling without introducing undue risk of harm either to operator or machine. It may seem a trifling detail, but small size hexagonal-headed screws may with advantage be provided with cruciform slots.

The initial installation of a machine often of necessity carries with it difficulties in the way of setting-up and what not, but rarely does expedient fail to secure the completion of even an unusually stiff job. Doubtless, at times, work, especially when contract, is rushed through by hook or by crook, as the saying goes, much of which might have been avoided and more scrupulousness used had the machine not "worked in so cussedly." But experience has long taught that it is not so much the getting in of a job which proves the ultimate criterion of its real service, as the getting out thereof, which, in the course of things mutable, must be considered inevitable. The cases innumerable of motors unnecessarily, or unsuitably, placed in inaccessible positions, would defy cataloguing. Ignorance, carelessness, lack of foresight, and amateurish rule-of-thumb have variously contributed to the failure of such schemes, and, in the fulness of time, the inevitable repair or overhaul becomes necessary. Obviously, such errors are costly, often doubly so, as in many cases subsequent re-lay-out of the plant is out of the question, and so the blunder has to be put up with in the best way possible, the mischievous effect of which falls almost wholly upon the maintenance man. For instance, imagine a big-powered motor cramped up against a right-angled corner, with its commutator end next the walls, one inspection door, or grid, capable of being opened (with careful negotiation) half-way, the other one having to remain closed owing to exigencies of space. Or, take the case where a wall brick had to be removed to make room for the terminal block side fixed to the yoke shell. This absurd arrangement necessitated the withdrawal of the whole motor, which was on a fixed bolted foundation, in order simply to disconnect the service leads. Another case was that of a foundry where a motor was located in a pit roughly dug out of the sand floor, a wooden trap-door being placed over the opening for protective purposes. Armature failures became a frequent occurrence, and bearing seizures were common. Owing to the confined space in which the motor was placed, the commutator and brush-gear were practically ungetatable, and the whole machine had to be removed bodily for withdrawal of its armature. As might be expected, the cavity was always more or less filled with foundry dirt. A cotton spinning mill had had some of its machinery in the earlier processes converted to electric driving, the motors being completely encased in wooden housings. The conditions of working were such as usually obtain in this class of textile work; and the effects of high atmospheric temperature and humidity soon rendered necessary the provision of effective ventilating arrangements. Such obvious conditions make blunders of this kind inexcusable in the eyes of possible converts, who are thus often prejudiced against electric driving. An oversight of this character may easily prove a very costly matter eventually, as the application of an efficient ventilating scheme of the kind mentioned calls for expert knowledge, and may, indeed (considered financially) be almost of equal importance to that of the plant installation, which it serves in the capacity of accessory.

(*To be continued.*)

ELECTROLYTIC ALKALI MANUFACTURE IN CANADA.

Although Canada has considerable salt deposits, her salt industry, at present confined to the Province of Ontario, is of very limited extent. Nevertheless, she already possesses a plant for the manufacture of caustic soda and bleaching powder by the electrolytic method. This plant, the property of the Canadian Salt Co., has been in operation since 1911 at Sandwich, Ontario, and it is described in a report on the Salt Industry of Canada issued by the Government Department of Mines.



Section and Details of Gibb Electrolytic Cell.

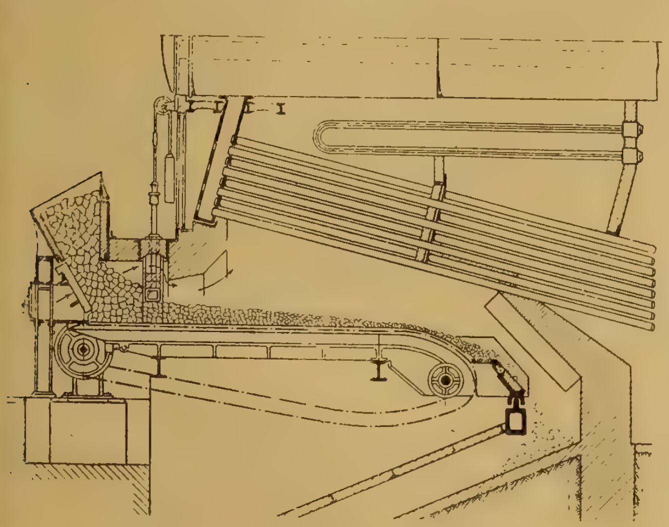
The cell employed for the electrolysis is a modified form of the Gibb type, and its construction is shown in the accompanying figure. The cell itself (2) is built of cast steel, and the diaphragm (8) is said to be of asbestos, although in all probability a mixture of asbestos with some other substance is used in practice. A feature of the diaphragm is that its walls increase in thickness from the top to the bottom of the cell (fig. 2), so that the increase in permeability is compensated by the increased hydrostatic pressure. The cathode consists of a metal jacket placed round the diaphragm, with a number of projections embedded in the diaphragm. It may be either perforated (fig. 6) or corrugated (figs. 3 and 4). This enables the products of electrolysis to be forced into the cathode chamber and out of the sphere of electrolytic action. The anode is made up of a ring of carbon rods (10) which project through the dome of the cell (11), in which there will be noticed the gas outlet (13). It is claimed that the use of the jacket cathode embedded in the diaphragm maintains the permeability of the diaphragm for an indefinite period, for while a certain amount of disintegration goes on on the outer side owing to gas evolved, the diaphragm builds up on the inner side. Further, the intimate contact between the anode liquor and the cathode insures a complete action of the nascent hydrogen at such points, and this destroys any small percentage of deleterious hypochlorite which is often present in the final liquor.

In the cathode cell the sodium primarily deposited of course at once reacts to form caustic soda solution, which is concentrated in vacuum pan evaporators and purified until pure caustic soda results. The chlorine gas produced in the anode chamber is led into bleaching chambers, where it reacts on hydrated lime to form bleaching powder. The products find a ready market in Canada.

The plant at Sandwich consists of 256 Gibbs cells, and they are worked from a 550-KW. Westinghouse generator, which gives 2,500 amperes at 220 volts. As the cells are stated to be arranged in eight rows with 32 in each row, it is to be presumed that each cell consumes 312 amperes at just under seven volts.

COKE AS A BOILER FUEL.

Owing to the shortage of labour (probably as much potential as actual) and the closing of various foreign markets, energetic measures have been taken in Germany to prevent the possibility of a serious coal famine and to utilise huge quantities of coke which would normally be exported. These measures have attained a considerable degree of success, and from various reports it appears that a number of German electricity supply stations are using coke for boiler firing. Where a mixture of coal and coke is used, no particular trouble is experienced beyond that of obtaining and stoking a reasonably uniform mixture of the two fuels, but the use of coke alone is a less simple matter, particularly if machine stokers be used. It is impracticable to break and grade coke so that it can be used satisfactorily in sprinkler stokers, whilst if it be attempted to use coke alone on a travelling grate the difficulty is to ignite the gas-free fuel as it enters the combustion chamber. Normally, heat from an incandescent arch of refractory material over the point of entry of the fuel, frees gases from the latter, and these gases burning with a long flame keep the arch hot, and thus render the whole action of ignition continuous once it is started. With a fuel such as coke, free from volatile gases, this action fails and the fuel ignites late and imperfectly, if at all, as the grate advances.



Section of Coke-burning Furnace.

An ingenious method by which this difficulty has been overcome is shown in the accompanying illustration (from *Z.d.V.d.I.*). The lower part of the coke-feed hopper is lined with refractory bricks and fitted with an inclined grate at the front and a flue at the back leading into the combustion chamber of the boiler. There is thus formed a hopper furnace which preheats the fuel above it, and brings it to incandescence before passing it on to the travelling grate. The greater part of the heat which is not usefully employed in this direction passes beneath the boiler, and is there utilised. This equipment, which is due to Belani (Essen), is said to have been tested with satisfactory results on a water-tube boiler in the Düsseldorf Elektrizitätswerke, though, owing to some mishap during the coal-firing tests, all that could be established was that the results with coke firing were more favourable.

Other tests, this time on a boiler with ordinary horizontal grate, showed that coke may be literally a better fuel than coal of higher thermal value. The heating surface was 1,680 sq. ft., and a flaming coal of 13,000 B.TH.U. calorific value raised 3.4 lb. of steam per hour per sq. ft. of heating surface, or 6 lb. per lb. of coal; on the other hand, coke of 12,600 B.TH.U. per lb. (size ranging from dust to $2\frac{3}{4}$ in.) raised 3.8 lb. per sq. ft. of heating surface, or 6.6 lb. per lb. of coke. The highest measured combustion chamber temperature and the flue gas exit temperature were respectively 1,220 deg. and 376 deg. C. with coal; and 1,145 deg. and 473 deg. C. with coke. The paradoxical superiority of the coke is due to its requiring a smaller surplus of air for combustion and suffering no loss from unconsumed gases or tar. On the other hand, it must be remembered that the preceding data evidently refer to anything but a modern high-power boiler, and no mention is made of the relative costs of coal and coke as boiler fuels. This is at present of minor importance to Germany as compared with the fact that her surplus coke supplies can be used—staving off the possibility of a fuel famine, and permitting full military advantage to be taken of the by-products of coke manufacture.

REVIEWS.

The Mathematical Analysis of Electrical and Optical Wave-motion on the Basis of Maxwell's Equations. By Dr. H. Bateman. Cambridge: University Press. Price 7s. 6d. net.

The author intends this book to be an introduction to some recent developments of Maxwell's electromagnetic theory which are directly connected with the solution of the partial differential equations of wave-motion. A complete investigation of the subject requires very great mathematical knowledge, and the author does not aim at supplying proofs which depend upon difficult and complicated analysis, but, rather, at simply stating such proofs and dealing in detail with those portions of the subject which do not require such advanced mathematical treatment. The principle of relativity, which has been recently treated by several authors, has not been dealt with, and details of numerical computation are omitted.

Perhaps to the physicist and electrician the most interesting portion of the work is that dealing with the structure of the aether. It is shown towards the end of the book that mathematical analysis indicates three distinct theories of the universe, which may be described briefly as follows: —

Aether.	Matter.
(1) Continuous medium.	Aggregates of discrete particles.
(2) Discontinuous medium, consisting of a collection of tubes or filaments.	An aggregate of discrete particles attached to the tubes.
(3) Continuous medium.	An aggregate of discrete particles to which tubes are attached.

The first theory is, of course, that which has in the past received most attention, and is the one which is most satisfactory from an experimental point of view, and the mathematical study of theories (2) and (3) may possibly help to enrich it.

Some of the subjects treated of are (1) a general survey of the different methods of solving the wave-equation, (2) polar co-ordinates, (3) cylindrical co-ordinates, (4) the problem of diffraction, (5) homogeneous solutions of the wave-equation, (6) electromagnetic fields with moving singularities, (7) miscellaneous theories.

For the practical man the work is much too mathematical, but for the student of pure science it is a most useful addition to the literature of the subject. It remains to be added that much of the work is original and due to the author himself.

Tramway Track Construction and Maintenance. By R. Bickerstaffe Holt, M.I.M.E., etc. London: *Tramway and Railway World* Offices. Price 10s. 6d.

Despite the large amount of tramway construction which has been executed during the last 20 years, there is very little literature setting out how such work should be done, what to avoid, what to insist upon, and how to secure a permanently satisfactory job. Tramway track construction is in many respects special and peculiar; the necessity for conforming to street alignment and levels, the condition that it must be paved over, and that the track paving must bond into that of the rest of the street, and other limitations which will occur to any tramway engineer, differentiate it widely from, *e.g.*, railway track construction. There is, therefore, ample room and justification for a book which describes methods which have been found satisfactory and gives a reasoned consecutive account of the work, including the important question of maintenance.

Mr. Holt's book partly fills this room. The author is permanent way engineer to the Leeds Tramways, and, as such, has been responsible for the construction and maintenance of a large tramway system for many years—time enough to find out what happens to tracks in use under conditions of subsoil, surroundings and traffic of considerable diversity; and he has recorded the results of his experience with clearness, sincerity, and a fullness of reasons for his practice and advice that is somewhat rare in technical books of this kind, and will be found refreshing and convincing by his readers. Convincing, that is, in the sense that the reason behind the views expressed is always in evidence.

The first chapter is headed "Concrete Foundations," but is mainly occupied with defective concrete work, as revealed in the course of maintenance and reconstruction, with some discursive remarks on wrong methods of laying and abortive methods of repair. The belief that concrete foundations are good for all time will be dispelled, it is said, in the majority of cases when reconstruction becomes necessary. Mr. Holt rightly insists that fractured concrete is generally due to original defects in construction, and that there is nothing to do but cut it out and replace it.

Chapter II deals with concrete materials. Stress is properly laid upon the selection of hard stone broken to angular shape (it might be added, and to fairly regular size, not exceeding what will pass a 2-in. screen), and of clean sharp sand.

Two novelties are mentioned as having given satisfactory results at Leeds—clinker sand from the local refuse destructors, and "trass," or ground puzzolana, which is claimed to give some elasticity to the concrete, to cause it to set from the centre, and to harden to greater strength. A concrete of 7 stone, 1 trass, 2 sand, and 1 cement is stated to be equal in strength to ordinary 4-2-1 concretes. This deserves serious attention. The use of puzzolana is not *per se* a novelty, as it was used by the Romans in their best lime mortar, which has endured for many centuries in well-known examples, a good omen for the Leeds tracks.

Chapter III deals with repairs to concrete foundations. It ascribes most of the trouble with loose rails and paving to fractured concrete, in the main to longitudinal fractures under one or both rails, and advocates the cutting-out of fractured foundations, replacing the old concrete with a foot of new made with quick-setting cement, and the observance of precautions to keep the traffic weight off the new concrete until it has set.

Chapter IV, entitled "Track Design," commences with the statement that "British permanent way cannot be said to have been too well designed."' It has, in fact, been too much stereotyped, with little regard to the peculiar requirements of each locality, and, in consequence, methods of construction which have been satisfactory in one district have failed in others. The subsoil, the weight and density of the vehicular traffic, the speed and weight of the cars to be run, and the frequency of the service, Mr. Holt points out, should all be considered. He might have added that financial considerations should be duly weighed, and if he had been writing as a tramway company engineer doubtless this aspect of track design would have been given more weight. The most difficult conditions are set by a sandy subsoil subject to alternate heavy rain and drought, where the road bottoming is but a thin crust, entirely cut through by the excavation for the track. These conditions result in irregular subsidences, and either concrete stringers or a complete concrete raft the whole width of the track and margins will fail by transverse fracture. Sleeper construction with hard packing of broken stone under the sleepers becomes the most economical form of substructure. In mining districts, heavy longitudinal sleepers under each rail have proved satisfactory; in sandy subsoil cross sleepers are better. The importance of subsoil conditions is well exemplified by comparison of constructions found successful at The Hague, where the rails are laid directly upon a firm sandy soil, and Amsterdam, where, owing to water-logging, the same method failed, and had to be replaced by concrete foundations.

Chapter V, on rail packing, is a detailed account of the methods and materials used by the author. The importance of this operation and the care necessary to ensure its success in giving the rail bases uniform support and contact justify the amount of detail.

Chapter VI deals with rail laying; the procedure described is thoroughly sound, the pitfalls of inexperience are pointed out, and the reasons for the right, and against the wrong, methods clearly set out. The somewhat controversial question of anchoring is discussed in some detail, mainly as to the proper means of securing the advantages of anchors.

Chapters VII and VIII deal with joints, and are to be unreservedly commended. The second is confined to joint welding, describing both Thermit and arc welding, and their application to both construction and repair work. Mr. Holt has had good results from both, and most experience with Thermit, but is not prepared to admit their superiority to well-made plated joints. It does not appear that the desirability of joints being neither more nor less rigid vertically than the rails themselves has met with the consideration it deserves from tramway engineers generally, and it is not specifically set out by the author.

Chapter IX, on "Wear of Rails," is mainly a statement of facts observed and how wear may be minimised, and is well worthy of careful study. The same remarks apply to Chapters X and XI, on "Composition, etc., of Tramway Rails" and "Rail Corrosion." It will cause some surprise that corrugation is but slightly mentioned, and that no theory of its causes is put forward.

"Track Paving" is dealt with in Chapter XII with much thoroughness, the correct and incorrect methods of sett-laying being fully described. Mr. Holt has found soft wood paving last as well as hard wood on tramway tracks, and thinks that wood paving does not altogether deserve the bad name it has among tramway men. The trouble due to rutting alongside of the rails is not even mentioned, although an illustration of soft wood paving after ten years' service shows this distinctly.

Chapters XIII and XIV, on "Reconstruction" and "Rail Drainage, Cleaning and Grinding," describe up-to-date practice. The Woods-Gilbert rail planer is described and illustrated. The use of this machine seems well worth attention, and may give worn rails a new lease of life.

"Special Trackwork," dealt with in Chapter XV, is likely to provoke some difference of opinion. The author strongly deprecates the existing lack of uniformity in design and layout, to which he attributes excessive cost and the need for stocking large numbers of spares. There should be an effort made to standardise these important materials, and clearly much more might be done in that way than has been attempted. As regards renewable inserts, the author has not found the expected benefit. Wear occurs which prevents the new inserts joining up with the old surfaces. Hence, he prefers solid manganese steel special work. The difficulty of drilling this material is not mentioned.

Appendix A on "Special Track Construction," by Mr. Ernest Lamwith, is a useful addition, the author having selected and developed methods at once simple and suitable for tramway conditions. It may be noted with regret that nothing is said either in the Appendix or any part of the book as to the best methods of transferring the calculated and plotted track positions to the street surface, a matter of no little importance.

In conclusion, one may say that whilst this book is a valuable and very fairly complete exposition of tramway track construction in town streets, it does not deal with the important differences that occur in work on country roads, or unformed roads and cross-country work where mixtures of tramway and light railway methods apply, and where capital economy is of paramount importance. This is no discredit to the author, who has confined himself to the conditions of his own experience, but indicates that a text-book on construction in different conditions is still needed.

Overhead Transmission Lines. By F. Kapper. Translated by P. R. Friedlaender. London: Constable & Co. Price 16s. net.

Naturally this book deals primarily with German regulations and German equipment and practice. The translator has incorporated Board of Trade rules relating to overhead transmission lines, and has used English weights and measures. We believe, however, that all the examples of pole or tower construction are from German practice, and that practically all accessories illustrated (insulators, connectors and so forth) are of German make; such prices as are included appear to be based on German markets for labour and material, and German symbols are used in such formulæ as are included. Occasional reference is made to American practice. It is a pity that English practice and material could not have been incorporated —if not actually substituted for some of the Teutonic matter— but this difficulty always arises in translating any technical work designed originally to meet the requirements of a particular country. As it is made very clear which rules and which apparatus are German, any misgiving based on prejudice or expectancy of confusion should be set at rest.

The main object of the book is to explain fundamental principles, and give data essential to the proper execution of the varied duties falling to the lot of the engineer engaged in modern overhead line construction and maintenance. This aim is very well fulfilled. Numerous worked examples, mostly from practice, are included to supplement the text and illustrate the application of formulæ. The scope of calculations seems to be carried far enough to cover the direct practical requirements of designer and constructor, and no further. The whole work may, therefore, be read with profit by the average student or older engineer interested in this branch of engineering. The author writes from the mechanical standpoint, and no information is included concerning electrical design, pressure surges, corona, etc.

The physical properties of conductor materials are first dealt with, and the relative merits of copper and aluminium neatly compared. Sag and tension relationships are then treated by simple mathematics, and a number of tables, curves and examples are included. The next section, on the design of supporting structures, is necessarily almost entirely mathematical, but the working is made quite clear, and the reader's path is smoothed by systematic arrangement of the various cases considered (single pole, stayed pole, double pole, etc.) and by the inclusion of numerous examples. Lattice pole calculations here and elsewhere in the book might be arranged rather more clearly, and paragraph and section headings, particularly in

Chapter 4, might be thrown into clearer relief. Stability problems and forces set up in foundation blocks are treated analytically in Chapters 5 and 6, and practical notes on means and methods of foundation construction and pole-fixing are given in the next two sections. Pole construction is discussed in a long, well illustrated section, but the notes included on impregnation of timber poles might profitably be extended and made more critical in nature; less than justice seems to be done to creosoting processes, which British experience has proved so satisfactory.

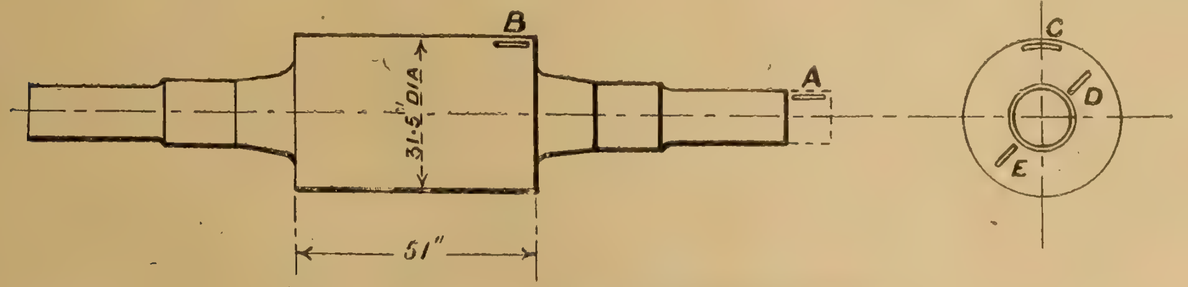
The treatment given to insulators is useful (though by no means comprehensive), and is followed by practical sections on insulator mounting, wire attachment, and joint and branch connections. The chapter on arrangement of wires should certainly be extended, and we believe that some attention might be given to inductance, capacity, and voltage drop calculations. Practical notes on earthing methods and devices are included, and a long chapter deals with crossings over postal wires, railways and roads; after describing and illustrating the general arrangement adopted, the author presents detailed calculations and schedules. The actual erection of poles or masts and wire forms the subject matter of two interesting sections, which are followed by one summarising rules and hints for the design and erection of overhead lines.

An unusual feature and one of great value is the inclusion of sections dealing with instruments for surveying and laying out the route of a line, and with the actual procedure of surveying and entering up the necessary observations. Typical field record sheets are presented, and useful notes and suggestions are made in connection with the erection of poles on private property. A series of curves is included showing the influence of span on cost of construction, and it is pointed out that a span longer than that which is theoretically most economical is often justified. A corresponding section compares various supporting structures with reference to minimum annual charges and on the basis of different spans. The long chapter on local overhead distributing systems should prove very useful if considered in conjunction with English conditions and regulations. The final sections include a model form for agreements with contractors, a schedule of prices, list of tools and appliances; and B.O.T. and V.D.E. regulations relating to overhead transmission schemes.

Taken as a whole this book is excellent, and its production is beyond criticism, except that it is distinctly extravagant of space, and a reduction in price, effected by economy in this respect, would be very welcome in later editions.—R.E.N.

SOME DIFFICULTIES OF DESIGN OF HIGH-SPEED GENERATORS.

In the course of the discussion at Leeds on the paper read before the Institution of Electrical Engineers by Prof. A. B. Field, reported in our issue of December 17th, Mr. S. F. Barclay, of Messrs. Vickers, Ltd., made an exceptionally interesting contribution to the discussion, which we are pleased to be able now to print *in extenso* :—



Rotor Forging for Vickers 5,000-kw. Turbo-alternator.

With regard to the steel rings for retaining the rotor end windings, there is one point to which the author has not referred, and that is the opening of the rings due to centrifugal force. For example, in the case of a typical 5,000-kw. 3,000-r.p.m. alternator when running at full speed, the rotor ring increases 0.03 in. in diameter, and is therefore actually floating quite clear of its seatings. It is not practicable to prevent the floating by shrinking the rings on to their seatings. The floating may have several undesirable effects, but the principal one is change of balance. This undesirable feature is entirely safeguarded against by making the ring and its outer supporting flange all in one piece. This construction is adopted by Messrs. Vickers, Ltd., as standard with all sizes of polyphase turbo-alternators. In the case of single-phase machines, a similar construction is employed, but a band of high tensile manganese-bronze is introduced between the core and the steel ring. The extra cost of the solid steel end ring compared with the built-up construction is justified by the mechanical soundness gained, and the construction also has other useful features. For example, the supporting flange can be given such stiffness that the ring does not need to be registered on the core; an effective gap between the core and the ring may thus be provided, very considerably reducing the magnetic leakage. Moreover, the opening between the ring and the core is most effective in improving the ventilation of the rotor end windings. The short length of rotor coil between the core and the ring is given adequate support by extending the wedges beyond the core into the ring. The ring is made a sound press fit on its seating on the shaft, and is positively driven by keys of ample size. The complete ring is turned from a hollow nickel-chrome steel forging having an elastic limit of at least 40 tons to the square inch, an ultimate strength of at least 50 tons to the square inch, and a minimum elongation of 20 per cent. After being forged the rings are annealed, and after rough-turning are re-annealed, oil-hardened and tempered. The treatment ensures the rings being homogeneous throughout and free from appreciable initial stress. Circumferential and longitudinal tests are taken from each ring.

Under any ordinary condition of out-of-balance—such as occurs in furnace work, etc.—the solid steel end rings are found to keep perfectly cool. The amount of out-of-balance for which the machines described by the author had to be designed is quite unusual, and no doubt it was desirable to introduce a little copper into the rings in the way described.

The wedge described by the author is ingenious, but in my experience is unnecessary. If a good lead is given to the wedge and a metal liner is placed on the top of the coil, all the downward pressure desired can be obtained with an ordinary wedge. Moreover, the wedge described must require special tackle to apply the vertical pressure to the whole of its length, and that might be a grave disadvantage in carrying out a repair on site.

As the rotor revolves, the stress in the bolts increases as they move to the bottom and decreases as they move to the top. Therefore, superimposed on the constant initial stress is an intermittent stress being applied and removed over 2½ million times a day. Since the bolts are a reamered fit in the core, the diameter of the screwed portion must be less than that of the body of the bolt. Therefore, the area of the bolt in the short length between the face of the nut and where the thread ends is appreciably less than that of the rest of the bolt. As the intermittent stress comes on, the short length of reduced area stretches more in proportion than the body of the bolt, causing local weakness. Also, the driving torque by tending to twist the rotor and increase the bolt length adds to the bolt stress, and a short-circuit must similarly add considerably to the stress. It is also to be remembered that the action of tightening the nuts must impose a considerable torsional stress on the bolts. It is, therefore, to be expected that a breakdown will occur in the course of time in consequence of a fatigue fracture at the bottom of the thread just outside the nut. It would be interesting to learn how long the machines have been running, and if there have been any failures. The construction could have been improved by using high-tensile steel bushes, a reamered fit through the core, and with the bolts passing through them with an ample clearance, and turned down their whole length to a diameter slightly less than the diameter of the bottom of the thread.

The statement made by the author at the discussion in London that steel manufacturers would not accept the test in a radial direction immediately below the surface must be contradicted. The maximum stress in the rotor occurs at the root of the tooth, and from every forging made by Messrs. Vickers, Ltd., a radial test is made at that part, and no forging would be used unless the test showed that the properties of the steel were in every respect suitable for the duty. An example of the results obtained in the case of a rotor forging for a 5,000-kw. 2,400-r.p.m. turbo-alternator is given herewith :—

Test.	Description.	Elastic limit.	Breaking.	Elongation per cent. on 2 in.
A	**Longitudinal**	19·5	36·0	34·0
B	**Longitudinal**	20·5	36·0	32·0
C	**Tangential**	22·0	37	28·0
D	**Radial**	20	36·8	14·5
E	**Radial**	19·5	36·4	15·0

It will be noticed that the tensile strength is practically uniform throughout, and the elongation—even in the case of the radial tests—has a very satisfactory value.

It is always possible to work to a factor of safety of at least 6 to 1, and when it is remembered that the tooth stress is a pure tension and constant in magnitude it shows how safe is the forged rotor construction. Provided that high-class forgings can be obtained, undoubtedly the solid forging is the ideal construction for all outputs at 3,600 and 3,000 R.P.M. For large outputs at 1,500 and 1,800 R.P.M. the soundest construction is to have a hollow forged cylinder shrunk on to a through shaft. With either construction a definite guarantee can be given for the strength of the steel in the direction required.

The only possible apology for the rotor built-up of plates bolted together is that the construction saves money.

In dealing with solid forged steel rotors there are several essential points that must be observed:—

1. Large allowances must be made on the forging, so that all metal unavoidably damaged by the forging process is removed by machining.

2. By a thorough annealing after the forging has been made, and by re-annealing, oil-hardening and tempering after the forging has been rough-turned, the forging must be rendered homogeneous and free from appreciable initial stress.

3. The rotor design must be such that at all parts the rate of change of stress is gradual and within the capacity of the steel. The average stress at any point may be quite low, but due to a too abrupt change of section the rate of change of stress may be too great, resulting in the crystals sliding over one another, and so causing a fatigue fracture to develop. Not only must the shaft between the journals and the core be carefully stepped, but also large radii must be provided at all changes of section, and, moreover, all the radii should be formed truly and be given a dead-smooth finish.

An additional point in favour of the forged steel rotor that will be appreciated by the purchaser is that in the remote contingency of there being any flaw not detected by the tests and exposed by the machining operations, it is almost certain that the overspeed test at the makers' works would show its presence, whereas with a rotor of the kind described in the paper, any defects of design would most probably not be found out until the machine had been in service for some time.

I can quite appreciate the statement made at the top of page 5, that the type of rotor described has no true critical speed, but the explanation given by the author is not clear. The area of the plates in compression is very considerable compared with the area of the bolts, and, therefore, the addition of even a few hundred pounds to the bolt stress would cause the bolts to elongate sufficiently for the plates to lose their compression and become loose. This opening and closing of the plates would effectively damp the natural transverse vibrations, and, therefore, the rotor would have no critical speed. This condition holds good if the fit of the spigots is free, but if they were made of a good press fit one inside the other very probably there would be a definite critical speed having a value liable to change and difficult to forecast.

ELECTRICAL FITTINGS ON LEASEHOLD PREMISES.

[From a Legal Contributor.]

There are certain factors in the present situation which appear to make it desirable to consider once again the legal position of landlord and tenant in relation to electric fittings. The unwelcome visit of a Zeppelin to the "London district" may result in the destruction of a large quantity of electrical property; and it may become necessary to consider who is to bear the loss. It is a well-known maxim of the law that *res perit domino.*

Another consideration makes it desirable to refer to the law of landlord and tenant. Owing to the economic condition brought about by the war, a large number of leases now current will not be renewed at the same rent. Possibly they will not be renewed at all. In these circumstances, what is to become of the electrical fittings?

Questions have frequently arisen in the past as between landlord and tenant as to the ownership of electric light fittings. A tenant who incurs the expense of fitting out a house with a complete electrical installation is not unnaturally astonished to find that, at the end of the lease, the landlord asserts his rights as owner of the soil by saying that whatever is annexed to the house or building must, of necessity, become his property. In so doing, the landlord relies on the ancient maxim *quiquid plantatur solo, solo cedit.*

Before proceeding to consider particular cases, it may be well to understand the general principles of law by which fixtures become vested in a landlord. The consideration whether the article is essential to the enjoyment of the premises on the one hand, or whether it is a mere convenience on the other, is a material element in deciding the character of the annexation as being complete or incomplete respectively. There are, however, certain articles which are removable as between landlord and tenant, which have so become removable by custom, having regard to the reason of the *purpose* for which such annexation was made. Amongst these are certain articles of trade, agriculture, ornament, and convenience.

In all cases, of course, where fixtures are taken down, it appears that the tenant is liable to repair the injury the premises may sustain by the act of removal. The fact that an article can be removed in its entire state is an element to be considered in drawing the conclusion that it is removable.

Amongst fixtures for domestic use or ordinary convenience which have been held to be removable by the tenant are cupboards fixed with holdfasts, clock cases, bells, and gas fittings.

Applying the foregoing principles, it will be seen that electric fittings, though *prima facie* some of them may be fixtures, must to a certain extent be treated as removable. Roughly speaking, the line appears to be drawn in practice between those parts of an installation which are necessarily of a permanent character and those parts which may be altered to suit the fancy of a particular tenant. Regard must also be paid to the extent to which any particular article is affixed to the freehold. It is obvious, for instance, that wires embedded in the plaster of a wall could not by any stretch of the imagination be regarded as a fixture which a tenant was entitled to remove. It would be as fair to say that a gas pipe put in by a tenant as part of a lighting system did not become the property of a tenant. On the other hand—to go to the other extreme—it is clear that a mere incandescent lamp could not possibly be looked upon as the property of the landlord.

It is somewhat remarkable that the only case which throws any clear light on the subject is one in which it was held that gas fittings do not vest in the landlord. There appears to be no reported decision on the subject of electric fittings, and questions relating to them must be answered by having recourse to first principles.

It is now proposed to deal with concrete cases.

(*a*) A tenant *wires* a house which he holds under a lease for years. Do the wires vest in the landlord at the end of the term?

It is clear that in this case the wires and the casing of the wires vest in the landlord, and cannot be removed by the tenant unless pursuant to special powers conferred upon him by his lease. A tenant would be liable if he attempted to remove the wires.

(*b*) A landlord *wires* a new house, and the tenant puts in switches, distribution boards, and lamp brackets. Can he remove them at the end of his tenancy?

With regard to switches and distribution boards, these appear to fall within the category of articles which are of a permanent character, and would have to be used in practically the same form in relation to any installation. At any rate, one would be sorry to advise a tenant to remove them only to leave blank spaces on the walls to which they were affixed.

With regard to lamp brackets, these appear to fall within a different category. They are often fanciful in design and very expensive. They can be removed without doing damage, often by the mere turn of a screw. In these circumstances, it appears to be clear that they are tenant's property which he can remove at will.

(*c*) A tenant puts in a transformer at his own cost and expense. Does the transformer vest in the landlord?

With regard to a transformer, this appears to be a separate instrument which would clearly be easily detached, and must be treated as a tenant's fixture which he can remove.

(*d*) A tenant puts in ceiling roses, made of metal or porcelain, and wall plugs. Do any of them belong to the landlord?

Ceiling roses appear to be very much on the border line, but it would seem that, inasmuch as they are generally ornamental objects, they should be treated as tenant's fixtures. It is probable that, in case of a dispute, a reasonable landlord would agree to treat an ornamental rose as the property of his tenant and the ordinary white roses as landlord's fixtures. As to a wall socket, *i.e.*, the part into which the plug is fitted, it is conceived that this would be a tenant's fixture, as it might easily be removed and replaced by a permanent connection to a wall or bracket lamp.

(*e*) Assuming a tenant installs electric light throughout a house, can any action be brought against him by his landlord if, on finding that the landlord refuses to pay anything towards it, he deliberately cuts or damages the wires without defacing the decorations?

It is clear that if a tenant does any damage, whether by removing landlord's fixtures or improperly removing his own, he can be held liable to make it good.

The ordinary covenant to repair and leave in repair would clearly impose such a liability upon him.

With regard to damage done by fire, the question as to who is liable depends upon the ownership of the fittings. As a rule, leasehold premises are insured against fire in the name of the landlord, the tenant paying the premium under covenant to that effect inserted in the lease. In these circumstances, in so far as the electric fittings were or had become annexed to the freehold, they would be covered by the landlord's policy. As to fittings which are obviously the tenant's, they would be covered by the policy which a prudent tenant takes out for the separate protection of his own furniture and effects.

War risk insurance is a matter which the tenant should take into special consideration, because it is *not* covered by an ordinary fire policy. If an incendiary bomb, thrown from a Zeppelin, causes a fire to break out, the tenant must (if his is an ordinary repairing lease) reinstate the entire building.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Institution and Alien Enemy Members.

This subject has been discussed for several weeks in your "Correspondence" columns—unfortunately anonymously—and the Council of the Institution now informs the members that it is helpless in the matter, because it is advised that it has no power except under Article 41. Is the Council unaware of the existence of Article 80 (1912 ed.), which is drafted with special reference to altering or adding to the Articles of Association? Why, then, not draft and pass a suitable new Article for the purpose of effecting what appears to be the general desire of the members? There would be little difficulty in drafting such an Article.

In "ordinary times" it has always been my pleasure to passively support any proposal put forward by the Council, but these are not "ordinary times," and those members who are not indifferent to patriotism must take active steps to secure a new Article to deal with the new conditions now prevailing. If there be honour, if there be benefits, if there be privileges in belonging to the Institution, founded 44 years ago, as the Council has told us it is helpless, it is for the members to say whether the enemy aliens are to enjoy those honours, etc. I, for one, am prepared to say most emphatically no, they shall not, because I firmly believe that the credit of the Institution in years to come must be enhanced by expunging at the present time any representatives of a nation which has sunk beneath the cognisance of civilisation, and that 50 years hence the members who then form the Institution will feel proud of the attitude adopted in 1916 if we now decline to admit any association with enemy aliens. Such scraps of paper as Article 41 may well be superseded.

Chas. A. Baker.

Victoria Embankment, W.C.,
December 28th, 1915.

[We reprinted the Council's statement and Article 41 in our last issue. We may point out (1) that the Council never said it was helpless, (2) that Article 41 contains adequate powers for the purpose aimed at by our correspondent, if the Council chooses to exercise them, and (3) that the reason why the Council did not say so is a matter for conjecture.—Eds. Elec. Rev.]

WAR ITEMS.

The Waste of Brains.—The Conference of Headmasters was held at the Board of Education last week, and among the resolutions adopted, says the "Times," was one which called attention to the unwisdom of employing young students of mathematical and scientific ability as subalterns in Line battalions. It was pointed out that the place for the man of action was at the front; that for the young man who had a special gift for science, mathematics, or mechanics was in the laboratory. This was eminently a war of science, and the mathematical and scientific ability of the country should be husbanded jealously. It might be said that with the end of the war the need for such men would be less pressing, but the fact was that the present warfare in the field would be child's play to the grim commercial struggle which the Germans, with a far-sighted concentration of purpose compelling our admiration, were already organising. The resolution was carried unanimously.

Callenders at the Front.—We have received a copy of the December issue of "Callender's Staff Service Gazette." It contains a very lengthy Roll of Honour of men from the London office, the Belvedere Works, the Anchor Works, and outside employés of Callender's Cable, etc., Co., who are with the Forces. Extracts are given from a large number of letters that have been received from them. Inset is a lifelike portrait of "Mr. Tom (our managing director)," and one of 2nd Lieut. T. O. Callender, R.M.L.I.

Exports to Switzerland.—The "London Gazette" for December 24th contains a lengthy list of articles that may not be exported to Switzerland unless consigned to the Société Suisse de Surveillance Economique. The list includes electric accumulators and accumulator plates, electrical fire-lighters, electrical carbons, electrical insulated wires and cables, electrodes, piles and component parts, electrical machinery, dynamos and motors, magnetos, mica (rough and worked), materials for telegraphs, etc.

War-Workers' Theatre.—The Vickers Company have built a modern and most attractive Picture and Variety Theatre (of which we have received some illustrations in colour) in the neighbourhood of one of their very large works, with the object of providing relaxation and recreation for their war-workers.

After the War Trade.—In the House of Commons last week Mr. Runciman, President of the Board of Trade, made a long and interesting statement respecting the after the war trade investigation work that had been occupying the attention of the Board in conjunction with outside industrial experts for some time past. Unfortunately pressure upon our space compels us to hold over fuller reference to the matter until next week. The Board has been doing a vast amount of work which it is politic to perform in secret, but the statement that Germany is a commercially beaten nation, while it is perfectly correct in regard to the effects of the blockade by our Fleet during war-time, will not be true when the blockade be raised unless all the information collected enables us to adopt a strong national and allied trade policy. Much is expected from the conferences that are to take place between ourselves, the Colonies, and the Allies. The Allied Trade Conference in Paris was to have taken place in January, but we read in the "Times" of Wednesday that it will be held in March, that it will be attended by the High Commissioners of the Dominions, and that among the subjects to be discussed will be the commercial relations with the belligerents during the war, protection against German commercial invasion after the war, the establishment of an International Patent Office, and an allied preferential tariff applicable to the Colonies.

Tasmania and Enemy Contracts.—The Attorney-General (Mr. Earle) of Tasmania has introduced a Bill to provide for the cancellation of enemy contracts. It provides for the annulment of all contracts to which an enemy subject is a party or in which he has a material interest, or which are likely to be for the benefit of enemy subjects or of enemy trade. Power is also given to terminate contracts suspended by the war.—"Tenders."

LEGAL.

Osram Lamp Works, Ltd., *v.* Pope's Electric Lamp Co., Ltd.—Judgment.

(Concluded from page 807.)

It was said for the applicants that the differences were differences in degree only; that was not his view of them. In his opinion they passed the border line which separated a difference in degree from a difference in kind, and the defendants' process, as a whole, was, in his opinion, substantially different from the one described in the plaintiffs' specification. If the test to be applied was the commercial value of the result there could be no question on this point, as the one process enabled the filaments to be made in bulk, whereas the other required each individual filament to be separately handled before the electric current could be passed through it. The applicants, however, contended that though the defendants' process might to the eye appear different, and might contain various improvements, yet the defendants had taken the substance of their invention, and applied it to the manufacture of their filaments. The way in which the case was put was this:—It was said that the real principle or substance of the invention was the application of the known reaction between steam and carbon to get rid of any carbon in the filament while leaving the tungsten metal unaffected. It was said that the use by the defendants of tungsten oxide in their mixture rendered it impossible for them to carry out their process without making use of the steam-carbon reaction, because when the filaments reached the required degree of heat steam was produced, either from the small quantity of water contained in the material of the filament or from the oxygen in the tungsten oxide combining with the hydrogen introduced into the furnace, and this steam reacted with the carbon in the filament and dispersed it. A number of experiments were given in evidence with the view of proving this, and the two main points endeavoured to be established were:—(1) That the reaction between oxygen and carbon, which the defendants claimed to be the agent by which they expelled the carbon from the filament, did not take place below a temperature variously given at 1,000 to 1,030° C.; (2) that much below that temperature the carbon was found in the defendants' process to be in course of being expelled, or, in other words, that before a temperature was reached at which the oxygen-carbon reaction could take place, the filaments had passed through a temperature at which the steam-carbon reaction must have taken place.

In his opinion it was not enough for the plaintiffs, in the peculiar circumstances of this case, to say this. It was not disputed that the oxygen-carbon reaction would, at the appropriate temperature, disperse any carbon in the filaments, and the question, therefore, must be not only whether the filaments had passed through the range of temperature appropriate to produce the steam-carbon reaction, but whether that reaction had to any appreciable extent dispersed any of the carbon in the filaments. To do so to a merely negligible extent could not, in his opinion, constitute an infringement of the plaintiffs' patent. On this question the time during which the filaments were in course of passing through the material range of temperature appeared to him to be important, but he could find no evidence directed to that point.

The material facts on this question appeared to him to be as follows: The defendants' mixture, or paste, after calendering, contained about 12 per cent. of carbonaceous material. This was reduced by the first ovening process to 2 per cent., and it was in this condition that the filaments were introduced into the first furnace in which the infringement was alleged to take place. When first taken out of the furnace the filaments contained 0·2 per cent. of carbon. The difference between these two quantities had, therefore, been dispersed during the 30 minutes, or thereabouts, during which the filaments had been in the furnace. By what agency had this been done? The first material point to establish in this connection appeared to him to be the temperature at which the steam-carbon reaction commenced to operate, because nothing which occurred in the furnace below this temperature could amount to a taking of the plaintiffs' invention.

On this point he found a great want of certainty in the evidence. At first the temperature was stated to be 600° C.; then it rose to 700° C., and later still to 800°. In order to ascertain what was going on in the furnace, the plaintiffs made an experiment, in which they interrupted the process at 500° C. Why this interruption took place at this stage was not explained, except that it was a sort of half-way house. It was ascertained that at that stage of the process the filaments contained 0·6 per cent. of carbon, that was to say, that the difference between 2 per cent. and 0·6 per cent. had by that time been dispersed by some agency which could not be any infringement of the plaintiffs' patent. What occurred in the furnace during the time that the filaments were travelling from the point at which the temperature was 500° C., to the point, be it 700°, or 750°, or 800° at which the steam-carbon reaction commenced, there was no evidence to show, and it was quite consistent with the evidence that the carbon had been reduced from 0·6 to 0·2 before the filament reached that point. No evidence was given as to the time occupied by the filaments in passing through the material range of temperature. In his opinion, so far as the plaintiffs' evidence on this point was concerned, it fell short of proof, and, so far as this experiment, and others intended to support it, were concerned, they had failed to satisfy him that any carbon in the defendants' filaments was to any appreciable extent dispersed by the steam-carbon reaction.

What he had just said with regard to the first furnacing in the defendants' process applied with equal or greater force to the second furnacing, where the filaments were passed rapidly up into a temperature of over 1,000°. Dr. Passmore apparently did not regard the plaintiffs' case as very hopeful on this point, as he said, when dealing with it, that the steam and hydrogen acting in the filaments might have removed all the carbon before the other (that is, the oxygen-carbon reaction) had a chance of taking place.

The conclusion at which he had arrived as to the first furnacing applied also to the vacuum process, where the alleged infringement was said to take place by the accidental presence of water vapour, which the defendants could not prevent, and which was said to be the agent which released the necessary hydrogen to form the steam and hydrogen atmosphere which constituted the alleged infringement.

He passed now to consider the other point mainly relied upon by the plaintiffs, namely, that the oxygen-carbon reaction could not take place at a temperature below 1,000° C. It was confidently asserted in argument that this was so, and the various experiments given in evidence were gone through in detail in support of the statement, as well as the evidence given by the plaintiffs' expert witnesses. These experiments were elaborately criticised by Mr. Terrell, who referred also to the opinion of the defendants' expert witnesses on the point.

He had carefully considered the evidence and arguments of counsel, and, as a result, he was not convinced that in the defendants' process, as carried out, the oxygen-carbon reaction did not commence at a temperature lower than 950° C.

The general conclusion, therefore, at which he had arrived was that the plaintiffs had failed to establish their case from whichever point of view it was to be regarded, and the appeal, therefore, failed, and must be dismissed, with costs.

Lord Justice Warrington also delivered a judgment dismissing the appeal, in the course of which he said there were in the defendants' process two chemical factors tending to produce the desired result. The evidence was insufficient to determine the precise part played by each, and he thought the Court was justified in holding, under those circumstances, that the plaintiffs had not proved that the carbon was removed substantially as described in the specification. But if he was wrong about that, he should still be of opinion that the defendants' process, taken as a whole, did not infringe the substance of the plaintiffs' invention, as described in the specification. It started from a different standpoint. The several steps in it were different in nature, and had different aims and results, and these variations were not merely colourable alterations. The result was that, in his opinion, the appeal ought to be dismissed.

Lord Justice Bankes said the Master of the Rolls (who was absent from indisposition) desired him to say that he concurred in the judgment delivered by Lord Justice Warrington and himself.

Mr. Walter: My Lord, this is a very important matter. The taxation of the costs in the Court below was allowed to stand over until after the hearing in the Court below. I do not know whether my friend would agree to the taxation standing over until after the final hearing?

Mr. Terrell said he could not agree to anything.

Mr. Walter: Your Lordship, I suppose, would not grant a stay?

Lord Justice Bankes: No.

Bradford County Court Case.

J. Roberts Bros. and Holloway, Ltd., electrical engineers, Bradford, were the claimants in an action heard at the Bradford County Court last week before his Honour Judge Graham, K.C., against Messrs. Brown, Vickers & Co., manufacturers, of Bradford, for £72 for work done. The defendants had paid £45 into Court. Mr. Newell, for claimants, said that his clients had accepted a contract from the defendant company to perform certain work at their premises for £25, and, afterwards, certain "extras" had been added. Mr. Watson, for defendants, said that all it was necessary to decide was what sum was due from the defendants to the plaintiffs for the work which had been performed, and whether or not the sum of £72 was excessive.

After argument, arbitration was suggested, and ultimately it was agreed by both sides to refer the matters in dispute to Mr. Felshaw, of Harrogate.

Albion Electrical Co., Ltd., v. L.K.W. Syndicate, Ltd.

At the Lambeth County Court on December 21st. before Judge Parry, the Albion Electrical Co., Ltd., of 67, New Oxford Street, W.C., brought an action against the L.K.W. Syndicate, Ltd., of 31, Great St. Helen's, E.C., to recover £58 19s. 8d., balance of account for overhauling the electrical installation at the Brixton Hall, now known as the Khaki Hall, Brixton, and so altering it as to comply with the requirements of the London County Council.

Mr. H. G. Simmons, for plaintiffs, said that on July 26th Mr. Charles Lille, manager for the plaintiffs, was approached by a Mr. James P. Naylor, an electrical engineer, to carry out certain electrical alterations to the fittings at the hall, then known as the Brixton Hall. He saw a Mr. Thomas Harold Crosby, who was the secretary of the L.K.W. Syndicate, and, as time was short, no estimate was prepared, Mr. Lille agreeing to carry out the work on the basis of being allowed 20 per cent. on the cost of material, 50 per cent. on the cost of labour, and engineers' fees. The work was a push job, but was completed, the hall being opened on July 27th. He had great difficulty in obtaining payment, but eventually received a cheque for £5, signed by Crosby as secretary and manager of the L.K.W. Syndicate. He still pressed for payment, until he received a letter from Crosby on October 1st, stating that he was not to hold the syndicate liable for the account, but was to look for payment to a Mr. Horace Scott Laycock, who was the promoter of the syndicate, and was then a director of the newly-formed L.K.W. Syndicate.

Mr. Charles Lille, the manager of the plaintiff company, bore out this statement. He said that throughout the whole of the transactions in dealing with Mr. Crosby, he was under the impression that the L.K.W. Syndicate were liable for the account, and it was not until October 1st that he received any intimation that they were not liable, and that he had to look to Mr. Laycock for payment.

Mr. Thomas H. Crosby, for the defence, said he was the present secretary and manager of the L.K.W. Syndicate. From February 25th to July 28th he was acting as manager to Mr. Horace S. Laycock, at the same hall—the Brixton Hall, now the Khaki Hall. He ceased to be Mr. Laycock's manager on July 28th, when the syndicate came into existence, and the liabilities were taken over by the syndicate, his salary being paid until the end of July by Mr. Laycock, when witness became secretary and manager to the syndicate. The syndicate was registered on May 27th. During the time he was Mr. Laycock's manager the latter obtained a lease of the Brixton Hall as a cinematograph theatre. The electrical arrangements were made by Mr. Naylor, and, as he was unable to carry out the work, he introduced him to Mr. Lille, who was to undertake the installation, under the superintendence of Mr. Naylor. Anything Mr. Naylor passed would be satisfactory to witness. No figures were mentioned, but it was agreed the plaintiffs should have a reasonable profit on work and material, which should be sanctioned by Mr. Naylor.

Judge Parry: Were you asked by anybody who was to be responsible for payment?

Witness: Not directly. Mr. Naylor said I was all right, as he had known me for many years. Certainly the L.K.W. Syndicate was not mentioned as the responsible party to look to for payment.

In answer to the Judge with reference to a cheque for £5 paid to plaintiffs on account, signed by him as secretary and manager of the L.K.W. Syndicate, he said that at the time he was drawing a number of cheques, and this was given to plaintiffs, as Mr. Laycock did not have his cheque-book on him at the time.

Judge Parry said he had the greatest sympathy with witness, as he had great difficulty at the time in finding out who was his employer, whether Mr. Laycock or the syndicate.

Mr. Horace S. Laycock said he was a director of the Montreal-London Development Agency, Ltd., and several other companies, as well as of the L.K.W. Syndicate. He obtained a lease of the Brixton Hall in February, when he gave Crosby certain instructions regarding the electrical fittings. The syndicate was formed on May 27th, and took over the hall on July 29th. He was personally responsible for payment for the work done and now claimed for. He thought the charges were high, and had been willing to come to terms, but plaintiffs refused to do so, demanding the full terms claimed.

In answer to questions, Witness stated he had no legitimate business, such as a bootmaker or butcher, simply being a director in certain companies. He was made a bankrupt in 1905, in 1911 applying for his discharge, which was suspended for a year. He had also one or two County Court judgments against him. Witness added that there was an agreement between him and Mr. Kemp that he should be responsible for all accounts incurred before the syndicate was formed.

Mr. James P. Naylor, an electrical engineer, of West Dulwich, said it was agreed that he should superintend the installation, and that plaintiffs' account should be submitted to him. He thought 20 per cent. on material and 50 per cent. on labour for the "push job" were reasonable, but the account submitted to him was insufficient to show what had been done.

Judge Parry said he had heard a few unpleasant cases of this kind, but he thought this was the limit. Nobody knew what or who the L.K.W. Syndicate was, but they had the material and the labour and must pay for them. He held that the defendants were liable for the account, and referred to the Registrar the question of the amount, fixing 20 per cent. on material and 50 per cent. on labour as the basis for taking an account of what was due.

BUSINESS NOTES.

British Industries Fair.—The Board of Trade have now completed the arrangements for the holding of a British Industries Fair at the beginning of next year, on lines similar to those which characterised the Fair organised by them at the Royal Agricultural Hall, London, in May of this year. The Fair, which will be opened on Monday, February 21st, and remain open until Friday, March 3rd, 1916, will be held in the buildings of the Victoria and Albert Museum, South Kensington, London, S.W. Only British manufacturers engaged in the following trades, viz., china and earthenware, glass, fancy goods, toys and games, stationery and printing, will be permitted to exhibit. As before, admission to the Fair will be by invitation of the Board of Trade alone, and will be restricted to *bonâ fide* buyers for the trades concerned.

Book Notices.—"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIV, No. 12. December 1915. New York: The Institute. Price $1.

"*The Mechanical World* Electrical Pocket-Book for 1916." Manchester: Emmott & Co., Ltd. Price 6d. net.

"Aeroplanes and Airships." By W. E. Dommett. London: Whittaker & Co. Price 1s. net.

British Standard Specifications for "Wall Plugs and Sockets" (Report No. 73), and "Charging Plug and Socket" (Report No. 74), of the Engineering Standards Committee. London: The Committee. Price 5s. 3d. and 5s. 4d., post free, respectively.—The Specification for Domestic Wall Plugs and Sockets relates to the five-ampere two-pin type, for pressures not exceeding 250 volts. In view of their extended use, interchangeability is of the greatest importance, and the Committee has, therefore, given this aspect of the question the closest attention. In consultation with the manufacturers, the dimensions necessary to obtain this interchangeability have been agreed upon, the actual design of the plug being interfered with as little as possible. It is of interest to note that the standard plug is required to have side entry for the flexible wire, and a suitable hand shield, as recommended by Mr. Ram, in his reports to the Home Office. In conjunction with the Electric Vehicle Committee of the Incorporated Municipal Electrical Association, the Committee has standardised the essential details necessary to secure interchangeability between any charging plug and any socket of the design selected by the Electric Vehicle Committee. The way is left open for invention and progress, should at any time another type of charging plug be introduced.

"Hazell's Annual, 1916."—London: Hazell, Watson & Viney, Ltd. 3s. 6d. net.

"The *Journal* of the Municipal School of Technology, Manchester." Vol. VII. Manchester: The Education Committee.

Dissolutions and Liquidations.—Cicoy Magneto Co., Ltd.—This company is winding up voluntarily, with Mr. W. G. Newman, 116, Cannon Street, E.C., as liquidator.

Renew Electric Lamp Co., Ltd.—Creditors must send particulars of debts, &c., to Mr. J. E. Percival, 6, Old Jewry, E.C., the liquidator, by January 24th.

Marsh, Son & Co., Ltd.—A meeting is called for January 25th at 12, Old Square, Lincoln's Inn, W.C., to hear an account of the winding up from the liquidator, Mr. R. W. Brown.

Sheffield Electrical Engineering Co., Ltd.—This company is winding up voluntarily, with Mr. H. Cawood, 68, Eyre Street, Sheffield, as liquidator. A meeting of creditors is called for January 4th at Ashton-under-Lyne. Creditors must send the usual particulars to the liquidator by January 15th.

Fire.—A fire occurred at the premises of Messrs. Claud Hamilton, Ltd., at Aberbeen, on December 23rd.

Bankruptcy Proceedings.—Louis Alfred Thomson, electrical engineer and contractor, formerly trading at 39, Victoria Street, S.W., under the style of "Saville & Walton."—A sitting of the London Bankruptcy Court was held last week, before Mr. Registrar Linklater, for this public examination. The statement of affairs disclosed total liabilities £3,334 (unsecured £2,922), and net assets valued at £77, after deducting £58 for payment of the preferential claims. In reply to Mr. Egerton S. Grey, Official Receiver, the debtor stated that having been employed for ten years by Siemens Bros. & Co., Ltd., he in May, 1911, joined a Mr. Neale in partnership, and they started business as above, at Bream's Buildings, Chancery Lane, W.C., removing later to Victoria Street, Westminster. Witness was financed by his father-in-law to the extent of £1,000, and Mr. Neale borrowed £200 from his mother. There was no deed of partnership, but each of them drew £5 weekly from the business, which consisted mainly in the installation of electric light and power in works and private houses. The trading was successful, and in 1912 and 1913 branches were opened at Cardiff and Cobham respectively. Mr. Neale retired from the partnership in 1913, and witness took over and continued the business. He paid £100 to Mr. Neale's mother on account of the sum she had advanced for the purpose of capital. The trading subsequently declined; it was further handicapped by trade strikes in January and August, 1914; and then came the war, whereupon he rejoined the Army. A manager carried on the business for him until last May or June, when witness decided to close it till he was again able to give it his personal supervision. He attributed his failure to competition, loss of contracts, lack of capital, and the outbreak of hostilities. The examination was concluded. The following are the principal creditors:—

Unsecured.	
Armorduct Manufacturing Co.	£34
Baldur Engineering Co.	21
British Westinghouse Co.	278
Burt, Bolton & Haywood, Ltd.	20
Brimsdown Lamp Co.	13
Barlow Engineering Co.	30
D.P. Battery Co.	35
Drake & Gorham, Ltd.	42
Electrical Co.	24
Electrical Apparatus Co.	18
Forward Electrical Co.	14
Hann & Ingle	15
Sun Electrical Co.	145
Siemens Bros. Dynamo Works	105
Siemens Bros. & Co.	96
Stella Conduit Co.	£22
St. Helens Cable Co.	20
Veritys, Ltd.	62
Western Electric Co.	25
Waltardaw Co.	36
Flitton Engineering Co.	21
Jap Engine Works	13

Partly Secured.	
Fishenden, Capt.	£1,770
(Security valued at £354.)	

Preferential.	
Rent	£21
Rates, &c.	36

Herbert Page (Smeeton & Page), electrical engineer 63, Queen Victoria Street, London, E.C.—First and final dividend of 6¼d. in the £, payable after January 5th at Carey Street, W.C.

J. W. & T. W. Tattersall, electrical engineers, Kimberley Road, Willesden Lane, N.W.—First dividend of 6d. in the £, payable at Carey Street, W.C.

Catalogues and Calendars.—The Runbaken Magneto Co., Ltd., Camp Street Works, Deansgate, Manchester.—84-page illustrated and priced catalogue of magneto parts and accessories. Copies will be sent to readers on application.

Messrs. Willans & Robinson, Ltd., Rugby.—20 page pamphlet containing illustrated descriptive matter relating to the design and construction of their turbine-driven centrifugal pumps.

The British Thomson-Houston Co., Ltd., of Rugby, have again issued a large hanging calendar roll with monthly sheets for 1916. As before, on each sheet the dates for the current month are arranged on a large scale prominently placed, the preceding and following months appearing in smaller type. On each sheet there is a photograph of the exterior of the Rugby Works and illustrations of B.T.H. manufactures.

Messrs. Ferranti, Ltd., Central House, Kingsway, London, W.C.—The firm has now completed the catalogue upon the preparation of which it has been engaged for some time. It is a bulky work in a neat expanding file cover, and has a substantial and plainly printed finger index to sections. These sections are devoted to the following:—House service meters, heating and cooking appliances, static transformers, instruments, switchgear, starters and controllers, panels and sundries. Under the division sheet of each section there is an index and discount sheet. Each list number is made up on a system which is explained at the beginning of the book, as is also the system upon which the cable code-words are compiled. In addition to descriptive matter relating to the manufactures mentioned, prices, and particulars of dimensions and weights are tabulated. Well-executed illustrations are included in every section. The work involved in the preparation of the catalogue must have been enormous.

The Consolidated Pneumatic Tool Co., Ltd., of 9, New Bridge Street, Westminster, S.W., have prepared a wall calendar with monthly sheets for 1916. Each sheet contains a picture of a grinder, rivetter, compressor, drill or some other tool of which the company makes a speciality.

The Key Engineering Co., Ltd., of Trafford Park, are circulating a celluloid vest-pocket calendar for 1916.

Messrs. J. E. & S. Spencer, 16, Dowgate Hill, Cannon Street, London, E.C.—Circular giving net prices for cutting-out and screwing w.i. tubing up to 6 in. diameter at their London warehouse, where they have put down new machinery.

Trade Announcement.—On January 1st Messrs. Mitsubishi Goshi Kaisha will open at 149, Leadenhall Street, E.C., a branch office of their Tokyo business. In addition to their operations as bankers and merchants, they are producers of Japanese steam coal, electrolytic copper, Wolfram and tin ores, and other metals; steamship owners; proprietors of the dockyards, shipbuilding, and engineering works at Nagasaki and Kobe; iron founders; paper-makers; owners of public wharves and warehouses and real estate; refiners and exporters of Chinese oils and cereals, &c. They have branches and agencies in all the important cities in Japan, and in Shanghai, Hankow, Peking, Hong-Kong, Singapore, Manila, Vladivostock, and Glasgow.

Prices Advance.—The Electric & General Works, Ltd., of Victoria Street, S.W., announce a further increase of from 20 to 25 per cent. in catalogue prices for switchgear as from January 1st.

New Manufacturers' Association.—The British Manufacturers' Association, 1915, has been formed with offices at Lincoln House, High Holborn, W.C., with Mr. R. G. Cheesman as chairman. It is to be formed exclusively of British manufacturers, and is to be run on purely business and non-political lines in the interest of Empire manufacturers. One of its chief aims is to secure the appointment of a business man as Minister of Commerce.

Exports to Switzerland.—The import into and transit through Switzerland of electrical and other goods have been placed, since November 16th, under the control of a society established at Berne under the name of the Société Suisse de Surveillance Economique. Permits for exportation of goods to or transmission through Switzerland must be obtained from this Society without which no shipments or transit traffic will be allowed. Previous or unsuccessful applications to the Inter-ministerial Commission must now be renewed with the above Society. A reference to the matter appears in our "War Items" to-day.

LIGHTING AND POWER NOTES.

Aberystwyth. — Price Increase. — Owing to the advance in the price of fuel and the increase in wages, the Chiswick Electricity Supply Corporation, Ltd., announces that until further notice accounts for current will be increased by 10 per cent., as from the date for reading meters for the December quarter. Meter rents will remain as heretofore.

Australia.—The West Guildford (W.A.) Roads Board has made arrangements to purchase electricity in bulk from the Government in connection with the Perth plant.

The Claremont (W.A.) Council, which already has an electric generating plant, has been approached by the Perth electricity department regarding the supply of current in bulk at 1¾d. per unit, low tension, "providing the Council will give the Government the right to supply direct any power consumers in the district."

At Tumut (N.S.W.) a local syndicate proposes to install a hydro-electric plant in order to provide power for timber cutting and other works. The State Government is to be approached respecting the water rights.

The Katoomba (N.S.W.) Municipal Council has decided to discard the old steam pumping plant at the waterworks, and obtain electric power from the Katoomba Electric Supply Co., at the rate of 1d. per unit. The company is also to obtain certain water concessions.—*Tenders.*

The Shire Councils of Flinders and Alexandria (Victoria) have instructed Messrs. McCarty, Underwood & Co., of Melbourne, to furnish a report on the electric lighting of Sorrento and Alexandria.

The Townsville (Queensland) City Council has requested Messrs. Wylde, Ball & Co., of Brisbane, to report on an electric lighting scheme for the district.

The Mount Gambier (South Australia) Council has entered into arrangements with Messrs. Bridger, Ltd., of Adelaide, for the installation of electricity in the town.—*Tenders.*

Barking.—The local Ratepayers' Association has passed a resolution asking the U.D.C. to apply for powers to supply electrical fittings free of charge, and to add a small sum per unit for current to meet the cost. It is considered that by this means electricity would be used in the homes of many working men.

Batley.—The Electric Lighting Committee has decided that for the future a charge of 5s. per yard, or part thereof shall be made for all lighting services in excess of 20 yards; that the wages of shift engineers be increased to 36s. per week of 56 hours, and that a Development Sub-Committee, consisting of eight members, be appointed.

Bradford.—Mains Extensions.—Important extensions of electricity mains have been decided upon by the Electricity Committee, along Canal Road to Bolton Lane abattoir (including switchgear), at a cost of £2,856; from Thornbury sub-station along Leeds Road to the city boundary (including switchgear for the Yorkshire Electric Power Co.), £883; to Bowling Iron Works (including transformer chamber equipment for Messrs. Bever, Dorling & Co., Ltd.), £498; and several smaller extensions.

The Electricity Committee has authorised the Common Seal to be affixed to agreements for bulk supply to a new company at Bolton Lane abattoir; and with the Yorkshire Electric Power Co. and Messrs. Bever, Dorling & Co., Ltd.

Castlewellan (Co. Down).—E.L. Scheme.—The new electric lighting system for the town, introduced by the Irish Towns Light and Power Co., Ltd., has been officially opened. The arrangement with the local Committee is to provide 40 street lamps for lighting from September to March, at a cost of £1 per light, with 6d. per unit for private lighting, and 3d. per unit for power purposes.

China.—Tsingtao.—According to a report by the U.S. Consul, in the Government electric light works there are two dynamos of 170 kw. capacity and one of 410 kw., while a third of 1,000 kw. is being ordered from Japan to provide for extension of the service to the suburbs. The works employ a staff of about 103 men, and the monthly receipts from sales of current are about $2,500. The fixed rate per lamp ranges from c. 41 per month for a 10-c.p. lamp to $1.85 for one of 400 c.p. The charge per kw.-hour ranges from c. 9 for a total consumption per month of less than 50 kw.-hours to half that rate when more than 400 are consumed; there are also minimum charges per number of lamps for each subscriber. Current for motors is charged for on a sliding scale, ranging from $2.68 per month per h.p. to $2.16. Rent is charged for meters, as these are the property of the Government. Two electric light plants are located at Syfang and the Hungshan coal mines respectively, the former in the Shantung Railway's car shops, and the latter in the railway's mines. The supply in Tsingtao is a.c. with a frequency of 50 and a voltage of 120.—*Eastern Engineering.*

Church Stretton.—Prov. Order.—The local Electric Supply Co. has applied for a provisional order for electric supply in the urban district of Church Stretton, and the parishes of All Stretton and Little Stretton, in the rural district.

Dodworth.—At a meeting of the Urban District Council, upon it being stated that the application of the Electrical Distribution of Yorkshire, Ltd., in respect of a provisional order for lighting in various Yorkshire areas, had been adjourned until after the war, it was stated that the Council had no option but to use gas, being tied to the local gas company for a period of 14 years, five of which had expired. What was wanted was competition with the monopoly of the gas company.

Ecuador.—A decree has been published providing for the raising of certain funds for the installation of an electric lighting system in the town of Tulcán.

Greenock.—Proposed Loan.—The Corporation is to apply to the Scottish office and the Treasury for authority to borrow an additional £40,000 for electricity purposes.

The Electricity Committee has received permission to contract for a cooling tower at an outlay of from £1,500 to £1,600.

Haslingden.—Service Costs.—The Tramways and Electricity Committee has decided that, during the continuance of the war, or until further notice, the whole cost of any service for a supply of electricity shall be borne by the prospective consumer, subject to any special arrangements. The Corporation will supply up to 8 ft. of cabling on private premises.

High Wycombe.—Street Lighting.—The T.C., in order to come to an amicable agreement with the E.L. Co. regarding restricted public lighting, has decided without prejudice to agree to a reduction of £600 in the charges for the year, instead of the £700 originally sought. The Council also agrees to the contract being extended for three years beyond the termination of the existing contract.

Ilford.—Destructor Power Plant.—With reference to the electrical equipment of the proposed engine room at Seven Kings dust destructor, for which a loan has been refused, the U.D.C. has informed the L.G.B. that the best arrangement under existing conditions, and entailing the least capital expenditure, is to transfer from the Ley Street works the two 200-kw. sets, together with switchboard panels, to install a 10-ton overhead travelling crane, and to lay a four-way duct and cables from the engine room to the Ley Street works, connecting to the main switchboard. The approximate cost is £3,100, and a loan for this is to be again applied for. The U.D.C. has fixed the price of current for the tramways for the year ended last March at 1⅛d. per unit net.

Keighley.—Subject to the approval of the T.C., it has been decided to install electric light at the Keighley Museum, in Victoria Park.

London.—Seventy feet of electric cable was destroyed, three distributing boxes were blown into the air, and 40 ft. of pavement, 10 ft. wide, was hurled in all directions by a recent explosion in the mains in Rotherhithe Street. A second explosion occurred as a fire engine drove up, and the driver was injured.—*Evening News.*

Woolwich.—The B.C. has received formal sanction from the L.C.C. for the borrowing of £4,700, required for the purpose of defraying expenditure in linking-up with the South Metropolitan Electric Light and Power Co., Ltd.

Maidstone.—Price Increase.—The T.C. announces that owing to the increased cost of coal, the charges for current for lighting will, from the New Year, be increased as under:—Flat rate, from 4¼d. to 4½d. per unit; maximum demand, from 7¼d. and 2¼d. to 7½d. and 2½d.; telephone system, from 8s. per 30-watt lamp per annum, and 1¼d. per unit to 8s. and 1½d.; fixed charge, from 11s. per 30-watt lamp per annum to 11s. 6d. The charges for other services remain unaltered.

Manchester.—Further Lighting Restrictions.—Efforts have recently been made with a view to securing permission for increasing the lighting of the city, and hopes were held out that some satisfaction would be gained. On Monday, however, it was announced that a more rigorous restriction of lighting would come into force on January 10th in the areas of Manchester, Salford, and Stretford (which includes Trafford Park).

Apropos of the reference last week to the threatened shortage of coal, it may be added that it has since been reported that considerable relief has been secured as a result of pressure by the Government in the necessary quarter, and the action of the Electricity Committee in going further afield for supplies.

Middlesbrough.—The gross profit on the working of the Corporation electricity undertaking for November has been estimated at £1,940, an increase of £336, as compared with the corresponding period last year.

The Corporation has arranged to take over the lighting order for North Ormesby (recently amalgamated) from the Cleveland and Durham Electric Power Co., as from January 1st. It had been agreed to pay £986, but since the agreement a further £101 ha been spent on mains, &c., and it has been decided to add this to the amount to be paid by the Corporation.

Loan Application.—In reply to an application for sanction to borrow £43,000 for mains, meters and fittings, the L.G.B. has sanctioned the borrowing of £3,994 for mains, and £1,159 for meters and fittings, these representing amounts already spent, but has intimated that no new mains should be laid except for special purposes.

Morley.—Year's Working.—The annual accounts of the Corporation show that, for the year ended March 31st last, the deficiency on the electricity undertaking had been reduced to £301, it having been £443 at the end of the preceding year, and £783 in 1912. The total expenditure during the period under review was £4,227, and the receipts £3,925. Coal accounted for an expenditure of £715; wages, £778; cost of distribution, £351; interest on loans, £784; and sinking fund charges, £1,146.

New Zealand.—In his annual report the general manager of the Wellington tramways department states that consideration will shortly have to be given to the best and most economical means of generating and transmitting power to outlying districts, more particularly South Wellington and adjacent suburbs. The electrical engineers of both the tramways and lighting departments have been requested to report fully on the matter and to consider the advisability of installing such additional generators as may be required to supply both undertakings. As this would necessitate the use of alternating plant, it will give rise to the question as to where such machinery should be installed, and whether a new building should be erected capable ultimately of housing the whole of the machinery for both systems. The general manager states that consideration should be given to the possibility of a hydro-electric scheme being adopted for the supply of electricity for all purposes in the city, in order that all extensions may be utilised in connection therewith.—*Board of Trade Journal.*

Portadown.—Mr. D. Chapman has intimated to the Council that, owing to the increased cost of coal and oil, he has been obliged to advance the price of electric light by 15 per cent. Mr. W. J. Johnston said the Council had a guarantee from Mr. Chapman not to increase the price for five years.

Portpatrick.—The Rhins District Committee of the Wigtownshire C.C. has agreed to offer the Portpatrick E.S. Co. £35 in respect of street lighting between September 20th, 1914, and February 4th last; it had been proposed to offer £25, but the company considered this inadequate.

Spenborough.—The Electricity Committee of the Urban District Council has authorised the electrical engineer to refuse any application for power purposes except in special cases. This decision has been come to on account of the electricity works being at present loaded to their full extent.

Torquay.—It is understood that the Tramways Co. objects to the payment of the increase of ¼d. per unit made by the T.C. for energy used, and intends to submit the question to arbitration in accordance with the terms of the contract.

Weymouth.—Year's Working.—The annual report of the borough electrical engineer for the last completed year shows that 920,769 units were sold as against 863,705 in the previous year; 103 motors of 515 H.P. and 145 KW. of heating apparatus are connected to the mains, the total connections in equivalent 33-watt lamps amounting to 51,894. The maximum load was 554 KW. and the load factor 18·97 per cent. The gross profit amounted to £3,868, and after meeting interest and loan charges there remained a deficit of £252, which, except for £20, was met by the reserve fund. The war has adversely affected the revenue of the undertaking, and the increased expenses give little hope of profitable working under present conditions.

Wirral.—Prov. Order.—The B. of T. has informed the R.D.C. that its consent to the prov. order for E.L. applied for in regard to the parishes of Eastham, Little Sutton, and district is not necessary at present, as the order will not be allowed to be proceeded with until after the end of the war.

TRAMWAY and RAILWAY NOTES.

Australia.—A report on the proposed electric tramway from Melbourne, through West Brunswick and West Coburg, has been prepared by Mr. V. J. Crowley, consulting engineer; the suggested route is 8 miles 23 chains, the capital cost by the Royal Park route is estimated at £123,000, and the estimated yearly loss £838; by the alternate route the capital cost would be increased by £10,850, and the gross yearly loss to £1,814.—*Melbourne Age.*

Electric Vehicles.—The Sydney City Council has ordered three Baker electric trucks fitted with Edison A 10 cells, at a cost of £1,180 each.—*Tenders.*

Blackpool.—Contract Tickets.—For some time the Tramways Committee has been considering the question of contract tickets which for many years have cost £3 for the whole system. Mr. Furness, the general manager, reported that the loss on these contracts were over £2,000 per annum, and he suggested the price be raised to £4 10s. There was an immediate outcry. On December 23rd Mr. Furness suggested contracts should be abolished altogether. This, however, was not adopted, the Committee deciding to continue contracts on the old basis of £3 per annum.

The monthly returns of the Corporation tramways for November show an increase of £188 in receipts, despite the suspension of annual and other tickets pending a decision on the subject. The receipts from April 1st have been £67,405, an increase of £1,638.

Bradford. — Auxiliary Car-Drivers.—In response to the Tramway Committee's appeal to public-spirited citizens above military age who were willing to assist in the running of the tramways, 150 applications have been received. Those who pass the necessary medical examination are to be trained as auxiliary drivers on lines which have proved very successful at Birmingham.

An application has been made to the Tramways Committee, on behalf of the tramwaymen, for an advance of 5s. per week for employés paid weekly and 1d. per hour additional for those paid by the hour, this to take the place of the bonuses of 1s., 2s., and 3s. granted by the Corporation. If this advance is acceded to it will mean an additional expenditure of £12,000 per annum.

In consequence of the decision of the Tramways Committee to engage women as conductors, some 100 applications have been sent in for appointment, and an experiment with 20 female conductors is to be made. In this connection it is interesting to note that already 689 men have left the Bradford tramway department for service with the Army, and 550 of the remaining 818 of military age have been attested under Lord Derby's scheme. It is stated to be absolutely necessary that the present staff of 1,281 employés should be retained if the present service is to be maintained. The department is paying sums totalling £8,000 to dependents of employés on service, and, in the event of further numbers being called upon, this figure is likely to be increased threefold.

The Tramways Committee has appointed a Special Sub-Committee to inquire into the whole question of tramway track construction and maintenance, with authority to visit other towns to make inquiries into the matter and to report.

It has been agreed that when prices become normal again the Corporation shall include in the next Parliamentary Bill clauses empowering it to construct and work the Baildon tramway itself.

Continental.—Sweden.—Railway Electrification. According to a report presented to the Government of Sweden by the State Railway Administration in November, the working of the line between Kiruna and Kiksgransen has fully corresponded to the requirements. This railway, which was converted from steam to electric traction in January, 1915, has a total length of 80 miles. It is operated by means of single-phase locomotives which haul goods trains each conveying 2,000 tons of iron ore, in addition to passenger trains. As sufficient experience is said to have now been gained with the system used, the Railway Administration recommends that the transformation of the section between Kiruna and Svarton (Lulea) should be undertaken. In this event the whole of the mileage used for the carriage of iron ore in this part of Sweden would be provided with a uniform system which would permit of greater economy in working and an increased utilisation of the plant at Porjus Falls station, which supplies energy to the first-mentioned line.

Switzerland.—Electrification of the State Railways.—The problem regarding the proposed conversion of the Swiss State Railways to electric traction is beginning to assume a more definite stage. Early in December an important conference was held at Berne, at the instance of the Swiss Association for the Regulation of Water Powers and the Association of Electrical Engineers, under the chairmanship of Prof. Landry, President of the latter Association, to discuss the question of the electrification of the Federal Railways. Among the 250 persons present were representatives of all the transport undertakings, including members of the general management of the Swiss Federal Railways, and of the Federal Council of Government Departments. M. Thormann, the engineer who was in charge of the work of transforming the Lotschberg Railway, delivered a lecture on the various systems of electrical working, and proposed the adoption of the single-phase method, which has given every satisfaction on the Lotschberg Railway. After discussion, a resolution was passed expressing a hope of the speedy conversion of the St. Gothard Railway and of the approach lines, together with the approach lines to the Simplon Railway, the conference being convinced of the advantages which would result from the better utilisation of the existing water powers by assisting in rendering the country independent, from an economic point of view, in regard to supplies of coal for railway working. The subject was also raised on December 15th, at the sitting of the Standerat, in connection with the consideration of the State Railway Estimates for 1916. M. Forrer, in reply to questions, stated that the matter of electrification now stood in the foreground of public interest, and the Federal Council shared the opinion that a forward step should be quickly undertaken. The work would involve an expenditure of nearly £20,000,000, but it would contribute towards securing the independence of the country. The Federal Railway Administration and the Railway Department would have to decide the problem of the particular system to be adopted, although members of the Standerat have also the right to express their views, as they would have to sanction the necessary credit votes. A decision as to the system was still outstanding, but M. Forrer declared that it would have to be settled by the end of 1916 at the latest, before the erection of the power station was commenced.

GERMANY.—Since the outbreak of war the number of tramway accidents has shown an alarming increase, due chiefly to taking experienced motormen and conductors for the Army, and filling their places with unskilled men. Statistics published in Munich show that in the period between the beginning of the war and December 8th, 1915, there were 425 collisions between tramcars, 120 of these between August 1st and December 31st, 1914, and 305 between January 1st and December 8th, 1915. In the same five months—August to December, 1913—there were only six collisions. The collisions between tramcars and wagons and other vehicles also show a tremendous increase in the last 16 months. The municipal authorities have decided to appeal to the military commandant to release motormen and conductors who are merely performing garrison duty, and permit them to return to work.

Edinburgh.—At a meeting of the Tramway Committee on Thursday, Mr. Hamilton, of Leeds, was present, and the proposed agreement between the Corporation and the Tramway Co. was discussed.

Glasgow.—WOMEN DRIVERS.—The Tramways Committee is proceeding with a scheme for utilising female labour in substitution for male. Already several hundred women are employed as car conductors and car cleaners. Protests have, however, been received from labour organisations with regard to the employment of women as "motormen." Some time ago Mr. Dalrymple, the general manager, with the consent of the Committee, trained five young women for the work of the driving platform, and after serving a probationary term they were put in charge of cars. So successful has the experiment proved that it is now proposed to train a number, not exceeding 30, of additional women to enable the manager, should the occasion arise, to advise the Committee on the advisability or otherwise of employing women as car drivers.

Halifax.—FEMALE LABOUR.—During the course of a discussion on the appointment of women as conductors on the Halifax cars, a deputation from the Tramwaymen's Union was informed that it was not the intention to continue the employment of women on the tramways after the termination of the war.

Newcastle-on-Tyne.—A landslide took place on the 27th inst., on the North-Eastern Co.'s electric railway, at Lants Quarry, between St. Peter's and St. Anthony's stations, near the River Tyne; a portion of the railway embankment slid away, leaving the railway track suspended in the air.

Stockport.—STRIKE.—About 30 men employed in the car depôt came out on strike on Tuesday, because their demand for a bonus on similar lines to that granted to car drivers had not been acceded to. The Tramways Committee had suggested a revision of wages, but the depôt men would not agree to that.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Public Works Committee of the Federal Parliament has submitted its report upon proposals to establish further automatic telephone exchanges. The savings effected where the automatic system has been installed tend to show that, although the cost of installation is much higher than is the case with the manual system, under the full automatic system the working cost on each line would be reduced approximately £1 a line a year.

It is estimated that the Sydney Exchange will cost £116,801 for 5,000 lines, or £339,899 for 20,000 lines. The immediate suggestion is to install a switching equipment of 5,000 lines. At the time of transfer it is estimated the revenue will be £5,180, and with 20,000 subscribers, £185,000.

For Malvern, also, will be installed an automatic switchboard, having a present capacity of 3,600 lines, but capable of extension to 7,500 lines. The immediate cost of the work is estimated at £46 933. The estimated revenue with 3,600 subscribers connected is £23.940. The Committee expresses its approval of the proposals.

The Collingwood station also will be a new one with a present capacity of 3,400 lines and an ultimate capacity of 9,000 lines. The estimated immediate cost is £49,752. The revenue is estimated as £22,610, with 3,400 subscribers connected.—*Australian Mining Standard.*

Berlin-Sofia. — Direct communication by telephone between Berlin and Sofia, Bulgaria, has been opened.—*T. and T. Age.*

Duplex Marconi Wireless.—The trans-Atlantic wireless circuit between Louisburg, Cape Breton and Clifden, Ireland, is being operated automatically as a duplex, the Wheatstone being used for transmission and the Dictaphone for reception.—*T. and T. Age.*

Long-Distance Wireless.—On November 29th an operator of the Federal Wireless Telegraph Co., at Honolulu, Hawaii, picked up messages transmitted from Nauen, Prussia, to Tuckerton, N.J., approximately 9,000 miles away. It is stated that the signals, as received, were very clear.—*T. and T. Age.*

Russia.—A temporary interruption in telegraphic communication between England and Russia last week was removed at the week-end.

Telephonic Interruptions. — A violent storm on Monday night brought down numerous telephone wires in various parts of the country, and communication between London and important provincial towns was in many cases restricted or completely interrupted. Communication between Cardiff and Birmingham, Liverpool and Manchester was stopped.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—ADELAIDE.—January 19th. P.M.G. Common-battery switchboard. See "Official Notices" November 19th.*

January 26th. Deputy P.M.G. Twenty tons of galvanised-iron wire, 400 lb. to the mile.*

January 26th. Deputy P.M.G. Telephone instruments, parts and accessories.*

BRISBANE.—February 23rd. P.M.G. Wheatstone apparatus. See "Official Notices" Dec. 17th.

April 15th. P.M.G. Common-battery multiple switchboard, or automatic or semi-automatic switchboard, and associated apparatus. See "Official Notices" to-day.

SYDNEY.—January 31st. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

February 7th. Metropolitan Board of Water Supply and Sewerage. For No. 1 pumping station at Ultimo. Two centrifugal pumps and electric motors (4,000 gallons per minute each), switchboards, starters, &c. Contract No. 1,301.*

February 28th. Municipal Council. Tenders for induction regulators. Specifications (11s. 6d.) from the Electric Light Department, Town Hall, Sydney.

Bristol.—January 4th. Electric fittings for six months, for the B. of G. Mr. J. J. Simpson, Clerk, St. Peter's Hospital.

Darlington. — January 12th. Corporation. Coal bunkers, elevators, &c., for the electricity works. Specifications from the Borough Electrical Engineer, Haughton Road.

London.—ST. PANCRAS.—January 10th. B.C. Steel constructional work (power-house extension) for the Electricity Department. Specifications (£1) from the Borough Electrical Engineer, 57, Pratt Street, N.W.

HAMPSTEAD.—January 6th. B.C. Electrical engineer's stores, oils, &c. Particulars from the Town Clerk, Town Hall, Haverstock Hill, N.W.

ISLINGTON.—January 21st. B.C. Twelve months' supply of engine-room stores, electrical fittings, meters, cables, &c. See "Official Notices" to-day.

Manchester.—January 5th. Alterations and additions to pipework and condensing plants for Nos. 13 and 15 turbines, Stuart Street station. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Newton-in-Makerfield.—January 3rd. U.D.C. Two Lancashire boilers, one steam-driven gas exhauster, one 25-H.P. D.C. electrical set. Specification from Mr. R. T. Surtees, Gas Works, Newton-le-Willows.

New Zealand. — AUCKLAND. — February 23rd. City Council. Centrifugal pumping electric motors, and automatic starting and controlling apparatus, for the four city pumping stations. Specifications from the office of the Water Board, Town Hall, Auckland.

DUNEDIN.—May 17th. City Council. (1) Tramcar bodies; (2) electrical equipment. Plans, &c., from the Town Clerk, Dunedin.

RAETIHI.—March 14th. Town Board. 40-H.P. hydro-electric generating set, switchboard, &c. Plans and particulars from Messrs. H. W. Climie & Son, Raetihi.*

South Africa.—DURBAN.—January 5th. Corporation Telephone Department. (1) Telephone apparatus and materials; (2) underground cables; (3) 540 c.i. pipes, 9 ft. long, for cables. Messrs. Webster, Steel & Co., 5, East India Avenue, E.C., are the Corporation's London agents.*

Spain.—January 20th. Installation and working of an electric lighting system at Segovia for five years, for the municipal authorities.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Aldershot.—The U.D.C. has accepted the tender of Messrs. Spencer, Whatley, Ltd., for the supply of 1,500 tons of Griff peas coal, at £1 3s. 3d. per ton, for the electricity works.

Australia.—The following tenders have been accepted :—

Victorian Railways Department.

15 tons of galvanised telegraph wire, £257.—The Whitecross Co.

Public Works. (Shipyard), Williamstown.

Motors for machine tools.—Gardner, Waern & Co., £148; Aust. General Electric Co., £231.

N.S.W. Public Works Department.

Switchboard for Port Kembla power station.—Panels 1 and 2, and additions to existing panel, £358, Aust. General Electric Co.; panels 3 and 4, £290, Haes & Eggers, Ltd.

West Australia Tender Board.

Static transformers (Railway Department), 80 k.v.a. and 200 k.v.a., £832.—J. R. W. Gardam.

South Australia Supply and Tender Board.

20 tons of copper wire, £2,170.—Harris, Scarfe & Co.

Sydney City Council.

The Electricity Committee recommends that the tender of Messrs. N. Guthridge, Ltd., be accepted for a 2,000-kw. motor-converter constructed by Messrs. Bruce Peebles, Ltd., at £8,237; and that tenders for motors for hiring out be accepted as follows :—

Sections A, B, C and D.—Aust. General Electric Co. Tender "A" for motors manufactured by the General Electric Co. of U.S.A., and tender "C" for starters manufactured by the B.T.H. Co.

Section E.—Aust. General Electric Co. Tender "A" for motors and starters manufactured by the G.E. Co. of U.S.A.

Section F.—Standard Waygood Hercules, Ltd., for motors and starters manufactured by the British Westinghouse Co.

And that the following initial orders be given :—

Section A, motors £923, starters £57. Section D, motors £1,437, starters £155. Section E, motors £2,028, starters £543.—Aust. Gen. Elec. Co. Section F, motors £422, starters £63.—Standard Waygood Hercules, Ltd.

Also that 58 motors, at prices 30 per cent. in excess of the contract which expired on October 8th, be obtained from Standard Waygood Hercules, Ltd., at £2,996; and that additional switchgear and transformers be obtained under existing contracts from N. Guthridge, Ltd., £1,438; British General Electric Co, £457; British Westinghouse Co., £502; Aust. General Electric Co., £441.

—*Tenders.*

Public Works Department, Sydney.

104 A 6 Edison cells, in four batteries of 26 cells each, for the Newcastle workshops, £551.—Standard Waygood Hercules, Ltd.

—*Sydney Evening News.*

Melbourne.—The Melbourne, Brunswick and Coburg Tramways Trust has accepted the tender of Messrs. Burt & Timms, at £27,863, for construction of the permanent way.

Ilford.—The tenders of Messrs. W. T. Henley's Telegraph Works Co., Ltd., have been accepted by the D.C. for the supply of 3,387 yards of triple-concentric cable, at £2,260, and for joint boxes, at £59. Eleven tenders were received.

Ryde.—The T.C. has accepted the tender of Messrs. Ruston, Proctor & Co., Ltd., for a semi-Diesel engine for pumping purposes, at £298.

FORTHCOMING EVENTS.

Rontgen Society.—Tuesday, January 4th. At 8.15 p.m. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "Some Observations upon the Occurrence of Uranium," by the President, &c.

Royal Institution of Great Britain.—Tuesday, January 4th, Thursday, January 6th, and Saturday, January 8th. At 3 p.m. At Albemarle Street, Piccadilly, W. Christmas Lectures for Juveniles, "Wireless Messages from the Stars," by Prof. H. H. Turner.

Greenock Electrical Society.—Friday, January 7th. At 7.45 p.m. At the Temperance Institute, 19. West Stewart Street. Paper on "The Economy of Electricity in a Small Household," by Mr. W. B. Smith.

Electro-Harmonic Society.—Friday, January 7th. At 8 p.m. At Holborn Restaurant. Smoking concert.

Manchester Association of Engineers.—Saturday, January 8th. At Grand Hotel, Aytoun Street. Paper on "The Importance of Uniform Conditions for Engineering Operations and Industrial Work," by Mr. A. Etchells.

NOTES.

A Happy New Year!—We wish all of our readers—nanufacturers, professional and commercial men, electrical ngineers engaged in munitions production at home, and friends n the Fleet or in the trenches—all the good that they can wish or themselves in 1916. May the Victory of the Allies not be long eferred, permitting the electrical industry to return to its normal nterests and activities.

Russian Iron for Electrical Purposes.—In 1913 he quantity of iron imported into Russia for the construction in hat country of electrotechnical apparatus amounted to a total of 000 tons. Investigations recently carried out have shown that n the Urals there are large reserves of iron which, suitably treated, ould serve quite successfully for this purpose, not only as a conructional material, but also in respect of its magnetic properties. is hoped that in the future Russian iron will take the place of erman iron in the national electrotechnical industry.

Chain Screen Doors for Furnaces.—Everyone who s had to work round ovens and furnaces knows what discomfort s to be endured by the attendants from the heat when the doors e thrown open, and, further, what a chilling effect the inrushing ld air has upon the interior of the furnace and its contents. Doors, however, must be opened, be it to renew the charge, manipulate the contents, or study the interior conditions.

The Wiegand chain screen doors, in the form used mostly around glass, metal and chemical furnaces, consist of a multitude of freely hanging individual strands of steel chain suspended close together from a steel bar in a manner to form a continuous sheet or curtain of chain, not unlike the familiar Japanese screen.

This curtain effectively hinders the heat from leaving the furnace and the cold air from entering. The loosely hanging strands are parted with ease and pressed aside by the tools or other objects projected into the furnace, falling together again afterwards.

The holes in the links of chain permit an unhampered view of the interior—in fact, a better survey than under ordinary conditions may be obtained, as the glare is toned down, and the effect is similar to looking into the furnace through a piece of wire gauze.

The doors are supplied in "automatic" and "non-automatic" forms. The automatic is employed mostly on boiler furnaces, where the opening of the ordinary fire door causes the screen to unroll from a cylinder hung above the furnace opening. The non-automatic, which is much used on ovens and other furnaces, is much simpler in construction. The chains forming the screen are suspended from a bar and may be raised out of the way by a hand chain running through a pulley overhead. When needed, the screen is lowered into supporting brackets fixed at the sides of the opening.

These chain screen doors are the result of several years of experimentation, having been first adapted for use on boiler furnaces, where they have been in practical operation for three years. They are made by the E. J. Codd Co., Baltimore, Md., U.S.A.—*Metallurgical and Chemical Engineering.*

Reinforced Concrete Construction.—The *London Gazette* for December 28th contains the full text of the regulations made by the London County Council, and confirmed by the Local Government Board, for the use of reinforced concrete in building construction. The regulations are very detailed, and include technical data and formulæ to be used in calculating bending moments, resistance moments, permissible loads, &c.

An Excellent Record.—At the outbreak of the war the Calico Printers' Association, Ltd., of Manchester, had a staff of 37 electricians engaged on maintenance work. Within the first two months 15 joined the Forces, and within the first six months 10 left to take up various grades of work for the Government. There then remained a staff of 12, nine of whom have attested, the remaining three being over military age. Out of the nine attested men the Association is hoping to retain at least five to enable the electrical department to continue its operations. How important these operations are may be gathered from the facts that all the engineering shops, many of which are electrically operated, are working at full speed; over 400 dynamos and motors, representing between 11,000 and 12,000 h.p., are daily at work, and some 600 miles of wire and 30,000 lights have to be maintained. We recently recorded that a late member of the staff had been granted the "Croix de Guerre" for gallantry in France. The department certainly seems to be "doing its bit."

New Motor-Car Lighting Regulations.—Under the new motor-car lighting regulations which come into force on January 10th, not only are all headlights prohibited, but it is provided that, where electric side lamps are used, the bulbs must not exceed 12 watts, or give, in use, a greater candle-power than a 12-watt bulb, as standardised for side lights by the Engineering Standards Committee. The front glass, if circular, must not exceed 6 in. in diameter, and, if rectangular, the longer side must not exceed 6 in. The whole of the front glass must also be obscured with one thickness of ordinary white tissue paper. In certain scheduled areas the light must be further obscured by disks of cardboard or opaque material in which are pierced six small holes.

Institution and Lecture Notes.—Diesel Engine Users' Association.—At the December meeting of the Association, Mr. Geoffrey Porter, borough electrical engineer to the Worthing Corporation, was elected President; and Messrs C O. Milton (Maidenhead), C. Gould (Letchworth), and H. Leslie Dixon (Leatherhead), were elected members of the Committee. Mr. Percy Still (Chelsea) was elected as Honorary Secretary. The Acting Hon. Secretary for the current year stated that there had been an increase during the year of 19 members, the total membership to date being 48, and representing 104 Diesel engines, having a total horse-power of 23,984. During the year 1915 a work of considerable importance had been accomplished in drawing up a standard form of policy of insurance against breakdown specially applicable to Diesel engines, in conjunction with Messrs. Banks, Warner & Co., Ltd. Under this arrangement preferential terms are granted to members of the Association, or to the undertakings for which they act. The scheme also provides for inspection of engines and full reports by engineers who have made a special study of Diesel engine plant. The subject of income-tax assessment, and of the allowance made for depreciation by the Inland Revenue Authorities, also received careful consideration. Before the conclusion of the meeting, the retiring President, Mr. J. E. Edgcome, referred to the rapid growth of the Association from small beginnings, and spoke of the work carried out, which had proved useful, not only to users of Diesel engines, but also to engine makers and others interested in the industry. The next meeting will be held on January 19th, 1916, when the subject of the possible use of "Tar Oils and Fuel Oils from other Sources" will be considered.

Electrical Association of Australia (Victoria Section).—The Council reports that 22 members of the Association have joined the Expeditionary Force. One, Lieut. R. T. Watts, died as a result of wounds received at the landing at Gaba Tepe. Mr. E. H. W. Westwood has resigned his office as secretary, owing to military duties. The average attendance at meetings has been 51·8 members and visitors. The scheme for licensing wiremen, which was delayed by unforeseen circumstances, will be submitted in the near future.

Association of Mining Electrical Engineers.—At a recent meeting of the Yorkshire Branch, at Sheffield, a paper was read by Mr. Andrew Gibson, of Glasgow, on "Bearings of Electrical Machinery." He said that ball bearings fulfilled better than any other type the principal aim of bearings—to reduce friction to a minimum. Properly installed, ball bearings required very little attention and very little oil, but it was essential that they should not be allowed to run dry.

Royal Society of Arts.—The following are included among the arrangements for meetings during January and February, 1916:—

Wednesday, January 5th, 3 p.m. (Juvenile Lecture.) Prof. John M. Thomson, LL.D., F.R.S., "Crystallisation." (With experiments.)

Wednesday, January 12th, 3 p.m. (Juvenile Lecture.) James Swinburne, F.R.S., "The Science of Some Toys."

Wednesday, February 9th, 4.30 p.m. (Ordinary meeting.) Prof J. A. Fleming, F.R.S., "The Organisation of Scientific Research."

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER ENGINEER CORPS.—Orders for week commencing January 3rd, 1916.—By Lieut.-Col. C. B. Clay, V.D., Commandant.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

Monday, January 3rd.—Sections 1 and 2, Technical; Sections 3 and 4, Squad, Signalling Sections and Recruits.

Tuesday, January 4th.—School of Arms with Architects Corps, 6 to 7 p.m.

Thursday, January 6th.—Sections 1 and 2, Shooting.

Friday, January 7th.—Sections 3 and 4, Technical; Sections 1 and 2, Squad, Signalling Sections and Recruits.

Officer of the Week: Monday, January 3rd, 1916, to Saturday, January 8th, Mr. L. C. Hughes-Hallett.

Platoon on Duty.—Monday, January 3rd, to Saturday, January 8th.—No. 1 Platoon.

Platoon on duty to provide a piquet for Headquarters of one N.C.O. and three men, and also one N.C.O. for instructing recruits.

Sections for Technical Parade at Headquarters, London Electrical Engineers, 46, Regency Street, S.W.

Sections for Shooting Parade at Miniature Ranges.

Unless otherwise ordered, all Parades at Chester House.

E. G. FLEMING,
Acting Adjutant and Company Commander.

Fatalities.—On Sunday last, at Eastbourne, a motor-car belonging to a visitor collided with and smashed one of the electricity supply H.T. switch pillars; two men who came to render assistance received fatal shocks, and several others had narrow escapes. The occupants of the car escaped injury, and, according to the *Times*, it is thought that the car was not actually touching any live metal, until it was moved by the men who came to help, when owing to the front axle coming into contact with a wire, the metal work of the car, which was rubber tired, became alive, and two of the men were killed. An inquest was opened on the 27th inst., and was adjourned in order that the Board of Trade might send down an expert.

An inquest has been held into the death of a driver in the A.S.C., who, during the gale on Monday, fell among some electric lighting wires used for lighting the Blackheath huts, which had been blown down, and received an electric shock. Verdict, "Accidental death."

Removing Iron Scale by Electrolysis.—When iron is worked into sheets, wires, tubes, &c., the well-known bluish-black scale is produced each time that it is heated to the annealing temperature, or in the case of tubes, to the welding temperature. This hard scale must be removed before the metal can be again rolled or drawn, or before it can be tinned or galvanised. This is usually done by immersing the oxidised metal in sulphuric acid, which is termed "pickling."

The black oxide of iron is Fe_3O_4, and this is not soluble in sulphuric acid. The scale is removed partly by dissolving the iron underneath it, and partly by forcing it off by generating hydrogen gas between the scale and the surface of the clean metal by the dissolving of the metal by the acid. The process is, therefore, intrinsically incorrect in principle, as it is not a true dissolving of the scale, but must consume good iron and a corresponding amount of acid.

In the electrolytic process, however, the action is reversed; the scale is rendered readily soluble and the metal insoluble, hence it is correct in principle, the scale alone being dissolved. In this process, first brought out by C. J. Reed, and patented by him, the iron is made the cathode, and the oxide dissolves readily; it is not reduced to metallic iron, but goes into solution as oxide. When the current density is high enough to keep the clean metal covered with hydrogen, no good metal will be dissolved. Hence the process is correct in principle; it will dissolve the scale only, will not dissolve any good metal, and will require the consumption of only as much acid as is necessary to dissolve the scale.

Although the amount of good metal and acid consumed in the ordinary pickling process, and saved by the electrolytic process, may be small relatively to the weight of the article pickled, yet when many tons of steel are cleaned per day, as in some large works, the value of these unnecessary wastes is considerable. Mr. Reed estimates that this saving would be about 50 to 75 cents per ton.

The anode in this process is most conveniently made of lead. The ordinary scale is removed in about a minute's treatment, less when thinner, and more when thicker. The cost of the electrical energy is very small, amounting to only a few cents per ton of wires and sheets. The iron comes out of the bath almost white, resembling silver, in marked contrast to the dirty gray appearance in the ordinary pickling process. It is then probably also in much better form for galvanising and tinning.—Carl Hering, in *Met. and Chem. Eng.*

Electric "Guard Wires."—In *l'Industrie Electrique* for December 25th an illustration is given of the electrically-charged wire fence erected by the Germans along the Dutch frontier to prevent desertions. The fence consists of several wires mounted on insulators and connected with a source of high-pressure current. Ordinary barbed-wire fences on either side prevent accidental contact with the electrified lines. The use of this system enables an effective barrier to be provided, and many sentries to be dispensed with, but of course the electric fence presents no difficulty to an electrician, and the Belgians are said to pass through the barrier with the greatest ease, with the aid of an ordinary barrel. Getting inside, the Belgian makes the barrel roll towards the electric fence by adopting the method of a squirrel in its cage; when the barrel reaches the fence, the iron hoops round it earth the wires, and the traveller, perfectly sheltered within his cage, passes under them without any risk or inconvenience.

Reserved Occupations.—A supplementary official list of reserved occupations includes:—

In all industries—Works Chemists.
Electricity Meter Manufacture—Calibrators.
Boiler Insurance Companies—Boiler inspectors, technical office staff.

Artificial Rubber.—According to German reports, Prof. Memmler, of the University of Berlin, has discovered a process for the manufacture of synthetic rubber, and a Frankfort firm of tire-makers has proved its practical value by exhaustive tests. The *Frankfurter Zeitung* opines that in the course of time "the manufacture of synthetic rubber will make it unnecessary to import rubber into Germany, and one of the gravest inconveniences caused by the stoppage of German oversea traffic will thus be removed; German science has made one more contribution towards winning the war."

For Sale.—Messrs. B. Norman & Son will sell by auction without reserve, at Westbourne Grove, W., on January 12th, a 60-H.P. gas engine, dynamo, switchboard, fittings, &c., of which some particulars are given in our advertisement pages to-day.

Appointments Vacant.—Shift engineers, station fitters, wiremen and engine drivers (steam and oil engine), for the Southern Command Military Camp, near Salisbury; two switchboard attendants for Wakefield Corporation. See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—A Melbourne paper says that the chief engineer of the Tasmanian Government hydro-electric department has made the following appointments:—Power station superintendent, Mr. H. H. A. Curtis, of Lake Coleridge, New Zealand; shift engineer, Mr. B. S. Marshall, of Dunedin; Mr. P. S. M'Arthur, of Hobart; and Mr. G. F. Evans, of Balmain, Sydney.

Mr. R. ALLAN BROWN has been appointed by the Falkirk Town Council electrical engineer for the burgh in place of Mr. Harold Ranson, who recently resigned with the object of joining H.M. Forces. Mr. Brown served his apprenticeship in Greenock, and afterwards held a position in connection with Glasgow Corporation tramways. He went to Falkirk five years ago as chief assistant engineer at the Corporation electricity works, and for the past three months has been acting as interim engineer.

The staff of the Bermondsey electricity works presented Mr. W. TANCRED with a handsome clock as a parting gift on his leaving Bermondsey to take up his appointment at the power station, Stalybridge.

General.—MR. CECIL SAINSBURY, managing director of Messrs. Stothert & Pitt, Ltd., of Bath, who is to be married on January 1st to Miss Lois Alder, has been presented by the working staff with a silver card tray, and by the employés with a silver salver, silver rose bowl, and a silver match-box.

Eastern Engineering states that Mr. ARTHUR H. PREECE (Messrs. Preece, Cardew, Snell & Rider, of London) recently arrived in Shanghai. He stopped at Hong-Kong, where his firm are consulting engineers to the Colonial Government and to the Hong-Kong Electricity Supply Co., and honorary consulting engineers to Hong-Kong University. Mr. Preece was to remain in Shanghai about a fortnight. He went to Shanghai in response to the request of the Shanghai Municipal Council that his firm send out a man "to advise the Electricity Committee and Council generally on all points connected with the electricity extension undertaking." He was the principal guest at the first annual dinner of the Hong-Kong University Engineering Society, held on December 5th. Prof. C. A. Middleton Smith, who presided, remarked that China was the Mecca of engineering.

Roll of Honour.—Rifleman Ernest Abbott, of the 12th Battalion Rifle Brigade, lately on the Rugby staff of the British Thomson-Houston Co., Ltd., has been killed in France.

Bombardier James Burke, of the Royal Field Artillery, formerly an electrician employed by Mr. R. Varley, of Colne, has been wounded in France, and is now in hospital at Boulogne.

We regret to learn of the death, at the age of 31 years, of Second-Lieutenant W. O. Garrett, who had been for some years in the service of Messrs. Siemens Bros. Dynamo Works, Ltd., at Madras. Mr. Garrett left Madras in October, 1911, having obtained a commission in the Queen's Own 3rd Sappers and Miners, and after a short training in Bangalore he left for the front in Mesopotamia, whence he is now reported to have been "killed in action."

The death is reported in action of M. Georges Meyer, for some time secretary of the Chambre Syndicale des Industries Electriques, and chairman of the seventh section of the same.

Private Frank Whitaker, of the West Yorkshire Regiment, who went to the Dardanelles on July 3rd, has been missing from his regiment for some time. He is 38 years of age, and had fought in Egypt, being present at the battle of Khartoum. Prior to the outbreak of the present war he was engaged with the Yorkshire Electric Power Co.

News has been received of the death, as a result of wounds received in the battle of Loos, of Sergeant J. Dalton, of the West Cheshire Regiment. Sergeant Dalton had seen service in India and South Africa, and had been with the Forces since August, 1914. He was wounded during the retreat from Mons and was invalided home, but returned to the firing line again. Prior to the war he had, for six years, been engaged with the Phœnix Dynamo Manufacturing Co., of Bradford.

Private Clifford Bentley, of the 12th Battalion Yorkshire Regiment, has died as a result of wounds received in action in France on September 30th. He was formerly engaged at the Heckmondwike electricity works.

Lance-Corporal Ernest Lakey, of the 9th Battalion West Riding Regiment, has been killed whilst on patrol duty in France. He was 21 years of age, and was formerly employed at the Halifax Corporation electricity works.

Obituary.—Mr. A. T. Webb.—The death occurred on December 21st, after an illness of ten months' duration, of Mr. Alfred Thos. Webb, who for about 20 years had been on the staff of Messrs. Crompton & Co., electrical engineers, of Chelmsford. He was 55 years of age.

Herbert Arnaud Taylor.—We learn with very deep regret of the death of Mr. Herbert Taylor, of the firm of Clark, Forde and Taylor, which occurred early on Thursday morning, the 23rd inst. Mr. Taylor was seventy-four years of age, and had been in failing health for some time past. Herbert Taylor obtained his commission as Lieutenant in the Royal Engineers (in June, 1862) when nearly 21 years of age. Ordered abroad at a time when, for urgent private reasons, it was necessary to stay in England, he resigned his commission and became a pupil of the late Mr. Latimer Clark, F.R.S., in 1867. This marked the introduction to telegraph and submarine cable engineering to which his whole life was devoted. Mr. Taylor, up to the time of his demise, was a partner in the firm of Clark, Forde & Taylor, the termination of his partnership occurring at his own request at the end of the present year. During Mr. Taylor's pupilage, and whilst acting for Mr. Clark as his chief assistant engineer, a large amount of useful work was carried out by him, notably in connection with the series of experiments which resulted in the production of the well-known Clark's Standard Cell and the determination of its E.M.F. in absolute measure, etc. In this work Dr. Alexander Muirhead was also associated. We may also mention the experimental work on the effect of temperature on the electrical resistance of gutta-percha covered conductors, which was carried out by Mr. Taylor on behalf of Mr. Clark. The first important cable work upon which he was engaged was the Persian Gulf cable of 1868, Latimer Clark being the engineer appointed by the Government to carry out the laying operations. On the voyage out to Bombay, on the P. & O. steamer *Carnatic*, the ship struck the Shadwan Reef in the Red Sea, many lives being lost. Mr. Taylor happily escaped by swimming to the Reef, on which some days were spent before relief came. The greatest trouble to Mr. Herbert Taylor was the loss of the whole of the testing instruments, but he, with improvised apparatus, sought for and constructed by himself, made the loss sufficiently good to insure the proper testing and control of the electrical part of the work during the laying of the cable. In 1892 Herbert Taylor became a partner with Latimer Clark, H. C. Forde and Charles Hockin, thus forming the firm known as Clark, Forde & Taylor, who, during the past 40 years, have acted as consulting engineers to all the great submarine cable companies, and whose name is intimately associated with the development and progress of submarine telegraphy. Beginning with the laying of the 1873 and 1874 Anglo-Atlantic cables, and in the succeeding years, Herbert Taylor acted as engineer on expeditions too numerous to record, including many of the lines of the Eastern Group. Indeed, tens of thousands of miles of cable were laid in all parts of the world under his personal supervision. The last foreign work undertaken by him was in connection with the laying of the British Pacific cable, upon which project he gave evidence before the Committee appointed to report upon the proposal, and for which subsequently his firm were appointed engineers, and as senior partner Herbert Taylor was responsible for the specifications to which the cable was manufactured and laid. Beyond taking part in his firm's engineering work, Mr. Taylor, in association with the Muirhead brothers, solved the problem of duplex working on submarine cables, and thus doubled the earning power of many millions of capital invested in such undertakings. The introduction of automatic transmission of signals on cable circuits was also in no small degree due to his efforts. The construction of highly sensitive relays was engaging Mr. Taylor's attention when, in 1898, Mr. S. G. Brown approached him in order to obtain his assistance in developing certain ideas relative to cable working, and this partnership resulted in the invention of the drum cable relay and magnetic shunt, which have proved of such great benefit to the numerous cable companies which have adopted the system. Such a record impresses upon us the services rendered to telegraphy by Herbert Taylor, whose many patents bearing on cable enterprise are evidence of his activities. Mr. Taylor was a member of the Institutions of Civil Engineers and Electrical Engineers, and served on the council of the latter for some years. As a member of the Sub-Committee on Cables, appointed by the Engineering Standards Committee, Herbert Taylor, with his exceptional knowledge of copper conductors, assisted materially in their deliberations. Unfortunately Mr. Taylor's natural reserve and dislike of publicity led to a large amount of interesting experimental work done by him not being published. We mention, however, papers on the "The Electromotive Force of Mercury Alloys," Hockin & Taylor; "Temperature Coefficients of Conductivity Copper" (C. F. & T.), which latter have been adopted by the Engineering Standards Committee. Those who knew Mr. Taylor admired him for his personal gifts and ever courteous manner. A staunch friend, and modest to a degree, he never had what is called the "business instinct." Disinterested and ready to assist any and all who came to him for help and advice on whatever matter it might be, assistance was rendered with a graciousness that left him no enemies but many friends, who will sincerely feel their loss in the death of this loyal gentleman, to whom meanness of thought or idea was absolutely foreign and unknown. Mr. Taylor was well-known to one of the Editors of this journal, and to a number of our readers, who, we believe, will desire to join with us in tendering sympathy with the family in their bereavement.

NEW COMPANIES REGISTERED.

Electrical Manufacturers' Co. of Great Britain, Ltd. (142,475).—Registered December 21st, by Lindo & Co., 2-3, West Street, Finsbury Circus, E.C. Capital, £12,000 in £1 shares. Objects: To carry on in Russia or elsewhere the business of commission, commercial, and general agents, contractors, merchants, bankers, engineers, ironfounders, shipowners, carriers, importers, exporters, buyers, sellers, and manufacturers of and dealers in machinery, implements, rolling stock, and hardware of all kinds, and to adopt an agreement between Bruce Peebles & Co., Ltd., Crompton and Co., Ltd., the Lancashire Dynamo & Motor Co., Ltd., Allen, West & Co., Ltd., Brook, Hirst & Co., Ltd., Eckstein, Heap & Co., Ltd., Whipp & Bourne, Ltd., and this company. The signatories (with one share each) are: E. H. F. Reeves, 381, Salisbury House, London Wall, E.C., company director; H. C. Siddeley, 28, Victoria Street, S.W., electrical engineer. Private company. The first directors (to number not less than two or more than ten) are J. H. Bunting, E. H. F. Reeves, H. C. Siddeley, W. J. Moggridge, J. A. Hirst, A. Eckstein, and S. Whipp. The said first directors are the respective nominees of the firms above named, and each may retain office during the pleasure of the firm nominating him. No qualification required. Registered office: 28, Victoria Street, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

W. A. Creedon and Co., Ltd.—Debenture, dated December 2nd, 1915, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: I. Staal, 13, Brownlow Street, High Holborn, W.C.

Ardee Electric Co., Ltd.—Particulars of £2,000 debentures, created July 28th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, and to Order of Court, dated December 13th, 1915, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Telephone Co. of Egypt, Ltd.—A memorandum of satisfaction to the extent of £290 on December 15th, 1915, of debenture stock covered by trust deed dated July 27th, 1904, and three supplemental deeds of acknowledgment dated February 21st, 1906, March 4th, 1908, and October 27th, 1909, securing £200,000, has been filed.

Oriental Telephone and Electric Co., Ltd.—A memorandum of satisfaction to the extent of £830 on December 15th, 1915, of debenture stock covered by trust deed dated June 28th, 1905, and supplemental deed of acknowledgment dated June 12th, 1907, securing £200,000, has been filed.

Albert A. Ball and Co., Ltd.—Debenture, dated December 16th, 1915, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holder: A. A. Ball, 92, Hornsey Lane, N.

CITY NOTES.

Melbourne Electric Supply Co., Ltd.

Mr. J. B. Braithwaite presided over the annual meeting, held at Finsbury Pavement House, E.C., on December 22nd. He said the only item on the debit side of the balance sheet which showed any change was the increase in the amount of consolidated ordinary stock from £300,000 to £375,000. The debenture issues were the same except that, of course, they had redeemed a further amount under the sinking fund. The dividend equalisation account of £10,000, established last year, remained intact. The balance carried to the profit and loss account was £64,777, which was much larger than last year. To deal first with the figures of the Melbourne undertaking, the income from private lighting was £94,791, against £81,778; from power, heating, etc., £44,393, against £37,466; from public lighting, £8,311, against £7,017; and from the supply to the municipal tramways, £21,443, against £16,836. The next item, that of bulk supply, £2,529, was exceedingly gratifying. Last year he told them they had commenced a bulk supply to one of the outlying municipalities of Melbourne, from which, at that time, they got the insignificant revenue of £321, but he pointed out the importance of that fact. Now they were supplying five of these outlying municipalities, so that it looked as if they had permanently put a stop to the idea of everyone putting down a little power-house of his own. Of course, the company supplied these municipalities on extremely reasonable terms—cheaper than they would be able to get a supply from a power-house of their own—but it consolidated their position and gave them an additional load. This year they had received eight times as much from that source as last year, and it was an item which was going to increase largely in the future. Meter rents, £8,084, showed an increase due to the increase in the number of customers, and the total revenue of the undertaking was £179,752, against £149,959, or an increase of about £30,000, which, in view of the war, the reduction made in price to consumers, and the drought from which the colony had only recently recovered, must be considered very satisfactory. On the other side, the generation of electricity had gone up from £27,125 to £35,072, the distribution of electricity from £1,695 to £1,794, repairs and renewals from £9,913 to £11,142, carbons, lamp renewals, etc., from £4,773 to £5,273, and general charges from £13,929 to £19,013. In connection with the latter item, he might say that 89 of their employés, or 17 per cent. of the total, had enlisted, and the company was paying the difference between the army pay and the wages they had been receiving to their dependents. Strictly speaking, he supposed this, and the subscriptions they had made to various funds, were a little outside the province of the company, but they were all members of the British Empire, and in this great war for the peace of Europe, he was sure the board would have the support of the shareholders in what they had done. As the result of the working of the Melbourne undertaking, they had carried £107,514 to profit and loss, as against £93,202. Geelong was a much smaller concern, and the revenue was slightly down, being £28,917 against £29,161. Geelong had felt the effect of the drought more than Melbourne, and, being a shipping port, had been affected by the war owing to the commandeering of ships and so on. The hay compressing industry had been interfered with, and as the compressors were worked by electric power the company had suffered. The balance carried to profit and loss was £10,161 against £11,137, which, under the circumstances, he thought was a good result. Coming back to Melbourne, he might say they had got the current available now in 537 miles of mains, and the expenditure which had been made in past years in the carrying of mains to the outlying districts was beginning to produce a harvest. Mr. F. W. Clements, their local managing director and chief engineer, had sent a report which showed the wisdom of the expenditure they had made in past years. He said they would never be able to say they had no distribution work to carry on, but that in the future it would be of much smaller dimensions than in the past. Out of 445 houses connected in one month, only 16 per cent. required pole extensions, and the company were about to reap the benefit of the capital expenditure of the past. There was the further satisfactory feature that they were not wholly dependent on new houses for their progress, as many of the applications were from old houses which were throwing out gas. Mr. Clements also said that they were justified in saying that money expended ten or fifteen years ago on overhead distributing mains was rapidly being rendered more profitable, and the increased profit was certain to be at a greater rate than the increase in capital expenditure. Another interesting feature was the success which had been achieved by the staff in the introduction of electricity for general domestic purposes. For instance, in the little matter of electric irons, they had over 5,000 installed in Melbourne, representing about 3,000 kw. of connections. They had also got a good load of radiators and other kinds of domestic appliances. With regard to Melbourne, there was a great deal on which they could congratulate themselves. As he had said, they were supplying five outlying authorities, and one was 18 miles from the power house. The traction supply was also increasing by the extension of the municipal tramways. In spite of the war and the drought, they had had over 4,000 additional consumers connected up, which was twice as many as any London company he knew of. The policy they had adopted of scrapping old plant and putting in the most efficient and latest type of machinery which could be obtained was steadily bearing fruit. Their proportion of profit was steadily increasing, and alongside of this they always had been and were considering the interests of the consumers, and they had reduced their rates for lighting and made further reductions in the power and heating rates, with the result that power could now be obtained by large consumers as low as .65d. per unit. So although their company was now in a very prosperous condition, its prosperity was not due to any mulcting of the consumers, but, on the contrary, they had always considered their interests and reduced rates wherever practicable. The true policy was to put in the most efficient plant possible, and make the whole system as efficient as they possibly could, and that enabled them to supply at a price which made it attractive. They were supplying a considerable amount of power to works making ammunition, and it was largely on that account that they obtained the Treasury consent to the issue of new capital in Australia. The Treasury would not give their sanction to the issue of the English portion at present, and as the issue of new capital at par represented a distinct bonus to their shareholders, they felt that the only course they could adopt towards their English shareholders was to give them certificates of rights which would entitle them to their portion of the shares at par as soon as the Treasury would permit the issue. The certificates were negotiable in the market, and they could sell their shares *ex* these rights. The result of the year's working was that, after paying the usual 10 per cent. and writing off the sum necessary to keep their station in an efficient state, and providing for sinking fund, etc., they proposed to carry forward over £40,000, as against £7,000 brought in. Shareholders might think that was a large amount to lay by, and undoubtedly it was; but, in all the circumstances, the board thought it the proper thing to do. They did not know what was before them. They did not know when the war was going to end, and they thought it wise to maintain their 10 per cent. dividend and keep their reserves absolutely liquid. He would, however, point out to the shareholders the security this gave them as to their dividend, for the £40,777 carried forward represented the full 10 per cent. dividend for the current year, which put them in a very strong position. In conclusion, the chairman dealt with the zeal and loyalty displayed by the staff in Australia, to whom, he said, the success of the company was very largely due.

Mr. David Finlayson seconded the motion.

Mr. H. R. Hawes pointed out that the auditors reported that nothing had been put to depreciation.

The Chairman explained that this was one of the little fads auditors had. They did not regard anything as depreciation unless it was called so in the balance sheet. They had written off £16,740 and had a general reserve of £70,000, and had carried forward £40,000; but auditors did not look on this as depreciation.

The motion was carried.

A vote of thanks was given to the local board in Melbourne.

British Columbia Electric Railway Co., Ltd.

The directors report that, owing to adverse circumstances, the result of the operations during the year ended June 30th, 1915, is exceedingly unsatisfactory. The period in question has been one of continuous difficulty and anxiety to the directors and the management in British Columbia. The following charges have been made against the revenue account for the year: Provision for renewals maintenance £167,888, addition to capital amortisation fund £2,554, provision for income-tax £10,000 = £180,442. The net revenue, after making these deductions, amounts to £180,661, plus £6,884 brought forward and £60,000 transferred from reserve fund, making £247,546. Deducting interest on debentures and debenture stock to June 30th, 1915, £132,879, and dividends already paid on 5 per cent. cum. perp. pref. stock for the year, £72,000, and on preferred ordinary stock for the year at 2¼ per cent. per annum, £36,000, there is a balance of £6,667 to carry forward. In order to make the above dividend payments it has been necessary to transfer £60,000 from the reserve fund.

Owing to the war, and especially to the resultant paralysis of the shipping trade, commercial depression of the most acute severity has prevailed throughout British Columbia, which has brought about an almost complete cessation of expenditure by the Government, municipalities, railways, and other large undertakings. This depression has been responsible for a decrease in population, estimated at about 30 per cent., in the districts served by the company. The spending power of the remaining population has been reduced, and a general tendency to economise has resulted.

As one result of the depression, a very serious difficulty arose at the beginning of 1915, when the company had to meet an extraordinary form of competition from privately owned motor cars which started plying for hire at ordinary tram fares in opposition to the company's cars. The directors have already issued circulars to the stockholders drawing their attention to the fact that these motor cars, which are called "Jitneys," are allowed by the authorities to compete with the company on a very unfair basis.

To meet this jitney competition the company, some months ago, reduced some of its fares as an experiment. The results of this experiment have been disappointing, and other measures are being adopted to cope with the situation. It has been proved that cities of the size of those served by the company cannot support a thoroughly efficient and convenient electric railway service and also an unrestricted service of jitneys. At the present time the tramway service is run to a regular schedule. It serves all districts, including outlying ones, at all hours, regardless of whether such service is profitable or not. The inhabitants will, therefore, have to choose whether they will retain the present tramway service, or whether they prefer the unregulated service of jitneys, coupled with a very much curtailed service by the tramways, which would necessarily be restricted to the actual requirements of present business and would also be restricted to routes and districts which were profitable to operate.

The depression and jitney competition combined have rendered it impossible for the company, notwithstanding the most rigid economy, to operate the street railway system at a profit. In order to meet the new conditions, the most determined efforts have been made by the board and management to curtail expenditure in every direction. The general manager has reduced and carefully reorganised the staff in British Columbia. Operating and all other expenses of the company have been drastically reduced, but the full effect of these economies is not apparent from the accounts now submitted. On June 30th, 1915, the wages agreement between the company and its employés terminated, and the Board of Arbitration made an award, reducing the rates of wages paid to the employés by about 8½ per cent., which will represent a saving of about £22,000 per annum. The general manager estimates that the various economies put into force during the current year, together with the reduction in wages, will amount to a reduction in expenditure, as compared with the year ended June 30th, 1914, of very nearly £200,000, and he states that this will be accomplished without in any way affecting the efficiency or general upkeep of the plant or the public safety. Unfortunately against this economy there is a decrease in gross earnings during the first four months of the current year of £124,147. For the purpose of comparison, it must be borne in mind that during the corresponding four months of last year the Jitneys had not commenced to compete and the full effect of the war had not been felt. In reviewing the work which has been accomplished during the year, the general manager reports that the company's plant has never been in a higher state of efficiency, and the company is in an excellent position to profit by an improvement in business conditions when the war is over. £167,888 has been set aside out of earnings for renewals maintenance. This charge is calculated upon a fixed basis settled some years ago, to which the board have determined to adhere. The charge is a heavy one to provide in times like the present, but provisions of this character make for a sound financial status. The expenditure on capital account during the past year by the company and its subsidiaries has been 875,558 dols., which compares with 4,110,327 dols. for the previous year. Practically the whole of this expenditure relates to works authorised and entered into some time prior to June 30th, 1914. In considering capital expenditure, it is necessary to remember that the population of newly-developed countries fluctuates to a considerable extent, and that such countries are susceptible to the extremes of prosperity and depression. It is, therefore, impossible for a public utility company always to provide the plant and equipment that is precisely adequate to the requirements of the moment. The company will probably have for some time a general equipment considerably in excess of immediate needs, and it may have to face a delay of some years in the development which would, but for the war, have taken place in the province. At the same time, the company is now undoubtedly in a very strong position to take advantage of the revival in business when it extends from the eastern part of Canada to the western coast. Without in any way minimising the difficulties which will have to be met in the next few years, the directors feel that they can congratulate themselves and the stockholders upon the strong financial position in which the company stands. As will be seen from the accounts. the company had on June 30th the following liquid assets, viz.:—Marketable securities (at cost) £105,000, short loans and cash in hand £418,876=£523,876. Since that date the liquid resources of the company have increased. Although there is no immediate prospect of sufficient profits being earned to pay the dividend on the 5 per cent. cumulative perpetual preference stock; the directors are of opinion that the company's financial position justifies the payment of the dividend for the current year out of the reserve fund, and a resolution will be submitted to the stockholders to approve of this course being adopted. The directors are unable to hold out any hope that they will be able to recommend the payment of any dividend on the preferred ordinary or deferred ordinary stocks for the current year. When the last War Loan was issued the directors, in view of the large liquid resources, subscribed for £100,000 thereof, which has been paid up in full, and is now held by the company as part of its liquid assets. In considering the situation the directors realise the severe disappointment of the stockholders at the present results and the hardship imposed on many of them, but they wish to warn them against undue pessimism. The directors remind the stockholders that a young country in the geographical situation of British Columbia feels the effect of the war far more acutely than an old country like England, and, on the other hand, British Columbia, with its magnificent and scarcely developed natural resources, should recover far more rapidly than older countries. In his last report, the general manager says:—"All we ask is reasonable time in which to readjust the business to changed conditions, requiring patience on the part of the proprietors."

Year ended June.		Income after charging renewals maintenance.	Passengers.	Lamps in use.	Balance available for dividend.	Pref. ord. stock, div.	Def. ord. stock, div.	Taken to reserves.
1918	..	£401,836	71,978,822	920 916	£256,242	6 %	8 %	£196,911
1914	..	410,229	6[illegible],429,023	9[illegible]1 623	260,9[illegible]5	6 %	8 %	144,920
1915	..	201,768	46,330,096	1,012,780	47,782	2½%	—	71,493

The annual meeting was held yesterday in London.

Allgemeine Elektrizitats Gesellschaft.

The annual meeting of the A.E.G. was held recently in Berlin, under the presidency of Dr. Walter Rathenau, who stated that the shareholders would understand that under present conditions the directors had imposed limitations on the length and contents of the report, as the company was one which was most attentively followed both at home and abroad, and the desire that they should offer no occasion for discussion which was not in the company's interests was comprehensible. A similar observation also applied to the account of investments, which was not particularised for the past year because it contained many securities of companies which were in operation in other countries. The question had been raised in the newspapers as to whether the profits realised in 1914-15 had arisen solely from manufacturing, or whether they also comprised profits on financial operations. The directors had refrained on this occasion from emphasising that the profits did not include those of a financial character, quite apart from the circumstance that those of the latter class were scarcely possible in the past year. Beyond this, the speaker added that the so-called war profits only amounted to a very insignificant sum, although the company had placed its plant to a large extent at disposal for the defence of the country; but this had not been done for the purpose of obtaining large profits. The increase in the dividend by 1 per cent. to 11 per cent. was supported by the confidence in the political situation, the progressive feats of arms of the allied armies, and the honourable conclusion for Germany of peace in the near future.

The Chairman proceeded to refer to the relations between the A.E.G. and the Berlin Electricity Works Co. during the past thirty years, and stated that as a result of the discussion at the recent meeting of the latter, and after further consideration, it had been decided to abstain from prolonging the agreement. The interests of the manufacturing firm would be sufficiently preserved by two of the oldest directors assuming seats on the board of management of the B.E.W. During the first three months of the new financial year the value of the turnover amounted to £4,500,000, as compared with £4,350,000 in the corresponding period of 1914, whilst the value of the orders on hand reached £16,700,000, as contrasted with £16,150,000 a year ago. The credit at the bankers had experienced a moderate advance since the conclusion of the financial year.

The question of monopoly contracts also occupied attention. The Chairman stated that the company had been the first to break with the system of such contracts, which concerned those which were concluded with municipal and other local authorities for the sole right of delivering installation materials. The company had recognised at an early date that that principle was not only incorrect, but also that it was undesirable. If subsidiary companies of the A.E.G., of the third or fourth rank, had here and there entered into negotiations aiming at a monopoly in the supply of materials, that did not represent the wish of the parent company. In the case of the Berlin Electricity Works, a so-called monopoly agreement had not existed; it was, rather, more properly designated as most favoured treatment. As long as the B.E.W. continued to supply Berlin the agreement was of importance to the A.E.G., but as the former company had ceased to be the supply authority, the most favoured treatment agreement was no longer of value to the latter. The shareholders, therefore, need not deceive themselves because the A.E.G. no longer had to expect large orders from the B.E.W. That was not any great misfortune for the company, as the orders received from the supply company had only represented 1.4 per cent. of the total orders booked.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The annual meeting was held on December 22nd at the offices, 106, Cannon Street, E.C., Major Leonard Darwin in the chair. The Chairman, after referring to the absence of Col. W. Jarvis, a director, who was away on military duties, said that at the meeting a year ago they had a very unsatisfactory report to make, but, in spite of the loss sustained, he ventured to express a hope that their main troubles were things of the past. This hope, he was glad to say, had been justified by the year's working. Owing to war conditions, both their factories at Silvertown and at Persan had been occupied with Government work, whilst they had been able to execute a portion of their ordinary work without interfering with the Government demands, which, of course, had had first call on their resources. This fact had on the whole increased their yearly turnover to a considerable extent, and although the Government orders did not in themselves carry as large a profit as their ordinary business, yet the increased turnover had automatically decreased the percentage of standing charges, and thereby increased their profit. During the year they had had to meet many difficulties in the ever-changing costs of labour, material, transit and fuel, and he was glad to think that their anticipation and action in the past with those unknown factors before them had been justified by the final results of the year's trading. With reference to the foreign branches, they had nearly all shown a distinct improvement on the past year's records. This improvement had been partly due to more economical methods being adopted, and also, to some extent, to an increase in the volume of the business due indirectly to the effects of the war. Their factory at Persan had done very well this year, having transformed what had been a loss for some years into a profit. This change had been due to a great extent to an improvement in the methods of buying, manufacturing, and selling the goods, and a more accurate knowledge of the costs of production. Their ship *Dacia* had been employed on important work which, he was glad to tell them, she had succeeded in completing in a most satisfactory manner. With reference to the future, he would not venture to prophesy, as it was extremely difficult, if not impossible, for anyone to accurately foretell the effects of this war on trade in general and their own in particular. As long as the war continued they hoped they would be able to fill their works and keep all the available labour employed, especially on Government requirements; but when the war finished and there was a falling off in the demand for war supplies, it would be necessary to some extent to rebuild that portion of the business which they had been unable to maintain owing to the war conditions. In addition to the above-mentioned method of dealing with such part of their ordinary business as had suffered from the war, it had been the aim of the directors, amongst other things, to be prepared to produce in their factories such work as had hitherto been produced in Germany and supplied to England and France, in order that when the munitions of war were no longer required they would be in a position to compete with the German suppliers in those markets. They anticipated that there would be difficulty in doing this, but, on the whole, they hoped to be able to maintain a satisfactory condition of profit. In the early part of the coming year they would have to deal with the question of the redemption or renewal of the debenture bonds, which at this most unfavourable time would doubtless mean an increased rate of interest in the future. The subject was receiving their closest attention, as it was one which required careful handling in the interest of all concerned. There were many problems of the future which had to be studied and decided upon when the war was finished, but their difficulties in this respect were the same as those of their competitors. They therefore looked forward to the future with the belief that their organisation and methods would enable them to successfully deal with those unknown conditions, and he thought the company would maintain its old record in the possibly altered circumstances arising out of the war.

Mr. C. B. GRAY seconded the motion.

In reply to questions, the CHAIRMAN said it was true that they had to go to the bank to help them pay the last interim dividend. Since then their affairs had prospered, with the result that the cash in their possession was considerably larger, and they had been able to pay off the bank loan. With reference to their telegraph ships paying, of course there had been some years when probably they had not made a profit, but on the whole he should say they had paid. They believed there would always be a future for cable work, and they looked forward fairly confidently to be able to do good work in that direction. At present they only had two ships, as compared with three a year or so ago, and it was just possible they might only keep one. They did believe, however, that there was a future for cable work before them, and, as he had told them, one of their ships had just been doing an important piece of work in connection with the war, which would give them a certain amount of profit and a very considerable amount of credit.

Mr. GRAY also replied to some questions with reference to the number of the company's employés who had enlisted. Speaking from memory, he said the number was somewhere in the neighbourhood of 450. They were allowing all such half-pay, a course of action which he was sure would meet with the approval of the shareholders. The number of women employed in the factories was between 450 and 500. He found they were doing their work fairly satisfactorily, but, of course, the labour question was a troublesome one throughout the whole country.

The report was adopted.

The Siemens & Schuckert Group of Companies.

THE NUREMBERG CONCERN.

The accounts of the Elektrizitats A.G. vorm. Schuckert and Co., of Nuremberg, shows gross profits of £436,000 for the year ended with July 31st, 1915, as compared with £412,000 in the previous twelve months. After defraying general expenses, interest charges, taxes, etc., amounting to £182,000, as against £166,000, and placing £5,000 to the coupon tax and reserve funds, as in 1913-14, the net profits and balance brought forward are returned at £315,000, as contrasted with £304,000. It is proposed to pay a dividend of 6½ per cent. on the ordinary share capital of £3,500,000, this being the same rate as in 1913-14, and to carry to the new year the balance of £76,000, as compared with £66,000 in the preceding year.

THE RHENISH SCHUCKERT CO.

The report of the Rheinische Schuckert Ges. für Elektrische Industrie, of Mannheim, which deals with the year ended with July 31st, 1915, states that constructional and installation work had to be restricted immediately on the outbreak of the war owing to the calling-up of employés and the scarcity of various materials. As the conditions did not improve in the further course of the year, the company was compelled to close most of the constructional department and to postpone the execution of the extensive works on order. The nature of the undertaking precluded the company from participating in Army contracts. Considerable difficulties also existed in connection with the company's supply works and associated undertakings. The scarcity of petroleum certainly caused an exceptional number of applications for house connections to be made by small consumers, but these could not be fully complied with for the reasons given. It was, therefore, not possible in all cases to equalise the decline in the delivery of power which was due to the war by an increased consumption for lighting purposes. Under these circumstances, the working results for a year would be regarded as comparatively satisfactory. The gross profits from undertakings, investments, etc., amounted to £107,000, as contrasted with £140,000. After meeting general expenses, interest on loans and mortgages, and setting aside £12,000 for depreciation and reserve funds, as against £14,000, and £13,000 for war allowances, the accounts indicate net profits and balance forward of £45,000, as compared with £56,000. It is intended to distribute 5 per cent. on ordinary share capital of £550,000, being the same rate as in 1913-14.

SIEMENS AND HALSKE.

The directors of Siemens & Halske, A.G., of Berlin, reporting on the year which closed on July 31st, 1915, observes that the statements made in the report for the previous year on the situation of the undertaking had also proved to be correct during the past year and down to the present time, and no change in the conditions had taken place which could influence the confidence which was expressed at that time. The displacement in the activity of the individual manufacturing departments which was proceeded with a year ago had been continued. The war had caused considerable demand for the provision of electrical auxiliaries of manifold kinds, either directly for the equipment of the Army and Navy, or indirectly for delivery to other undertakings which were working on war material. In addition to a substantially greater production of the types of manufactures which were already furnished for these purposes in times of peace, many new problems had to be solved, and by this means and the utilisation of still available plant for other war requirements, compensation had been obtained for the decline in the actual peace orders, both from the Government authorities and private customers. The working results, consequently, corresponded in general to those of former years, and it was possible to revert to the dividend rate of 12 per cent. The directors believed that they must make special provision this year for impending problems of war allowances, and the sum of £150,000 had, therefore, been included for this object. The number of officials and workmen called from the company's works and those of the Siemens-Schuckert Works, was 27,736, and the numerous requisitions had rendered it necessary frequently to resort to female labour in the offices and workshops. A very large increase took place in the average weekly earnings of the workers as compared with times of peace. The accounts show the following figures:—

	1912-13.	1913-14.	1914-15.
Ordinary share capital ...	£3,150,000	£3,150,000	£3,150,000
Loans	2,242,000	2,216,000	2,194,000
Balance brought forward ...	63,000	60,000	60,000
Gross profits	733,000	661,000	881,000
General expenses	54,000	49,000	55,000
Interest on loans	95,000	94,000	93,000
Depreciation	21,000	20,000	19,000
Provision for war grants	—	-	150,000
Net profits	562,000	496,000	566,000
Special reserve fund ...	100,000	100,000	100,000
Contingency fund	25,000	25,000	25,000
Bonuses	45,000	45,000	45,000
Dividend	378,000	315,000	382,500
Dividend, per cent. ...	12	10	12
Carried forward	60,000	60,000	62,000

The balance sheet shows cash in hand and credit at the bankers amounting to £713,000, and investments for £229,000; the permanent investment account, including the Siemens-Schuckert Works and the Austrian, English, and Russian companies, stands at £4,426,000, as against £4,607,000 in 1913-14. The debts due, including profits from the Siemens-Schuckert Works, represent £2,301,000, as compared with £2,156,000, whereas debts owing are £1,425,000, as contrasted with £1,228,000 in 1913-14. The ordinary reserve fund remains without change at £675,000, whilst the special reserve fund with the present allocation rises to £650,000.

THE SIEMENS-SCHUCKERT WORKS.

The report for 1914-15 of the Siemens-Schuckert Works states that the war materially affected the course of business, as the company's markets extended to all the countries involved in and influenced by the contest, and as a consequence the distribution of the manufactures in the markets had become changed. The former extensive exports had for the greater part ceased, but the Army and the Navy had made large claims upon their capacity, and further requirements were called for through the effects of the war. As a result of the compensation thereby afforded, the directors were able to resume the level of profit distribution which was departed from a year ago, and at the same time, having regard to the more favourable use made of the stocks on hand at the outbreak of the war, to make a special appropriation for the forthcoming problems of war provision, for which it was proposed to allocate the sum of £200,000. It was possible for the works duly to meet the multifarious requirements of the Army and Navy, and the demand for new electro-technical auxiliaries for the conduct of the war. In addition, abundant work was provided through the increasing activity of other branches of industry which served the purposes of the Army and Navy, particularly the chemical industry. Prominent in the latter direction was the equipment of the Imperial nitrogen works, which required transformer units of 30,000 KW. with 80,000 volts principal pressure, and weighing 70 tons, with oil insulation, which were the largest units hitherto constructed. An increase in the company's liquid funds was brought about through the hampered development of large new undertakings for the supply of electricity, the sale of a portion of the stocks, and the more rapid completion than in times of peace of the manufactures needed by the Army. Since the balance sheet was prepared, this liquidity had substantially increased, although the resumption of peace manufactures and a corresponding restoration of stocks would again lay claim to the funds now rendered available. The works took an active part in the discovery and employment of materials in substitution for the raw materials obtained from other countries in times of peace, and gratifying progress in these directions was achieved; but the development of manufactures for peace purposes naturally had to give precedence to war requirements. It was only possible by the engagement of new workers partly to equalise the deficiency caused by the call to the Colours of officials and workmen during the whole of the year, and a displacement took place in favour of female labour. Subscriptions to the Imperial war loans were made in the circles of the company, including their original houses, amounting to £250,000 of the first loan, £375,000 of the second, and £675,000 of the third, the last mentioned coming into the new financial year. The accounts present the undernoted figures for the past three years:—

	1912-13.	1913-14.	1914-15.
Capital	£4,500,000	£4,500,000	£4,500,000
Ordinary loans	3,805,000	3,877,000	3,847,000
Perpetual loans	2,500,000	2,500,000	2,500,000
Balance forward	15,000	17,000	12,000
Gross profits	1,167,000	1,063,000	1,399,000
General expenses	94,000	94,000	109,000
Interest charges	333,000	337,000	336,000
Depreciation	62,000	73,000	77,000
Net profits	676,000	557,000	876,000
Reserve Fund	125,000	125,000	125,000
Bonuses	75,000	75,000	75,000
Provident fund	25,000	25,000	25,000
War provident fund ...	—	—	200,000
Profit distribution	450,000	337,000	450,000
Profit distribution, per cent.	10	7½	10
Carried forward	17,000	12,000	13,000

The total sums owing to the company, including £2,350,000 on credit at the banks, amounted to £8,615,000, whereas the company's liabilities reached £3,085,000 at the end of the financial year.

Costa Rica Electric Light and Traction Co., Ltd.

Mr. W. F. Leese presided, on December 22nd, over the annual meeting, held at Dashwood House, E.C. He said that the result of the past year had not been so good as was that for 1914. The actual volume of business had been very nearly the same, and the profit would have been practically the same had the rate of exchange not fallen. The net earnings had amounted to £21,662, as against £26,351, a decrease of £4,689. The lighting department had been practically as good as in the previous year, and the cooking and heating department had shown up very much better. A great part of the electricity supply of Costa Rica in the future would be for those purposes, as there was no coal there, and wood was getting more and more scarce. Electricity was, fortunately, comparatively cheap, and as they obtained it from water power there was a constant supply. The tramway undertaking had not done so well, the reason being the poverty of the country generally. People must have light and they must cook, but when it came to a matter of travelling they economised by staying at home or walking. As to the future, he was glad to say there had been a fairly good coffee crop, which would benefit the country if it could be brought to Europe. The number of their customers for lighting had increased, but the number of lamps connected showed a small diminution. The number of power customers had also slightly increased, but there, again, the consumption had decreased a little. As he had said, for heating and cooking the demands were increasing rapidly. They had 360 such customers at the end of the year, as compared with 208 last year, and 60 two years ago—an increase of 300 per cent. in three years. The receipts also showed a satisfactory increase. The car mileage on the tramways last year was 459,353, as compared with 436,594 in the previous twelve months. The number of passengers carried was 1,892,000, as against 2,193,000, a decrease of 14 per cent.

Mr. F. M. Crisp seconded the motion, and the report was adopted.

Burmah Electric Tramways and Lighting Co., Ltd.

The annual meeting was held on December 23rd at the offices, Queen Victoria Street, E.C., Mr. D. C. Ellis presiding. The Chairman reminded the shareholders that the year under review practically coincided with the declaration of war, whilst it compared with a record year in the company's history. Having regard to those facts, he thought they would agree that the result of the trading might be considered satisfactory. The effects of the war conditions on the traffic receipts for the first four months of the year were seen at the last meeting. These drawbacks, coupled with considerable sickness and a heavy death rate from dysentery, cholera, and plague during the cold weather, and a complete absence of country folk during most of the year, caused a setback in the traffic which continued until May, when a gradual partial recovery took place. The result was a decrease in the receipts of £3,127. It was satisfactory to note the continued growth in revenue from lighting and power, the actual increase under this head amounting to £863. Whilst the number of new consumers was not quite so large as last year, the number of new lamps connected was the largest in the history of the company. Amongst other business, an agreement was entered into with the municipality for street lighting, which was commenced in February last with excellent results, the system having met with universal approval. The net result was an increase of £631 in the sundry receipts and a decrease of £2,581 in the total gross receipts. The total expenditure showed a decrease of £499, principally due to a reduction in cost of maintenance and repairs. The result was a trading profit of £6,662, plus £1,180 brought forward, giving a balance of £7,842. Out of this £2,000 had been carried to depreciation account, making it £18,394, leaving an available amount of £5,842, out of which it was proposed to pay a dividend on the preference shares of 5 per cent., absorbing £5,000, and to carry forward the balance of £842. It had been suggested that it would make the position of the arrears on the preference dividend clearer if the last two payments made and the one now proposed were allocated to the discharge of the first of such arrears, and the directors proposed to adopt this course. In regard to the prospects for the current year, the traffic receipts for the first quarter showed an increase of Rs.3,170. The manager reported that as the trade of Burmah still continued unsatisfactory, owing to the want of shipping facilities and capital, and as, in addition, there were the disturbing factors of the increase in the price of rice, the very high death-rate from cholera and the probability of a bad plague season, they must not count on any great improvement in the traffic returns over last year. On the other hand, it was satisfactory to report that the light and power business continued to go ahead. Incidentally, he might mention that they were now supplying current to a cinema hall, which had been started with great success, and which had brought them an order to supply a theatre, with the promise of a further hall. They were also commencing a temporary supply to the municipality for pumping purposes, and were considering a scheme for hiring out fans.

Major Henry R. Kindersley seconded the motion, which was adopted.

Humphrey Pump Co., Ltd.—The report states that the directors regret that the war still continues to seriously affect the business of the company. The company's claims in connection with the large pumping contract at Mex, Egypt, have not yet been finally settled. The principal patents have been maintained and defended and additional patents secured.—*Financier.*

Chili Telephone Co., Ltd.—The directors announce an interim dividend at the rate of 6 per cent. per annum, free of income-tax, for the past half-year.

STOCKS AND SHARES.

... ... Tuesday Evening.

The Christmas holidays have naturally taken up most of the time and pre-occupation of the Stock Exchange. Upon the resumption of business to-day (Tuesday), there was a good tone prevailing in most of the markets; but business was scanty, and the Stock Exchange presented a placid appearance, with the exception of the market for rubber shares, where, for an hour or two, considerable animation ruled, and prices advanced substantially during the greater part of the day.

So far as the electric markets are concerned, trade is very quiet. Price alterations this week are few and far between;

and, in the circumstances, we make no apology for presenting our usual lists of stocks and shares showing the changes on the year. We have cut the lists shorter than usual, because, after all, the interest attaching to observation of the prices is tinged with melancholy, and it is not kind to remind proprietors of the depreciation which their investments have undergone by reason of the war. So we take but a few selections from each division.

The Stock Exchange re-opened on January 4th, after having been closed for five full months. Business on the first day of re-opening collected rather under 1,000 bargains, whereas at the present time the average is roughly 2,100 *per diem*, while in the spring-time the number ran up to nearly 4,000. If there is one feature of the financial year which stands out particularly, it is, of course, that of Government borrowing; while another, not less remarkable, is that frequently dwelt upon here—namely, that all the demand for capital should have had so comparatively mild an effect upon prices.

Coming to our figures, we will take the electricity supply companies first. The final dividends for last year were all good, but in the interim distributions in respect of the current twelvemonth there were hints of probable reductions in respect of 1915. The market is stagnant and subdued :—

Share.	July 30, 1914.	Dec. 31, 1914.	Now.	Fall.
Charing Cross	5⅛	5	3½	1½
City of London	16	15½	12¼	3¼
Metropolitan	3⅝	3¼	2⅜	⅞
St. James's	9⅜	9	6¼	2¾

The Telegraph market has kept its end up with a good deal of strength, and some of the prices show rises since a year ago. This came about as the result of steady investment purchasing, coupled with the fact that the companies are mostly doing well—more particularly in the direction of reducing their expenses. This is a short list :—

Stock or Share.	July 30, 1914.	Dec. 31, 1914.	Now.	Rise or Fall.
Anglo-American pref. ...	108	103	100¾	−2¼
Anglo-American def.	22¾	21½	22⅞	+1⅜
Direct United States ...	6⅝	6¼	6¼	—
Eastern	130½	122	128	+6
Globe Telegraph and Trust	11½	10⅝	10⅜	−¼
Ditto pref.	12⅞	11¾	10⅜	−1⅜
Marconi	1 9-16	1⅝	1⅞	+¼
Western	13⅝	12½	12⅝	+⅛

The Home Railway Market has suffered a good deal from neglect, and from the uncertainty involved in the Government's having taken over the railway business of the country. With no traffics to stimulate interest, and with the interim dividends last autumn on a scale that was slightly disappointing, there has been little or nothing to infuse revival into prices. A few spurts there have been, mostly very short-lived; and the depression is reflected in the price lists :—

Stock or Share.	July 30, 1914.	Dec. 31, 1914.	Now.	Fall.
Central London Ord. ...	80	76	72½	3½
Metropolitan	31½	31½	24½	7
Ditto District ...	19	18	15¾	2¼
Underground "A" ...	6/6	6/3	5/6	9d.
Ditto Ord. ...	2⅛	2	1⅝	⅜
Ditto Income ...	83	80	77	3

Mexican, Brazilian and Canadian securities have undergone remarkable developments, and not a few rapid changes during the year, the reasons for which are so thoroughly well known that it is superfluous to reiterate them. Brazilian Tractions, on balance, are 5 points down on the year, after having been higher, as well as lower. Mexicans enjoyed a little favour when it seemed likely that President Wilson would recognise Carranza; but this was not followed up by definite action, and so most of the prices have sagged back, although not quite so low as they were before. A few prices are appended, to which we add three or four of the home industrial group :—

Stock.	July 30, 1914.	Dec. 31, 1914.	Now.	Rise or Fall.
Anglo-Arg. Trams 1st pref. ...	4 13-16	4½	4⅛	−⅜
Brazil Tractions	58	56½	51½	−5
Mexican Light and Power ...	41½	32½	30	−2½
Rio Tram. 1st mort.	97	95	91¾	−3¼
Babcock & Wilcox	2¾	2⅜	2⅜	—
Brit. Westinghouse pref. ...	1 11-16	1 15-16	1 15-16	--
Castner Kellner	2⅜	2¾	3	+¼

In the way of business, the market in manufacturing shares has "enjoyed" spasmodic activity—British Aluminium, for instance, and British Westinghouse preference, having been very prominent at various times. The rubber market is the best off in the Stock Exchange, both as regards orders and firmness of prices, which have been sustained by the strength of raw material and the promising outlook for the continuance of this condition; indeed, many people look for better prices still. And we may be permitted to express the devout hope that other markets will fulfil the same expectation in the period about to dawn, which determination, resolution and faith have already marked out as certain to prove a Happier New Year.

SHARE LIST OF ELECTRICAL COMPANIES

Home Electricity Companies.

	Dividend, 1914.	Price Dec. 28, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	7½	—	£6 18 4
do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	3½	—	7 2 10
do. do. do. 4½ Pref. ..	4½	3¾	—	6 0 0
do. do. City Pref.	4½	3	—	7 10 0
do. 4 Deb.	4	78	—	5 2 7
Chelsea	5	4¼	—	5 17 8
do. 4½ Deb.	4½	87	—	5 8 6
City of London	9	12¼	—	7 7 8
do. do. 6 per cent. Pref. ..	6	11	—	5 9 1
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10	—	7 0 0
do. do. 6 per cent. Pref. ..	6	10¼	—	5 17 3
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	83	—	5 8 0
Kensington Ordinary	9	6	—	7 10 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref. ..	6	4¼	—	7 1 2
do. do. 4 Deb.	4	75	—	5 4 0
Metropolitan	3½	2⅜	—	7 7 4
do. 4½ per cent. Pref. ..	4½	3¾	—	6 0 0
do. 4½ Deb.	4½	85	—	5 6 0
do. 3½ Deb.	3½	70	—	5 0 0
St James' and Pall Mall	10	6¼	—	8 0 0
do. do. do. 7 per cent. Pref.	7	6	—	5 16 8
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2¾	—	7 5 6
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6½	—	6 18 6
do. 4½ Pref.	4½	4⅛	—	5 9 0

Telegraphs and Telephones.

	Dividend, 1914.	Price Dec. 28, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	100¾	+ ½	5 19 6
do. Def.	1½	22⅞	—	6 11 3
Chile Telephone	8	6½	—	6 3 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	12½	—	*6 8 0
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord...	7	128	—	*6 4 0
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	10⅜	—	*6 12 2
do. Pref.	6	10⅜	—	5 15 8
Gt. Northern Tel.	22	83½	—	6 11 4
Indo-European	18	48 xd	—	6 15 4
Marconi	10	1⅞	—	5 6 8
New York Tel. 4½..	4½	101	—	4 9 1
Oriental Telephone Ord.	10	1⅞	—	5 6 8
do. Pref.	6	⅞	—	6 17 2
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	6	—	*7 12 5
do. Pref.	5	4¾	—	5 8 1
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12⅝	—	*6 7 0
do. 4 Deb.	4	80	—	5 0 0

Home Rails.

	Dividend, 1914.	Price Dec. 28, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented ..	4	72½	—	5 10 6
Metropolitan	1¼	24½	—	5 2 0
do. District	Nil	15¾	+ ½	Nil
Underground Electric Ordinary ..	Nil	1⅝	—	Nil
do do. "A"	Nil	5/6	—	Nil
do. do. Income ..	6	77	—	*8 17 6

Foreign Trams, &c.

	Dividend, 1914.	Price Dec. 28, 1915.	Rise or fall this week.	Yield p.c.
Adelaide Sup. 6 per cent. Pref. ..	6	5	—	6 0 0
do. 5 Deb.	5	95 xd	—	5 5 0
Anglo-Arg. Trams, First Pref. ..	5½	4⅛	+ ⅛	6 15 0
do. 2nd Pref.	6½	8½	—	7 17 2
do. 4 Deb.	4	75	—	5 6 8
do. 4½ Deb.	4½	79	—	5 14 0
do. 5 Deb.	5	81	—	6 4 0
Brazil Tractions	3½	51	— ½	6 18 0
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb.	4½	85	—	5 3 0
British Columbia Elec. Rly. Pfce. ..	5	60	—	8 6 8
do. do. Preferred ..	—	40	—	Nil
do. do. Deferred ..	—	40	—	Nil
do. do. Deb. ..	4½	64	—	6 12 10
Mexico Trams	Nil	42	—	Nil
do. 5 per cent. Bonds ..	—	49	—	Nil
do. 6 per cent. Bonds ..	—	48	—	Nil
Mexican Light Common	Nil	30	—	Nil
do. Pref.	Nil	42	—	Nil
do. 1st Bonds	—	47	+1	—

Manufacturing Companies.

	Dividend, 1914.	Price Dec. 28, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	2⅜	+ 1/16	6 18 0
British Aluminium Ord.	5	22/6	—	4 9 0
do. Pref.	6	18/-	—	6 13 4
British Insulated Ord.	15	10½	—	7 2 10
do. Pref.	6	5⅞	—	6 11 7
British Westinghouse Pref.	7½	38/6	—	7 16 0
do. 4 Deb.	4	69	—1	5 14 10
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	10½	—	7 2 10
do. 5 Pref...	5	4¼	—	5 17 8
do. 4½ Deb.	4½	90	—	5 0 0
Castner-Kellner	20	3	—	6 13 4
Edison & Swan, £3 pd.	Nil	9/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	62	—	6 9 1
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	14/-	—	8 11 6
do. do. Pref.	7	19/9	—	7 1 4
Gen. Elec. Pref.	6	9¾	—	6 3 1
Henley	20	18½	—	*8 12 6
do. 4½ Pref.	4½	4¼	—	5 6 0
do. 4½ Deb.	4½	92	—	4 17 8
India-Rubber	10	9½	+ ½	*12 7 0
Telegraph Con.	20	31½	—	*8 1 0

* Allowance made for dividends being paid free of income-tax.

Patents and Alien Enemies.—Application has been made to the Board of Trade for a licence in respect of Patent No. 15,128/11, granted to Siemens & Halske A.-G., for manganese peroxide anodes, by the Refractory Zinc Ore Treatment Co.

CONTROL GEAR FOR ELECTRIC LIFTS.

By ARTHUR L. HAWES.

The switchgear employed for the control of electrically-driven lifts is equally as important as the driving mechanism, although by some it receives very secondary consideration, so much so that often very unsatisfactory control gear is installed, resulting in endless trouble.

As the success or otherwise of an electric lift depends to a large extent on the control gear, no doubt a brief description of modern types, together with various methods of control, will be of interest.

A successful controller must operate the lift under all conditions of loading smoothly and without jerks (especially where passengers are carried); this will have the two-fold effect of reducing shocks to the machinery and discomfort to the passengers. The main essentials in the control gear are:—(1) Reliability; (2) Incombustibility; (3) Accessibility; (4) Mechanical strength.

In most cases the control gear is fixed where it cannot easily be seen, and is often only visited when a breakdown occurs, hence too much stress cannot be laid on the first-mentioned essential. All contacts should have large areas (face to face, not of the knife type), with one contact of carbon and the other copper, both easily renewable; this combination prevents to a great extent burning of the contacts, and in a well-designed controller the carbon takes practically all the wear and tear due to arcing, and the whole can easily be replaced at a cost of a few shillings.

All breaks and clearances should have an ample margin, and the main current-breaking contacts, if for direct current, should be protected by means of a magnetic blow-out, as this minimises the formation of an arc and lengthens considerably the life of the contacts; all bolts and screws should be fitted with spring or locking washers to prevent them working loose due to vibration, and if iron or steel is used for working parts subjected to the atmosphere, they should be nickel or copper-plated to prevent trouble due to rust, particularly the plungers of solenoids; where dash-pots are used, these should in all cases be easily and effectively adjustable to alter the rate of cutting out the resistance and to accommodate the class of oil available.

The insulation, where possible, should be of mica or porcelain; most other forms rapidly deteriorate, especially in a damp or tropical climate.

The resistances should be amply rated, especially on multi-speed controllers, so that they cannot be damaged if run for long periods with the resistance in circuit; the resistance units should be easily renewable, cast grids or wire nets form a very good arrangement, or, better still, large porcelain bobbins suitably grooved to hold the wire; this type of unit will stand greater overloads than the others mentioned owing to the large mass of porcelain, which rapidly absorbs and dissipates the heat from the wire.

The internal connections should as far as possible be made of bare copper; where insulation is required this can consist of insulating beads threaded on to the wire, and, finally, contacts and all wearing parts should be easily accessible without dismantling the controller.

The starting rheostat should have a large number of steps, and the resistance should be graded in geometrical progression so that the current peaks will be equal when the brush passes from contact to contact; it should also be of such a value as to allow of rapid acceleration of the motor with a minimum starting current, the latter being about 100 per cent. to 170 per cent. of full load running current.

The above remarks apply equally to the auxiliary switches, push buttons, relays and car switches, &c., as these are often the most troublesome; the general practice is now to arrange all car switches with a spring return to the "off" position when the handle is released, with removable handle and renewable contacts; car switches are generally a great source of trouble, and too much stress cannot be laid on the necessity of making them robust both mechanically and electrically. Push buttons have a nasty habit of sticking, and to obviate this all contacts should be face to face, and all plungers should be of porcelain or ebonite; fibre should not be used, as this is a constant source of trouble in damp atmospheres owing to its absorbing moisture, swelling and often causing leakage and shocks.

Where solenoids or magnets are used, it is always advisable to arrange that these are capable of working across the full voltage to obviate the use of cooling coils and their often troublesome switches, this being now quite possible by the patented systems of machine winding carried out by one or two firms. Special attention should be paid to solenoids for use on an alternating-current circuit; these should be of the best possible design, otherwise trouble will arise due to sticking of the plungers, with consequent over-heating and burning out of the windings.

In the general construction of lift control gear small neat castings or drop forgings are, generally speaking, better than stampings, as the latter tend to make a flimsy construction unable to stand up to the work required of them. There are certain parts which it is necessary to design from a mechanical rather than an electrical point of view, particularly the reversing switches of rope-operated controllers; the type at present in general use is by no means satisfactory. These should be amply strong and provided with definite mechanical stops to relieve the switch levers or blades of all pressure.

The systems of control generally used are given below; these by no means cover the whole field, inasmuch as nearly every lift maker has some special system of his own, which is really a means to attain a common end.

1. Hand rope.
2. Car switch.
3. Semi-automatic push button, "Up," "Down," "Stop."
4. Full automatic push-button call from landings and direct from the cage.
5. Full automatic push-button call and direct from both landings and cage.

The above are all arranged for one speed, except (2) which if used on D.C. circuits, can be arranged for two or three speeds with little trouble; this is an advantage with high-speed passenger lifts.

To obtain the greatest possible protection against damage to the lift, the following interlocks or safety devices should be incorporated:—

1. The up and down direction solenoids should be interlocked so that it is impossible to operate both at the same time, even if both up and down buttons are pressed simultaneously.

2. If the lift stops either by the controller or failure of the current, it must not be possible to start it again until the armature or rotor resistance, as the case may be, is reinserted.

3. In push-button systems the first operator to have the preference, all other points of operation being dead until the journey is completed.

4. Means to cut off the current when the cage reaches the top or bottom floor levels, a mechanical knock off being fitted to the car switch to bring it to the "off" position, or a limit switch in the control circuit operated by a tappet on the cage where the push-button system is used.

5. Means to cut off the main supply of current to the motor in the event of over-travel of the cage, this consisting of a switch in the main circuit operated in a similar manner to the above push-button limit switches.

6. In order to assist in stopping the lift in the shortest possible time and accurately at the floor level after switching off, the controller may be arranged to connect the armature across a resistance, the momentum of the armature driving it as a generator and so forming a dynamic brake; this can be arranged so as to have no detrimental effect on the motor or controller.

7. Full protection to the passengers by fitting all entrances to the lift with folding or sliding doors or collapsible gates, each fitted with an automatic electro-mechanical lock, so arranged that the circuit to the controller is broken except all gates are closed and locked, and so as to prevent any gate being opened except the cage is opposite to the same.

With hand-rope control the main reversing switch is operated by two ropes, one of which can pass through the landings and the other through the cage, thus making the lift operative from all points; this system is usually limited to one fixed speed, that is, there is no intermediate running speed between start and full speed.

Car-switch control is similar to the above, except that the main reversing switch is operated by two solenoids, the final connection being made by means of a two-way switch in the cage, this being the only point where the lift can be operated; this system can be arranged in various ways as under: —

(*a*) Single speed as described for hand-rope control.

(*b*) Two or three speeds obtained by connecting a resistance across the armature to obtain the low speeds; this is very effective, and also has the advantage that it will act as a dynamic brake if there is any increase in the speed of the motor above the normal.

The push-button systems are generally arranged for single speed, although it is possible to arrange them for multi-speed, but the control gear becomes so much more complicated that no real advantage is gained; the most common systems are: —

(*a*) Semi-automatic—the same as the single speed car-switch system, except that three push buttons, marked "Up," "Down," "Stop," replace the car switch, with a similar set on each landing connected in parallel; on pressing the button the lift continues to run until the stop button is depressed; or this can be arranged in the reverse way, so that the lift will continue to run only whilst the button is depressed.

(*b*) Full-automatic "Call" system. This is very much used, and consists of a call button on each landing, which when depressed operates the controller through a relay; the lift then starts and continues to run until it trips a floor-finding switch in the particular relay circuit in which the depressed button is connected, thus breaking the circuit and stopping the lift. The passenger on entering the cage finds a set of buttons numbered to correspond with the various floors; on pressing the required button, the lift starts, travels to and stops at the desired floor automatically, the operation being the same as when calling the lift.

(*c*) A modification of the above system consists of replacing the call buttons on the landings, with a set similar to those in the cage; this enables the lift to be called from, or dispatched to, any floor from any operating point without any person actually travelling in the cage. This system is both expensive and complicated, and, therefore, seldom used, as in most cases systems (*a*) and (*b*) are found to provide all that is required.

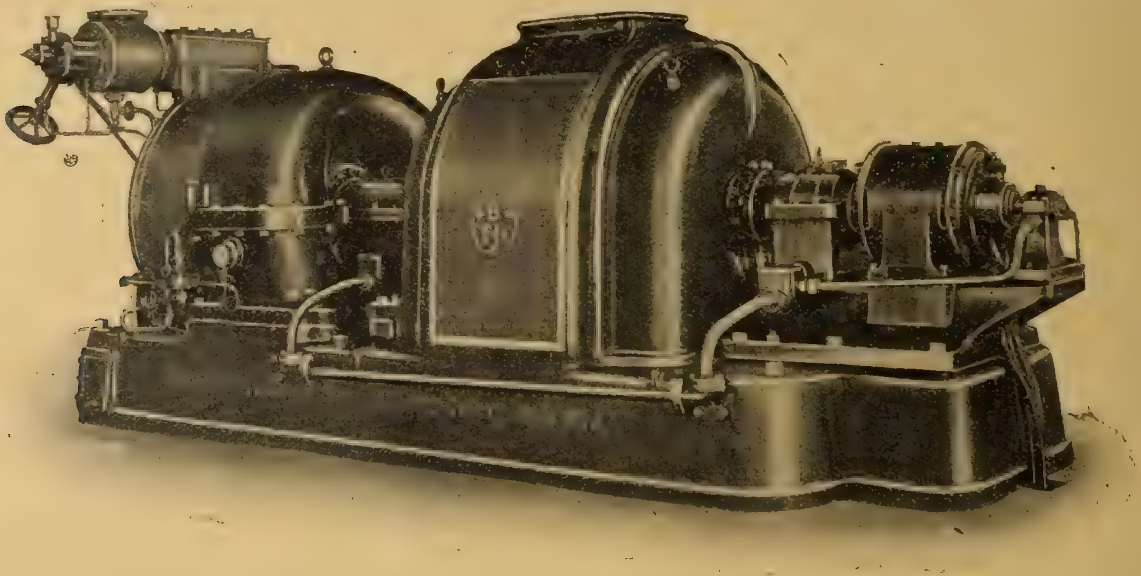
With all these systems af push-button control it is necessary to provide an interlock between the cage and landing push buttons, to prevent operation of the lift at more than one point simultaneously; this is generally carried out by fixing the cage floor on springs, and fitting underneath a small switch connected in the landing-buttons' circuit; when a person enters the cage the floor is depressed, opening the switch underneath, and so rendering the landing-buttons inoperative.

The above systems of control are obtained with alternating current, one, two or three-phase, but using one speed in all cases.

THE NEW PLANT OF THE CHINA LIGHT AND POWER CO., LTD.

The existing power station of the China Light and Power Co., Ltd., of Hong-Kong, China, is situated at Kowloon, and contains gas-engine-driven generators operating on suction gas. The necessity for increasing the output of the station to cope with the growing demand for electricity for power and lighting purposes in Hong-Kong led the managers of the company, Messrs. Shewan, Tomes & Co., to consider the type of prime mover most suitable for driving the new generators. After carefully considering the relative merits of gas-engine and steam-turbine-driven generators, the company, in conjunction with their consulting engineer, Mr. Conrad Mendham, decided in favour of turbo-generators, and contracts were entered into with the British Thomson-Houston Co., Ltd., for the supply of the generating plant and switchgear, and with Messrs. Babcock & Wilcox for the boiler plant.

This generating plant consists of two high-pressure, three-phase, 60-cycle, B.T.H.-Curtis turbo-alternators, rated at 937 K.V.A., 2,200 volts, at 80 per cent. power factor. These machines are provided with direct-coupled exciters, and designed to run at 3,600 R.P.M. when supplied with steam at 180 lb. per sq. in. gauge pressure, superheated 160° F., and exhausting into a vacuum of $27\frac{1}{2}$ to 28 inches. The turbines are three-stage machines, and the sets are each capable of maintaining an output of 1,170 K.V.A. for two hours. The alternators are designed to operate in conjunction with a Tirrill regulator which will maintain a constant voltage within 1 per cent. of normal, under all conditions of load and power factor.



B.T.H.-Curtis Turbine Set supplied to the China Light and Power Co., Hong-Kong.

Air filters are provided, by means of which the cooling air drawn through the windings of the alternators for ventilating purposes is thoroughly cleansed of dust, thus avoiding the necessity of periodically dismantling the machines for cleaning purposes.

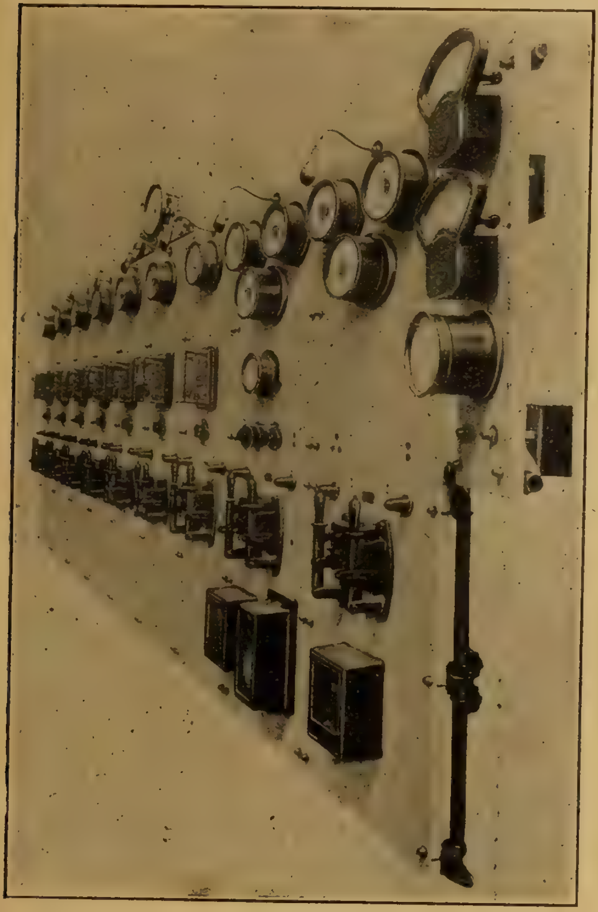
To enable the performance of either turbine to be determined at any time, a Lea recorder, fitted with an integrating attachment, is being supplied.

A nine-panel white-marble switchboard, fitted with all the usual operating gear and instruments, is being installed to control the output of the turbo-generators. To facilitate the handling of the load, a duplicate set of bus-bars is provided, and special barriers are being fitted between the panels, enabling the operator to work in complete safety behind any panel after having opened the isolating switches. A swing panel, mounted at the end of the switchboard, carries the usual synchronising voltmeters and synchronism indicator.

The boiler plant comprises three Babcock & Wilcox boilers having integral superheaters and chain-grate stokers, each boiler being capable of evaporating 9,000 lb. of water per hour from hot feed into steam at 190 lb. per sq. in. pressure, superheated 200° F. Economisers are employed to utilise the heat from the waste gases, and the necessary draught is produced by means of a fan discharging into a self-supporting chimney.

The condensing plant is of the surface type, and arranged for installing immediately below the turbines. Each condenser has a cooling surface of 1,650 sq. ft., and is equipped with rotary-type motor-driven pumps, the cooling water being drawn from the sea through a double set of suction mains. The circulating pumps are so arranged that they can feed into either condenser, as may best suit the requirements of the moment.

The inlet ends of the suction mains are provided with the necessary flap-valves and strainers, but experience shows that the latter do not prevent the nuclei of small shell-fish, shrimps, &c., from getting into the circulating pipe. In time these nuclei develop, and the precaution has therefore been taken of providing special shrimp-catchers in the generating station.



B.T.H. Switchgear at Hong-Kong Electricity Works.

The largest consumers of power from this station are the Hong-Kong and Whampoa Docks, who take a bulk supply which is led to their premises through a three-core underground cable. This supply is at 2,200 volts, and the outgoing feeder is controlled by suitable distributing panels installed in the main station. The plant installed in the Hong-Kong and Whampoa Docks was also supplied by the British Thomson-Houston Co., Ltd., and consists of two 350-kw., 250-volt, 900-r.p.m., six-phase, 60-cycle rotary converters, with the necessary step-down transformers and control gear. The latter comprises in each case one high-tension a.c. panel, one low-tension a.c. panel, and one direct-current control panel. The rotary converters are equipped with self-synchronising starting motors, reducing the operation of these machines to the simplest possible form.

We are indebted to the British Thomson-Houston Co., Ltd., for the foregoing particulars and accompanying views.

THE MAGNETIC TESTING OF BARS.

By ALBERT CAMPBELL, B.A., A.M.I.E.E., and D. W. DYE, B.Sc.

(From the National Physical Laboratory.)

(Abstract of Communication to the Institution of Electrical Engineers.)

For the accurate testing of magnetic materials, until recently it has been the usual practice to employ a uniformly magnetised test-piece, the condition of uniformity being ensured by using a closed magnetic circuit of ring form. This ring form is somewhat difficult to construct, it necessitates rather laborious winding of coils on each specimen, and, unless rings of rather large diameter are used, it is not suitable for high values of the magnetisation. For this reason all kinds of methods have been proposed and used for the testing of material in the form of bars, whether straight or curved. The main difficulties in all these methods have been (1) to obtain uniformity of magnetisation all along the specimen, and (2) to determine the true value of the magnetising field H which produces this desirable result. As a rule it has been the custom to complete the magnetic circuit as well as possible by a yoke or yokes, and to deduce the mean value of H from the number of applied ampere-turns; the unavoidable magnetic leakage, however, is apt to introduce considerable error in the determination of the H.

These difficulties will be avoided if we can find a method for the direct measurement of the H at any portion of the bar. The H is equal to the flux density in the air at the surface of the portion dealt with, and can be determined by means of a small search coil placed very close to the surface of the iron, the axis of the coil being parallel to that surface and in the direction of H.

The coils we have used in the National Physical Laboratory are of various designs, according to the form of the specimen to be tested, some being differential (circular or rectangular) and others single and usually very flat.

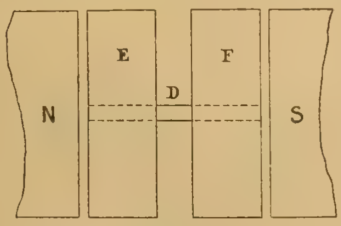


Fig. 1.

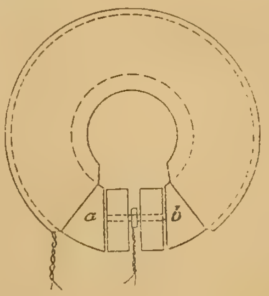


Fig. 2.

In all cases it is desirable that the whole of the effective area of the coil shall be as near to the surface of the iron as possible, otherwise the value of H obtained may not be the true field acting on the iron. It is important to know the rate of variation near the surface, in order to be able to estimate with what degree of accuracy the search coil reading gives the true value of H at the surface. For this purpose, in May, 1913, we adopted the expedient of winding a third coil (*c*) over two (differential) coils (*a* and *b*). By opposing coils *b* and *c* an outer differential coil is formed with an annular area farther from the iron surface than that between *a* and *b*. A comparison of the values of H obtained with the inner and outer annular coils gives a measure of the radial rate of variation of H.

Dr. E. Gumlich has improved on this arrangement by adding a fourth coil, so as to obtain a still better idea of the variation of H with the distance from the iron surface.

When the cross-section of the iron rod is small it is essential to wind the differential coils with extremely thin wire, so as to keep very close to the iron and yet have the product, (No. of turns) × (difference area), sufficiently great for good sensitivity. With enamelled wire of 0.07 mm. diameter (diameter of copper, 0.06 mm.), 1,000 turns can be got into a winding space of about 6 sq. mm.

The flat search coils are wound on thin plates of insulating material. For the smaller coils thin plates of glass (0.8 mm. thick) with ground edges form very convenient cores. The turns, which may be in several layers, are held in place by a winding of silk thread across them, the whole being made solid by paraffin wax or varnish. Semi-circular coils are wound on flat paper cores, well varnished with cellulose acetate enamel, bent round into tunnel shape and allowed to dry hard.

For search coils used to measure H, in general it is only necessary to know two constants of the coil, namely, its resistance and N_2s, the product of the number of turns and the mean area. For coils by which the total flux (Φ) is measured, we need only know N_2; if B is to be determined, *s* should also be known. The number of turns is usually counted when the coil is being wound. In differential coils it is absolutely essential that the inner and outer coils shall have exactly equal numbers of turns. Sometimes the mean area can be deduced with accuracy from the dimensions of the coil, but as a rule it is best to determine the N_2s by placing the coil in a known magnetic field or by determining the mutual inductance between the coil and a suitably wound solenoid or other standard coil.

When either B or H is measured by the help of a search coil, the simplest procedure is to observe the throw on a calibrated ballistic galvanometer when the B (or H) is either reduced to zero or reversed.

In the original form of Ewing and Low's Isthmus method rather elaborate coned pole-pieces are required, with accurate mechanism by which the test-bar along with these pole-pieces can be quickly turned end for end in a strong magnetic field. A much simpler system, shown in fig. 1, was found to be quite satisfactory. Instead of the cones, thick soft-iron disks E and F form the pole-pieces, and these do not touch the magnet poles, but are separated from them by small air-gaps (1 or 2 mm. distance). The test-piece D is fitted into central holes in the flat pole-pieces, which are clamped in an independent frame so that they can be removed together from between the poles. Instead of reversing the direction of the test-piece, the magnet is so designed as to allow quick reversal of the magnetic field. It consists (fig. 2) of a well laminated iron core of nearly square section (8 cm. × 7 cm.) formed of ring stampings of about 22 cm. mean diameter, the polar air-gap *a b* being about 8 cm. across. The winding consists of about 1,000 turns of copper wire of 2 mm. diameter (No. 14 S.W.G.), with a total resistance of about 2.2 ohms.

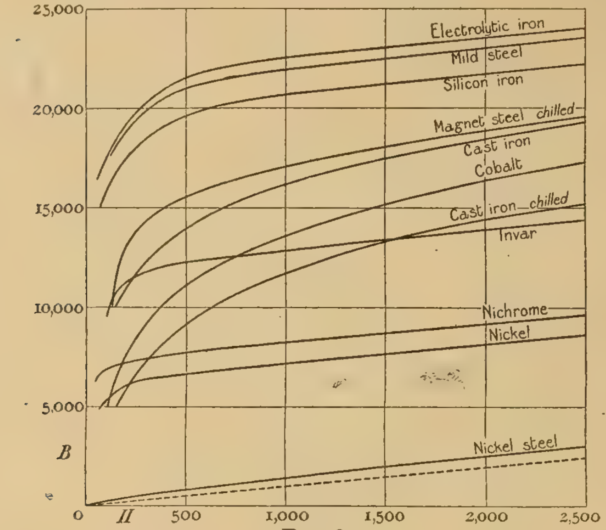


FIG. 3.

Magnet steel (chilled): Tungsten 3.3 per cent., carbon 0.75 per cent.

Invar: Iron 74 per cent., nickel 36 per cent.

Nickel, electrolytic: Ni 98.8 per cent., Fe 0.6 per cent., Cu 0.2 per cent., Mn 0.3 per cent.

Nickel steel: Ni 19.9 per cent., C 0.41 per cent., Mn 0.96 per cent.

The whole construction is extremely simple; the laminated magnet had not been specially designed for the purpose. The entire absence of fitted or clamped magnetic joints is a distinct advantage from the point of view of construction, and appears to have no disturbing effect in the tests, although the presence of the outer air-gaps lowers somewhat the maximum H obtainable in the central gap.

The specimen tested is in the form either of a rod 7 cm. long and 0.5 cm. in diameter, or an equivalent bundle of strips or wires. It does not seem essential that the strips should be so closely packed as nearly to fill the holes in the pole-pieces, for, when the section of the bundle is reduced by 50 per cent. by removing some of the strips, the total observed reduction in permeability is only of the order of 1 per cent. From H = 1,000 up to H = 3,000, rods shorter than 7 cm. gave satisfactory results so long as they entered the holes in the pole-pieces to a depth of at least 0.5 cm.

With such a large electro-magnet, when the current is suddenly reversed, in the worst case the current reaches 99.3 per cent. of its full value 0.5 second after the circuit is closed. With a ballistic galvanometer of 8 seconds' complete period the possible errors due to this cause appeared to be practically negligible.

At the middle point of the test-rod is placed a small ebonite bobbin with an inner winding of 40 turns for measuring B, and three outer coils of 400 turns each, used differentially as already described, for determining H. These coils are of enamelled copper wire of 0.06 mm. diameter (No. 46 S.W.G.), with an axial length of 4 mm., the mean diameters of the inner and outer annuluses being 6 mm. and 12 mm. respectively. From the results of a large number of experiments with various materials it has been proved that the magnetic field round the central portion of the rod is wonderfully uniform from H = 150 up to H = 3,000.

With rods of small section, and more particularly with small bundles of strip, the difference between the cross-section of the iron and the area of the search coil for B is considerable, and this necessitates a large correction on the observed value of B. If s = area of iron, s, = search coil area not occupied by iron, then True b = Observed $B - H\, s_1/s$. The correction increases in proportion to H. To avoid the trouble of applying this varying correction to each observation, we have found it convenient to eliminate the term $H\, s_1/s$ by means of a compensating device consisting of a small mutual inductometer arranged with its primary coil in series with the magnetising circuit of the magnet, and its secondary coil connected in opposition to the search coil for B, in the ballistic galvanometer circuit.

The apparatus can be used, not only for the determination of permeability curves, but also for hysteresis loops, including the remanence and coercive field. The remanent magnetism of the electromagnet, although it makes its appearance, does not introduce any errors, since the true values of H are given by the search coils.

The determination of the remanence and coercive field is most important for hardened steel used for permanent magnets, and here the tests must be made with high values of $H_{max.}$ (say 400 to 500). In determining the coercive force corresponding to a high value of $H_{max.}$, the galvanometer throw measuring the coercive force (H_0) is usually small compared with the throw due to $H_{max.}$, and it becomes rather difficult to read the small throw with sufficient accuracy. In order to increase the accuracy, one way is to raise the sensitivity of the galvanometer and to balance out accurately the complete throw from $+H_{max.}$ to $-H_{max}$ by the help of an adjustable mutual inductance connected similarly to that described above for the correction of B.

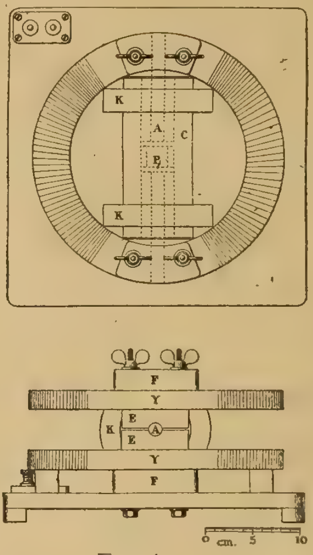


FIG. 4.

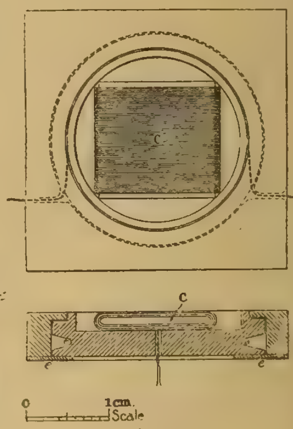


FIG. 5.

In fig. 3 are given a number of H-B curves obtained by the apparatus already described, the samples being in the form of thin rods or bundles of strips. As will be seen, most of the materials are of interest from a practical point of view.

The lowest curve in the diagram is the straight line for air (permeability = 1). All the other curves ultimately tend to become parallel to the air line as the magnetisation is increased, close parallelism indicating that the material has reached the condition of magnetic saturation.

In the apparatus already described the main disadvantage is that the rods tested must be of small diameter. For testing round rods up to 2.5 cm. in diameter the authors have constructed a special apparatus of a type somewhat similar to Gumlich's most recent design. The general arrangement is shown in fig. 4.

The test rod A, surrounded by a bobbin wound with a magnetising coil C, is clamped, by the help of suitably bored iron end-pieces E E, between the two circular yokes Y Y. F F are pieces of hard wood to equalise the pressures. (For bars of rectangular section the end pieces E E are not bored, but merely faced flat.) In order to increase the uniformity of the magnetising field near the middle part of the central bobbin, there are two additional magnetising coils K K, and the yokes also are wound with coils with their turns somewhat crowded towards each of the magnetic joints. All of the magnetising coils are in series. The central solenoid has 950 turns of No. 16 S.W.G. wire (1.63 mm. diameter), coils K K 150 turns each, and the yokes a total of 200 turns. A current of 12 amperes gives H = about 1,000.

Experiments showed that the additional windings greatly improved the radial uniformity of H at the middle of the bar for the range H = 50 to 150, but slightly decreased the uniformity at higher ranges (H = 400). On the whole, the average improvement is satisfactory, and appears to exclude errors greater than 1 per cent. Without further precautions the apparatus should not be used for permeability tests with values of H below 30. The H and B search coils are on a small bobbin P at the middle part of the test bar. For a rod of 1.25 cm. diameter each annular H coil has 1,800 turns, the innermost coil being at a mean radial distance of about 2.5 mm. from the surface of the iron. With bars of rectangular section flat search coils are used, which have the advantage of getting much closer to the iron surface (mean distance = about 1.5 mm.); two coils in series may be used, one on each side of the bar. The authors have also made satisfactory tests on rectangular bars of magnet steel in a short solenoid (22 cm. long) heavily wound and without any yoke. Very good uniformity of H can be ensured by extending the effective length of the bar by butting against its ends two soft-iron bars about 20 cm. in length.

In all the methods in which the H search coils are kept in a fixed position with regard to the iron, the throws on the galvanometer can only determine changes in H and not (directly) the absolute values. These values can be determined by pulling the search coil (where possible) quickly out of the field. In general it is difficult to do this, and, even when it is possible, a double throw of the galvanometer may occur, which vitiates the accuracy of the test.

A much better way is to mount a flat search coil so that it can be rotated in a plane parallel to the direction of H (*i.e.*, usually parallel to the surface of the iron). It can then be quickly reversed in position (turning through 180 deg.), and, when calibrated in a known magnetic field, will give directly the absolute value of H at any moment. The mounting of a very narrow reversible coil of this kind is shown in fig. 5.

The search coil *c* is mounted in a thin pulley (5 mm. thick) which can turn in a cell of ebonite with a thin German-silver cheek (*e e*) forming the second bearing. Two threads from the pulley (one of which can be fastened to a spring if desired) allow the coil to be reversed from the outside. Adjustable stops, not shown, limit the turning to 180 deg.

Tests on bars of magnetic steel by this method are in agreement with the results given by fixed search coils. The method is the simplest and most straightforward that we have tried.*

In practice it is desirable to be able to test curved as well as straight bars; for example, the magnets of horse-shoe form used in magnetos. If the curvature is not too great, the H at any part may be measured by means of search coils near the surface, as already described. For the horse-shoe magnets, flat search coils are tied (inside and outside) at the middle of the bend, and over the whole are slipped five or more magnetising coils.

The essential feature of all the foregoing methods is that the value of the magnetising H is not calculated from the somewhat indefinite length of the magnetic circuit and the ampere-turns, but is directly measured by the help of a search coil placed as near as possible to the surface of the iron.

ELECTRIC LIFTS.

A paper on this subject, from which we extract the following notes, was read by Mr. H. Marryat at a recent meeting of the Association of Supervising Electricians. The author points out that though goods lifts are frequently regarded as an inferior class of contrivance, it is only in service lifts wherein no person can possibly travel, that the factor of safety in respect of strength of materials and number of safety devices can be reduced justifiably below the standard maintained for passenger lifts. No form of notice or warning is sufficient to prevent a man risking his life if it will save him a little stair or ladder work.

The two main types of lift are sheave-driven and drum-driven respectively. In favour of sheave driving, Mr. Marryat advances the possibility of using more ropes, and hence smaller ropes than can be accommodated conveniently on drums. The rope of smaller diameter and the larger diameter to which it is bent on sheaves, as compared with drums, give longer rope life, and the speaker cited ropes still in use on sheave lifts after 15 years' service, whereas drum-driven ropes lasted only three years under similar conditions. A most important advantage of sheave driving is that in the event of over-running, the rope tension is relieved and the sheave slips under the ropes without doing much damage. With drum drive something must break, since the ropes are driven positively; to reduce the risk extra safety devices are needed, and these introduce further possibilities of trouble.

The most favourable arrangement is to place the driving gear at the top of the well and use a sheave just spanning (diametrically) the distance between car and counterweight centres, without the use of leading wheels. To prevent transmission of noise throughout the building, the bed-plate of the gear should be heavy and stiff, and the whole mounted on girders isolated by rubber blocks. A double ceiling, with asbestos or slag packing, may be used over the well. Architects frequently make the erection and maintenance of an efficient and reliable lift most difficult by neglecting to consult engineers as to the head room and pit depth required in the well. Lift wells should preferably be enclosed from floor to ceiling on each landing. In any case this should be done on the counterweight side. Several decorators have been decapitated by the counterweight when working over the top of a 7-ft. enclosure.

Manufacturers of lifts generally counterbalance the weight of car and attendant, plus 40 per cent. of the maximum load to be carried, but by examining the actual conditions of working when the lift has been placed in commission, 50 per cent. or greater energy economy can frequently be effected by altering the counterweight. The energy required to start and accelerate exceeds that required to raise a well-balanced lift, hence marked economy can be effected by using automatic lifts or by employing skilled attendants who will bring the car to the correct floor level at the first attempt. Mr. Marryat finds that modern electric lifts cost for energy about one-tenth the water bill of an equivalent hydraulic lift; and in Westminster it is found that 50 electric lifts average only 1,060 units energy consumption (each) per annum. Even a completely automatic electric lift costs not more to maintain than an hydraulic one, and it saves the attendant's salary, which is about five times the total maintenance cost. Rope renewals form the most expensive part of the upkeep of a good lift, and the labour of fitting costs about as much as the ropes themselves, hence it is wise to use the best material available. Top-gear needs only one-third the length of rope that is required if the gear be fixed at the foot of the well. The stranding found most satisfactory for all-round lift work is 6/19 laid round a hemp core; 6/24 and 6/30 wear through more quickly, but the greater flexibility is valuable where small sheaves or drums are used. For a set of four ropes a breaking strain of six times full load on each rope may be allowed; and for two ropes, a similar margin of seven times.

Compound-wound motors with 10 or 15 per cent. of series turns should be used for lift driving, rated for intermittent work. The rated motor horse-power should be about 2¼ times the net value given by (lb. out-of-balance, fully loaded) × (lift ft. per min. /33.000). When a worm wheel is used consisting of a phosphor-bronze or gunmetal rim on a cast-iron centre, it is vital that the two parts be thoroughly secured; if the rim comes adrift, or if its teeth wear to stripping point due to defective supervision, all safety devices are cut out except the dog grips on the car, and these cannot operate since the ropes remain taut.

Safety gear can and should be used to a greater extent on electric lifts than on any other type. It must guard against disaster due to broken ropes or over-running at either end of the well, and it must avert the consequences of human carelessness, folly and mischief.

About 90 per cent. of lift accidents are due to there being no car gate or inadequate gate locks. A car gate should always be provided, and in all cases it is desirable, and in automatic lifts it is imperative, that electric gate-locks be used of such construction that the lift cannot be used till all gates are electrically and mechanically locked, and no gate can be opened except that opposite the floor at which the lift is standing. A really good lock should not allow the door to open if it be pulled at the moment when the car is passing in its travel up or down the building. Unless gates are self-closing, a messenger has constantly to run up and down rectifying the omissions of careless passengers; the economy of an automatic lift is then mostly sacrificed. Gates which will close certainly and without banging can best be built on the Continental hinged door principle. Two 15-in. centre-closing panels can be opened inwards with little inconvenience in even a crowded car.

The points requiring special attention in lift inspection are: (1) Adequate lighting by day and night; (2) locking of all gates imperative before the lift can be started; (3) security of locks at all times and under all conditions during working; (4) sufficiency of brake power and effective action of limit switches which should not, however, be reached under ordinary working conditions; (5) adequacy of enclosure. It is highly desirable that all safety devices be tested periodically; they should not be left idle or ill-tended from the time they are installed to the moment they are supposed to act. The duties of maintenance contractors include testing all safety devices and watching wear in all parts.

After the war we may expect a period of great constructive advancement marked, in the lift world, by the perfecting of controller design, simplification of the automatic lift, and co-operation between architects and engineers to effect standardisation.

THE DESIGN OF HIGH-PRESSURE DISTRIBUTION SYSTEMS.

By J. R. Beard, M.Sc., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *December*, 1915.)

(*Continued from page* 831.)

Economical Section of Mains.—Although it is generally known that the economical cross-section of a main is that at which the sum of the annual charges and the value of the energy lost is a minimum, it is seldom that any practical use is made of the formula. In the case of high-pressure distribution systems, at any rate, the results are commercially useful.

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* Many years ago Ayrton and Mather introduced "trigger" coils which turned quickly through 180 deg. for the purpose of measuring flux densities in air.

The annual charges which have been taken for underground and overhead mains at various voltages are shown in fig. 1. These are based on average commercial prices, allowing interest at the rate of 5 per cent. per annum, and depreciation at 2 per cent. for underground mains and 3 per cent. for overhead mains, suitable allowance being made for trench work in the former case and for wayleave charges in the latter. With compound interest at 5 per cent. the rates allowed for depreciation are sufficient to enable the underground mains to be replaced after 22½ years and the overhead mains after 17½ years, allowing a scrap value of 20 per cent. in each case. In the case of overhead mains only one curve is given, as up to 20,000 volts the only difference is in the insulators, and this is so small that it is usually worth while to make the line suitable for 20,000 volts, although it may only be intended to operate it at a lower voltage.

The only losses which are important enough to be taken into account in this investigation are the resistance losses in the copper conductors, and in estimating their value it is necessary to take account of the effect of the addition of the load on the load factor of the system.

A system has been taken having a maximum load of not less than 50,000 KW. and an average load factor of 50 per cent.; figures which fairly closely correspond to what may be expected if the system deals with the general demand over a reasonably extended area.

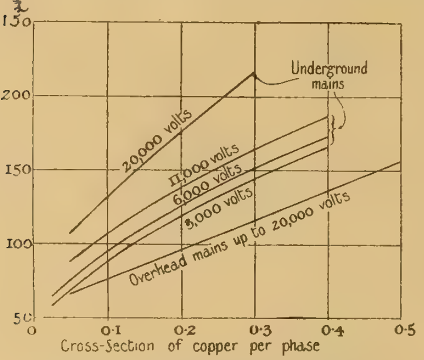

Fig. 1.—Annual Cost per Mile of Interest and Depreciation for Various Types of 3-phase Mains.

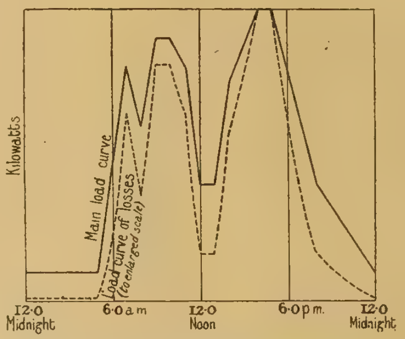

Fig. 2.—Load Curve of System with 50 per cent. Load Factor, and Curve of Losses with a Load Factor of 35 per cent.

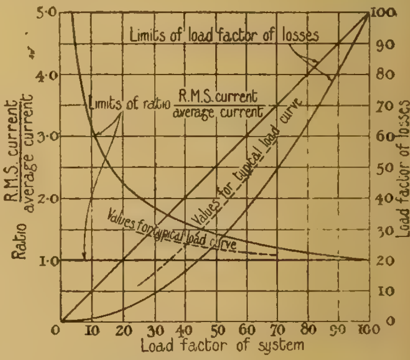

Fig. 3.—Effect of Shape of Load Curve on R.M.S. Current and Load Factor of Losses.

In fig. 2 the full-line curve shows the assumed load curve of the typical system with a load factor of 50 per cent., and the dotted curve shows to an enlarged scale the shape of the corresponding loss curve, which has a load factor of only 35 per cent. From an analysis of the fixed and running charges, the cost per unit of generating these losses at the power stations can be calculated, and to this must be added the fixed charges on the increased capacity of the distribution system necessary to transmit these losses. Since the power stations can seldom be located at the exact electrical centre of gravity of the load, the losses have to be transmitted, on the average over, say, two-thirds of the distribution system and should, therefore, bear two-thirds of the fixed charges of the latter. Taking the cost of the distribution system as two-thirds that of the power stations, the value of resistance losses on the typical system considered is about 0.25d. per unit.

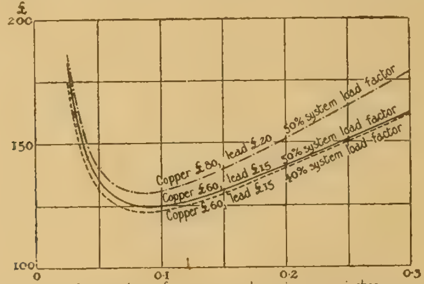

Fig. 4.—Combined Annual Cost of Interest, Depreciation, and Energy Losses per mile of 6,000-volt Underground Main carrying a Maximum Load of 100 amperes.

Since the resistance losses over a given time are proportional to the mean square of the current, it is very necessary in calculating them to take account of the shape of the current load-curve. For the typical 50 per cent. load curve given in fig. 2 the R.M.S. current is 1.18 times the average current. The full lines in fig. 3 show the extreme values of this multiplier for different load factors, and the dotted line the approximate values for the usual type of load curve; corresponding extreme and usual values for the load factor of the losses are also indicated.

On the system which we are considering, the load factor of the mains over the whole network would probably average about 40 per cent., and it will be seen from fig. 3 that the corresponding R.M.S. current would be 1.25 times the average current. Calculating the losses on this basis, and taking their value as 0.25d. per unit, the annual value of the losses per mile of 3-phase main is £0.000296 I^2/A, where I is the maximum current in amperes and A is the cross-sectional area of the conductor of each phase in square inches.

By adding the curves of annual charges and value of losses for mains of various sizes for any particular maximum current, a curve is obtained of the type shown in fig. 4, which refers to a 6,000-volt underground cable required to deal with a maximum current of 100 amperes. The most interesting feature of this curve is that the most economical section is not very definite; it is actually 0.09 sq. in., but for 2½ per cent. increase in the total annual costs the section can be increased 44.5 per cent., or decreased 27.2 per cent., the corresponding figures for 5 per cent. increase in annual costs being 65.5 per cent. and 36.1 per cent. respectively. It follows that it is not sound practice to cut the section of mains too fine, more especially since it is a most expensive matter after a main is once laid to increase its carrying capacity if this should prove too small.

A corresponding curve has been calculated in exactly the same way, but assuming a system load factor of only 40 per cent. This is shown dotted in fig. 4 and gives a reduction of only 2 per cent. in the most economical section and 2 per cent. in the minimum total annual cost per mile, compared with the original curve. The difference between the two curves is so small because the reduction in the number of units lost at the lower load factor is nearly balanced by the extra value of the losses per unit due to the lower load factor of the losses. A further curve has also been added—shown chain dotted—to show the extent to which the results are affected by the price of copper and lead. The original curve corresponds to basis prices of £60 and £15 per ton respectively, while the chain-dotted curve corresponds to basis prices of £80 and £20 per ton. This shows that the influence of ordinary variations in metal prices is negligible.

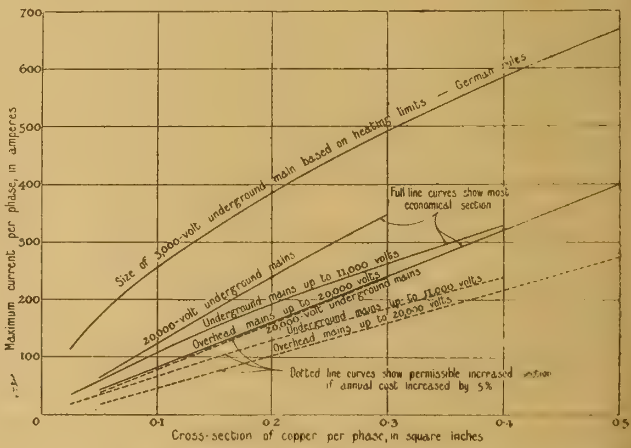

Fig. 5.—Most Economical Cross Sections of 3-Phase Mains for Various Currents.

By plotting a series of curves similar to the full-line curve in fig. 4, the curves shown in fig. 5 have been obtained. The full lines in fig. 5 give, for underground and overhead mains at various voltages, the most economical cross-section for any given maximum current, while the dotted lines show the increased cross-section corresponding to 5 per cent. extra annual cost. It will be noticed that up to 11,000 volts in the case of underground mains, and up to 20,000 volts in the case of overhead mains, the voltage makes no difference to the economical cross-section; and from fig. 1 it will be seen that this is because between those limits the annual charges happen to differ by approximately constant quantities which are independent of the cross-section.

To show how the economical cross-sections compare with sections settled by considerations of the safe carrying-capacity, a further curve has been plotted showing the carrying-capacity of armoured 3-core 3,000-volt cable on the basis of the rules of the Verband Deutscher Elektrotechniker. As the rules refer to continuous loads, and the maximum load is usually not maintained for a sufficient time to heat up the cable fully, the curve has been plotted on the assumption that the equivalent heating current is the mean between the R.M.S. current and the maximum current, *i.e.*, 0.75 of the maximum current in the present instance with a 40 per cent. feeder load-factor. The reduction for voltages up to 11,000 is not more than 10 per cent., but unfortunately no figures are available at present for 20,000-volt cables. It will be seen that except for 20,000-volt cables the economical section gives an overload margin of as much as 100 per cent. in nearly all cases, and even for 20,000-volt cables it is evident that a considerable margin exists, so that it is quite permissible to settle the cross-section of mains on the basis of maximum economy. That it does not pay normally to operate cables at the maximum current density allowed by heating-limits is of interest, since it means reduced voltage-drop per mile and consequently an increased radius of distribution for a given voltage.

From the series of curves used in determining the economical sections it is also readily possible to find the minimum annual costs of interest charges, depreciation, and losses per mile of main for given maximum currents, on the assumption that the economical sections which correspond to those currents are used. If an allowance for repairs is added, the resulting figures will give the total minimum annual cost per mile of main, thus providing a definite basis on which the relative economy of alternative arrangements of mains can be determined. The curves in fig. 6 have been obtained in this manner, the allowance for repairs being taken as a certain percentage of the cost of a 0.15 sq. in. main, since repairs consist almost entirely of jointing and labour and their cost is, therefore, independent of the cross-section. The percentages which have been taken are 1 per cent. for underground mains and 2 per cent. for overhead mains, but these must only be looked upon as approximations, since the cost of repairs depends on so many conditions.

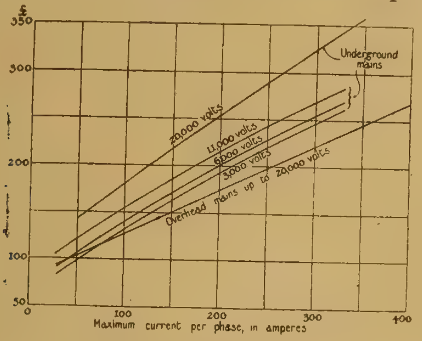

Fig. 6.—Minimum Total Annual Cost per Mile of 3-Phase Mains.

(*To be continued.*)

THE FRENCH ELECTRICAL INDUSTRY.

The liberation of the country from the Germanic element is felt to be no less profoundly necessary in France than in Great Britain, Italy, and Russia, and our French friends have, therefore, been engaged in a discussion for some months past in relation to the best methods to be adopted so as to develop the national industry in connection with trade in the home market and also in the markets of the world. In the *Lumière Electrique* in particular many pages have been filled with arguments and suggestions, and it is fitting to refer to these at the present time, although the task is somewhat difficult having regard to the numerous points raised in the course of the discussion. Let us, however, select, by way of a beginning, the important question of laboratory work, and in doing so we cannot do better than reproduce the beautiful words which were quoted from the well-known scientist, M. Pasteur, in the course of a lecture which was delivered before the Conservatoire des Arts et Metiers in Paris last February. The words, which were uttered by Pasteur as far back as 1868, are really as pathetic as they have proved to be prophetic, and they are particularly applicable to the electrical engineering industry. "Take an interest, I implore you," declared Pasteur, "in these sacred abodes which are designated by the expressive name of laboratory. Ask for them to be multiplied and embellished; they are the temples of the future, of riches and of welfare. It is there that humanity grows, becomes stronger and better. There she learns to read in the works of nature, works of progress and of harmony, whilst her own works [those of humanity] are too frequently those of barbarism, of fanaticism, and of destruction." Again quoting these words, M J. Violle, discussing the future of the physical resources of France in October, stated that had the suggestions been acted upon they would have enabled France to have paid the 1871 war indemnity several times over in the course of a few years.

Applying the Pasteur theory to the present, M. Violle suggests that the principals of the large French works should become imbued with these thoughts. Without laboratories there would be no inventions, no improvements even in the daily methods of working. The directors of the financial institutions, in his opinion, should also meditate on the words and combine with the technical men to secure fruitful results. But the high banking circles have often exploited the taste for exotic investments by diverting to other countries considerable sums which they have refused to guide into the channels of national industry. Unfortunately, the French do not stand alone in this respect, as we in Great Britain know to our deep regret and industrial loss. M. J. H. Jacobsen, dealing with electrical development, in November, goes even further than M. Violle in the matter of laboratory work, as he suggests that from the standpoint of patriotism and prevision, it might be expected that those who advised capitalists would support *services d'études* and place their powerful organisations at the disposal of national industry, as well as the great influence which they exercised upon the investment of capital.

Leaving now the question of laboratory work, we next come to the problem of production. M. Jacobsen, who has followed M. Victor Cambon and other authors, fully recognises that the electrical situation in France must be faced, as it is only by admitting and considering the difficulties that it is possible to propose remedies. German prosperity, as he states, is solely based upon the co-operation of capital and industry, and only such co-operation in France will enable the French to reach as high a stage of development as that of Germany—a matter which is of the highest importance. But the author is a little afraid—and his observations in this direction may perhaps be peculiarly applicable to schemes now in progress in Great Britain—that too great a disposition exists to form new groups to assist manufacturers to secure new markets abroad or to act as substitutes for these firms abroad. In his opinion, the French should guard themselves against the creation of new groups under existing conditions, as the multiplicity of organisations leads to a too great division of effort. Various organisations already exist for export purposes which only require to be modified so as to reach a definite programme which would ensure success, whereas new associations would have to overcome the difficulties which the present organisations have been confronted with and have surmounted. In fact, M. Jacobsen seems disposed in favour of some definite combination to which all parties would adhere, and presumably this would be subdivided into sections.

Having established this point to his own satisfaction, M. Jacobsen expresses himself definitely against the question of the export trade forming the starting point of development. Exports, he declared, are simply a result of intensive rational production, the first effect of which is to enable makers to reduce prices in the home market and to wholly supply the needs of the home market, so that foreign competition is driven out. An industry which has reached this position has attained to such importance that, in the words of the author, it is automatically approached by the local export commission agents, and then, as a consequence, it is approached by the representatives or agents abroad. Indeed, the continuous development of the industry has given rise to over-production, which enables the firms to respond to the demands of exporters and thus tends to the distribution abroad of the machinery and plant. We fear, however, that experience would scarcely fit in with this theory of automatic expansion abroad. M. Jacobsen nevertheless is on safer ground when he contends that the French electrical firms do not attach sufficient importance to applications from merchant houses, seeing that some of them in the past have purchased in France German machinery for export to South America. This proves, in his opinion, that the condition of intensive rational production has not been fulfilled, and that the French, therefore, were not ready to export; but he overlooks the fact that the Teutonic plant might have been, and in all probability was, offered at the so-called slaughter prices, which would commend themselves to merchants who never took national sentiments into consideration in business transactions. At any rate, the author returns to his contention of success being founded upon the co-operation of capital and industry, with the addition of the condition that it is necessary to grant long credits.

If we now come to more solid ground—ground which is common alike to French and British firms—it is mentioned that the whole of the country is interested in the industrial side of the question as well as the financial side. The financial yield of well-organised industry, M. Jacobsen remarks, is much greater, at least for the capitalist, than the best Government loan; he has obviously in view certain German firms. It is, therefore, regrettable that the French banks do not more frequently devote money to industry. This is due to the circumstance that the issue of a Government loan is much more advantageous to a bank than the emission of industrial shares under normal conditions; but if the profits realised by the banks on foreign loans were reduced the banks would naturally turn to industry. It is here that the author raises the problem of financial support being given to laboratory investigation, to which reference has already been made.

He adds, however, that if the banks were to assist in the development of the industry the financial yield would be equally as important as that appertaining to the flotation of foreign loans. M. Jacobsen also submits that the plain co-operation of finance and industry alone cannot solve the problem of industrial expansion, and he proceeds to discuss the part which must be played by the staff and the workmen in this direction, quoting from M. Cambon and M. Vogt as to the necessity for granting greater facilities for the improvement of the technical education of the men and the apprentices, the latter of whom should be adequately remunerated as soon as they become useful to their employers. We will, however, refrain from dealing further with this matter on the present occasion, particularly as the labour problem in France had assumed a grave aspect before the war, and will become still graver when peace has been proclaimed owing to the increased scarcity of workmen, from which France has been suffering for some years past.

One more matter may be raised in conclusion. It was brought forward by M. R. Légouez, and relates to a commercial question: the prevention of fraud or the passing off as of French manufacture goods made in other countries, the chief aim being against enemy countries. M. Légouez, starting from the premise that French consumers may be expected to give preference to national products so as to develop national industries, recommends electrical manufacturers to follow the example of the Federation of Producers of Ironmongery and of a second federation by the adoption of a characteristic trade mark. These federations have introduced a trade mark in the form of an oval ring, in the centre of which appears the word "France"; in the upper portion is the name of the trade organisation or chambre syndicale, and in the lower part is the name of the class of products protected by the trade mark, together with the particular number allocated to each firm using a trade mark. It is assumed that the adoption of this form of trade mark would be a guarantee of nationality, and that it would prevent fraud. We learn from another source—not French on this point—that the idea of the French promoters of the scheme is to secure the general use of the trade mark in that country, that it is desired to bring the trade mark under the control of one huge combination of associations for this purpose, capable of proceeding legally against any infringements from any source whatever, and that legislation would be necessary to secure the execution of the whole of the programme. With these observations we leave the French industry for the present, only remarking that the trade mark idea has found commendation also at the hands of an Italian contemporary.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

17,411. "Electrical apparatus for heating liquids." W. H. Smith. December 13th. (Complete.)

17,412. "Liquid-operated switches." W. H. Smith. December 13th. (Complete.)

17,413. "Electrical apparatus for heating liquids." W. H. Smith. December 13th. (Complete.)

17,419. "Braking devices for electric motors." Machinenfabrik Oerlikon. December 13th. (Convention date, December 11th, 1914, Switzerland.) (Complete.)

17,453. "Production of X-rays." J. M. Davidson. December 13th.

17,455. "Installations and apparatus for use in wireless telegraphy and telephony." E. Bellini. December 13th. (Complete.)

17,474. "Electro-magnetic relays." C. B. Burdon. December 14th. (Siemens & Halske Akt. Ges., Germany.) (Complete.)

17,480. "Construction of cord grip-holder for use in connection with electrical apparatus." G. Markt. December 14th.

17,497. "Electric control mechanism." O. H. Pieper & A. F. Pieper. December 14th. (Convention date, October 15th, 1915, U.S.A.) (Complete.)

17,503. "Auxiliary means for suspending electric lights." C. F. Millard. December 14th.

17,533. "Electrical devices to be used on taxi-cabs and the like." H. Richardson & H. E. Gill. December 15th.

17,538. "Electrically-operated horns." H. Lucas & W. H. Edwards. December 15th.

17,542. "Projector lamp for use with incandescent filaments." R. Bosch (firm of). December 15th. (Convention date, February 18th, 1915, Germany.) (Complete.)

17,551. "Microphones." F. Morano. December 15th. (Divided application on 82/15, January 2nd.) (Complete.)

17,580. "Electron-emitting cathodes and process of manufacturing the same." A. M. Nicolson & E. C. Hull. December 16th. (Convention date, December 26th, 1914, United States.) (Complete.)

17,581. "Automatic call distributing systems." E. B. Craft & J. N. Reynolds. December 16th. (Convention date, December 19th, 1914, U.S.A.) (Complete.)

17,592. "Compressors." British Thomson-Houston Co., Ltd. December 16th. (General Electric Co., U.S.A.)

17,595. "Machines for generating and distributing electric currents." F. L. Hollister. December 16th.

17,615. "Loading coils for superimposed telephone working and other purposes." C. E. Hay & H. W. Sullivan. December 16th.

17,629. "Reproducing a light in lamps, electric lamps and flash signals immediately producer is out." A. Batchelor & W. Batchelor. December 17th.

17,664. "Electro-mechanical colour effects device for use in theatres and the like." H. Richardson, H. E. Gill, & J. A. Molloy. December 17th.

17,677. "Means for transmitting electric impulses from a standard clock to impulse or secondary dial clocks." W. J. L. Smith. December 17th.

17,690. "Electrical protective devices." British Westinghouse Electric and Manufacturing Co., Ltd. December 17th. (Addition to 10,130/15. Convention date, December 29th, 1914, U.S.A.) (Complete.)

17,691. "Electric signalling." International Electric Co., Ltd., H. E. R. Roose, & R. G. le Noir. December 17th. (Addition to 3,520/15.) (Complete.)

17,713. "Electrically-heated stove or open fire." G. A. C. Thynne. December 18th.

PUBLISHED SPECIFICATIONS.

1914.

4,345. Transformation of Frequency or High-frequency Alternating Currents for Wireless Telegraphy and Telephony. Soc. Marius Latour et Compagnie. February 19th. (February 20th, 1913.)

19,045. Telegraphy. W. M. Bruce, Jun., & United Telegraph and Cable Co. August 25th.

23,171. Control of Electric Motors. A. H. Curtis, E. W. Short, and Igranic Electric Co. November 27th.

23,726. Electric Fire Alarm Apparatus. N. Bendixen & M. B. Mountain. December 8th.

23,749. Protective Arrangements for Electrical Systems. J. F. Watson, F. G. Waters, and Callender's Cable & Construction Co. December 8th.

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112. Galvanic Batteries. C. B. Burdon (Siemens Schuckertwerke Ges.). January 4th.

939. Arrangements for Telephone Systems. O. Imray. (Siemens and Halse Akt. Ges). January 20th.

1,088. Methods of Exhausting Incandescent Lamps or similar Glass Receptacles. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). January 22nd.

1,612. Electric Spark-quenching Apparatus. A. M. M. Goby. February 1st.

1,684. Electro-magnetic and Vacuum Lifters. J. P. C. Charlebois. February 2nd.

2,164. Telegraphic Apparatus. E. C. R. Marks (Delany Foreign Co.) February 10th.

3,419. Electric Signalling Systems. A. Stern. March 3rd.

3,433. Reactance Coils. P. Torchio. March 3rd. (Addition to 11,116/14.)

5,554. Electric Motor Meters. British Westinghouse Electric & Manufacturing Co. April 13th. (April 15th, 1914.)

7,271. Electric Meters for the purpose of Compensating for Temperature Variation. E. Fawssett. May 14th.

8,303. Insulation Division Piece or Partition for a Controller Arc Deflection, Circuit-breaker, and the like. W. R. McRae & R. Russell. June 4th.

8,376. Safety Device for use with Electrically-driven Vehicles. W. V. Turner. June 5th. (October 24th, 1914.)

9,110. Oil-cooled Electric Transformers. A. Duckham. June 21st.

15,148. Device for the Protection of Electric Installations against Excess Voltage. Soc. Generale des Condensateurs Electriques. October 26th. (October 26th, 1914.)

The Metric System.—The *Standard* states that the reported decision of the "South German Cotton Industrials," which is the principal body controlling the cotton industry in the Central Empires, to abandon English standards of measurement in yarn counts for the metric system is entirely satisfactory to the growing multitude of British manufacturers and merchants who advocate the adoption by the British Empire of the metric system of weights and measures and a decimal system of coinage. Germany, when she tried to steal our cotton industry, was forced to use our measurements at first. The abolition of British standards of measurement in Germany only matters to us at the moment so far as it may give her an advantage in export trade with neutrals, and she has no cotton to spare just now for that; but it will be a factor for serious consideration after the war. Linen manufacturers and silk spinners in Germany are following suit.

Reform of our coinage, weights, and measures on a decimal basis is one of the objectives of the British Manufacturers' Association, which has been formed to urge upon the Government the necessity of making adequate preparations for trade competition with Germany after the war. A representative of the *Standard* was informed:—"We feel that the introduction of the metric system into the British Empire in its entirety is one of the most urgent needs of British commerce. The change will be so colossal, however, that we feel that the appointment of a Minister of Commerce, whose duty it would be to deal with such far-reaching problems as this, must come first. The advantages to be gained are so indisputable that, apart from the cost and temporary inconvenience of the change, there is surely no serious case against it. The metric system is very easily learned, and people accustomed to calculate in acres, feet, inches, bushels, and gallons can adapt themselves very quickly. The saving of time in marketing and clerical work would be enormous. Coinage reform could come later, and, more gradually, as the present coinage was called in, but the extensive use of paper money due to the war would make the coming year a particularly favourable time for the change, and our intimate alliance with France is an additional reason for adopting a decimal system of monetary calculation now. In the era of strenuous commercial competition which is certain to follow the war we shall be greatly handicapped, as we have been in the past, by the retention of weights and measures which are not used outside the British Empire."

INDEX.

List of sub-headings :—AUTHORS, BANKRUPTCY PROCEEDINGS, CITY NOTES, CONTRACTS CLOSED AND OPEN, CORRESPONDENCE, INSTITUTION AND LECTURE NOTES, LEGAL, LIGHTING AND POWER NOTES, LIQUIDATIONS, NEW COMPANIES, NEW ELECTRICAL DEVICES, FITTINGS AND PLANT, OBITUARY, OFFICIAL RETURNS, PARLIAMENTARY, PROCEEDINGS OF SOCIETIES AND INSTITUTIONS, PROSPECTUSES, RAILWAY NOTES, REVIEWS, TELEGRAPH NOTES, TELEPHONE NOTES, TRAMWAY NOTES, WAR ITEMS.

ACCIDENT, Motor lorry, 526
Accidents, 16, 596, 692; 818
Accidents in 1914, Electrical, Mr. G. Scott Ram's report, 690, 713, 747
Accidents in mines, Electrical, 710, 761, 793
Admiralty Board of Inventions and Research, 115, 144, 755
Admiralty metal brokers, The, 437
Advertising.—Through business eyes, 245
Aerials of the umbrella type, The capacity of, by Prof. G. W. O. Howe, 426
Aeronautical production, 723
After the war, British electrical and allied manufacturers' discussion, 827
After the war, Discussion in the House of Lords, 826
Agriculture: Its national aspects, Electricity in, 729
Air raids and generating stations, 98
Air raids, Fires due to, 373
Aircraft, Insurance against hostile, 389, 834
Alien enemies, Patents and, 50, 84, 381, 405, 724, 756, 788
Alkali manufacture in Canada, Electrolytic, 838
A.E.G. development, An, 291
Alloy, Nickel-chromium, 145
Alloys, Electrometallurgical, 170
Alternating-current cable telegraphy, by E. Raymond-Barker, 250
Alternating-current for cable telegraphy, An unbroken, by Lieut.-Col. G. O. Squier, 156, 187
Alternators, Progress in high-frequency, 314
Alternators, Some wrinkles on the operation of, by E. B. Pausey, 252
Aluminium alloys, Exposure tests of light, by Prof. E. Wilson, 426
Aluminium, Neuhausen, 368
Aluminium wire, The electrolytic insulation of, 114
Aluminium works in Norway, 750
A.S.E., The, 499
America and Argentine trade, 298
America and electrical export trade, 327, 660
America and trade after the war, 628
American apartment houses, Electric cooking in, 723
American exports of electrical goods, 256, 475, 718
American motor searchlight plant, An, 676
Appeal from the trenches for more munitions, The, 482
Appointments vacant, 15, 50, 84, 113, 146, 214, 245, 277, 309, 339, 373, 403, 437, 471, 533, 564, 598, 629, 660, 692, 724, 754, 819, 850
Apprenticeship in the electrical contracting industry, by A. H. Dykes, 573
Apprenticeship scheme, Electricity works, 470
Arbitration, Australian contracts and, 16
Arbitration clause, The, 272
Arc-lamp, The Cadmium-vapour, by Dr. H. J. S. Sand, 426
Arc phenomena, by A. G. Collis, 446
Arc phenomena and tendencies in design, Oil circuit-breakers: Notes on, by K. C. Randall, 317
Argentine battleship *Moreno*, The electrical equipment of the, by H. A. Hornor, 348, 380
Argentine Republic, Electrical imports, 494
Argentine trade, America and, 298
Argyll cars, 494
Artists Rifles O.T.C., Engineers for the, 788
Association, A commercial electrical, 674
Audion receiver for continuous waves, The double, 347
Australia, Cockatoo Island works, 304
Australia, Municipal electrical trading in, 709
Australia on tariffs and trade "capturing," 405
Australia, Particulars of electric tramways in the Commonwealth of, 539
Australia, The manufacture of insulators in, 178
Australia, The trade of, 678
Australian contracts and arbitration, 16
Australian electrical trades union, 511
Australian imports, 399
Australian railways, 84
Australian steel, 331
Australia's invitation to trade, 675

AUTHORS—
  Abraham, A. J., on Units from refuse, 84
  Allison, H. B. C., and L. A. Hawkins, on Calorising: A protective treatment for metal, 158
  Anderson, Dr. J. S., on An electromagnetic vacuum balance, 267
  "Anglo-Egyptian," on British Electrical trade with Egypt, 283
  Archdeacon, G. R., on The electrical trade position in China, 185
  Asakawa, Profs. G. and J. E. Petavel, on Thermal efficiency of a gas engine, 365
  Austin, E. P., on Notes on faults in cables, 540
  Barker, Prof. A. H., on Domestic electric heating, 775
  Beard, J. R., on The design of high-pressure distribution systems, 829, 861
  Bennett, E. P., on The salesman, 525
  Blake, R. F., on Submarine Signalling, 28
  Bone, Prof. W. A., on The control of fuel consumption, 415
  Broadbent, F., on Preferential rates for exports, 444
  Butler, E. F., on Some motors I have met, 259
  Calder, J., on Metal spray processes in engineering, 391
  Campbell, A., and D. W. Dye, on The magnetic testing of bars, 859
  Chorlton, A. E. L., on Convertible combustion engines, 328
  Coburn, F. G., on Making and using thermocouples, 748
  Collis, A. G., on Arc phenomena, 446
  "Commercial," on Multicore cables, 774
  "Contango," on The electrical industry in the United States, 483
  Crouch, L., on A simple radiographic method for localising bullets, 155; on Lamp and lighting developments in the near past and future, 227, 281
  Cunningham, W., on Economic problems after the war, 413
  Darling, C. R., on Recent progress in pyrometry, 200; on Field telephones, 377
  Davies, F. H., on The Isolation of vibrational disturbances, 505
  Dugdale, J. W., on Tramways during war-time, 102
  Dye, D. W., and A. Campbell, on The magnetic testing of bars, 859
  Dykes, A. H., on Apprenticeship in the electrical contracting industry, 573
  Edwards, A. E. A., on The training of an engineer, 639
  Elkin, R. I., on Corrosion of steel smokestacks, 774
  Field, Prof. A. B., on Some difficulties of design of high-speed generators, 732, 764, 797, 841
  Gimingham, E. A., and S. R. Mullard, on A new high-efficiency incandescent lamp, 743
  Hale, W. B., on An underground telegraph cable installation in Puebla, Mexico, 708
  Hanson, D., and J. L. Haughton, on A thermostat for moderate and high temperatures, 489
  Haughton, J. L., and Hanson, D., on A thermostat for moderate and high temperatures, 489
  Hawes, A. L., on Control gear for electric lifts, 857
  Hawkins, L. A., and H. B. C. Allison, on Calorising: A protective treatment for metal, 158
  Hele-Shaw, H. S., Presidential address to the Engineering Section of the British Association, 332, 361
  Hollis, E. P., on The case for the electrification of cane sugar mills and refineries, 163, 195
  Hornor, H. A., on The electrical equipment of the Argentine battleship *Moreno*, 348, 380
  Horsnaill, W. O., on The electrical equipment of submarines, 3
  Howe, Prof. G. W. O., on The capacity of aerials of the umbrella type, 426
  Hunter, P. V., on Power station switchgear, 669
  Lacey, H. M., and C. H. Stubbings, on Transformer core loss as affected by triple harmonics, 424

AUTHORS—*continued.*
  Lees, S., on Direct-current motor maintenance, 836
  Lindquist, D., on The modern electric elevator, 486
  Lister, Lieut.-Col. J. F., Address to Birmingham Local Section of I.E.E., 582
  "Lux," on Half-watt lamps from the central station standpoint, 603
  Marchant, Prof. E. W., on A note on "Earth resistance," 415; on The relation of science to practice in engineering, 637
  Marks, John, on Over-specialisation, 172; on British business methods which must go, 807
  Marryat, H., on Electric lifts, 861
  Mawdesley, R. T., on The central power station of the Randfontein Estates, 80, 100, 154
  McKinnon, E. C., on Hints to Applicants for situations, 243
  McLachlan, N. W., on The heating of iron when magnetised at very high frequencies, 423
  Mills, E. C., on A gas-producer for steam boilers, 365
  Minton, J. P., on An investigation of dielectric losses with the cathode-ray tube, 91, 124
  Morgan, J. B., on Units from refuse, 196
  Mottram, C. F., on Trade conditions after the war, 543
  Mullard, S. R., and E. A. Gimingham, on A new high-efficiency incandescent lamp, 743
  Pausey, E. B., on Some wrinkles on the operation of alternators, 252
  Pearce, S. L., on Manchester electricity supply undertaking, 413
  Petavel, Profs. J. E., and G. Asakawa, on Thermal efficiency of a gas engine, 365
  Ram, G. Scott, on Electrical accidents in 1914, 690, 713, 747
  Randall, K. C., on Oil circuit-breakers: Notes on arc phenomena and tendencies in design, 317
  Randolph, C. P., on Sheathed-wire heating units, 37
  Rankin, R., on The installation and working of storage batteries, 638
  Raymond-Barker, E., on Alternating-current cable telegraphy, 250
  Riddle, W. G. L., on The electrical trade position in China, 556; on Electricity supply in China, 607
  Roles, T., on The practical result of the Point Five tariff, 132
  Rowell, H. B., on British industry after the war, 773
  Sand, Dr. H. J. S., on The Cadmium-vapour arc lamp 426
  Smith, Prof. C. A. M., on German engineers in China: A glance at their methods, 294
  Sparks, C. P., on Electricity supply,
  Squier, Lieut.-Col. G. O., on An unbroken alternating-current for cable telegraphy, 156, 187
  Starr, D. A., on The electrical industry and the war, 735
  Steylaers, R., on The scientific organisation of war material supplies in Germany and incidental—Robbery, 48
  Stubbings, C. H., and H. M. Lacey, on Transformer core loss as affected by triple harmonics, 424
  Thomsen, T. C., on The use and abuse of oils on mining plant, 284
  Thornton, Dr. W. M., on A new battery signalling bell, 215, 252
  Walker, Prof. Miles, on A self-adjusting commutating device, 414
  Watson, W. H. L., on Battery vehicles as an adjunct to tramways, 103
  Welbourn, B., on The production and properties of electrolytic copper, 647, 700
  Wile, F. W., on German business methods as I knew them, 667
  Wilkinson, G., on Electric heating, 828
  Willis, R. H., on Turbine pumps for colliery pumping, 316
  Wilson, Prof. E., on Exposure tests of light aluminium alloys, 426
  Windeler, G. E., on Cracked and seized pistons on Diesel engines, 70
  Wright, H. Hodgson, on The electrical industry and the war,

BALANCE, An electromagnetic vacuum, by Dr. J. S. Anderson, 267
Balance, The Hughes induction, 660
Battleships, Electric propulsion of, 755

BANKRUPTCY PROCEEDINGS—
  Boult, J., and Bolt, J. H., 43, 110, 174
  Broadbent, D. R., 74
  Burgess, G., 368
  Clark, J. P. K., 782
  Cobb, V. G., 110, 272, 368
  Dewhurst, J. W., 620, 653, 782
  Flather, T. A., 429, 653
  Gillespie, A. B., 429
  Godfrey, H. J., 494
  Hawdon, A. F., 272, 304, 335, 494, 527, 559, 653
  Hilton, J. G. M., 238
  Hipkins, G. E., 74, 717
  Page, H., 74, 140, 367, 559, 782, 845
  Parfitt, G. J. T. J., 335, 620, 782
  Pazolt, A. N., 620
  Pearson, C. H., 782
  Pease, W. H., 272
  Peddie, J. T., 368, 559
  Raphael, P. I., 814
  Rigg, T. H., 368
  Saville & Walton, 717
  Swainson, J., 588, 750
  Tattersall, J. W. & T. W., 11, 588, 845
  Thomson, L. A., 845
  Walker, W., 174
  West, H. A., 619
  Whiteley, A., 717
  Wright, H. G., 174

Batteries, Charging electric vehicle, 404
Batteries for Egypt, 83
Battery making, Poisoning in storage, 403
Battery vehicles as an adjunct to tramways, by W. H. L. Watson, 103
Battleship *Moreno*, The electrical equipment of the Argentine, by H. A. Hornor, 348, 380
Bell, A new battery signalling, by Dr. W. M. Thornton, 215, 252
Benevolent Institution, Electrical Trades, 287
Big concern can do, What a, 722
Birmingham, Electric dust vans, 15
Blowholes in castings by X-rays, Detection of, 603
Board of Trade inquiries, 437, 573, 588, 653, 686, 718, 750
Bottles for sampling transformer oil, Value of, 722
Brazil, 335, 429
Brazil, Trade statistics of, 164
Breach of a contract to supply machinery, Damages on, 459
British Association Committee on fuel economy, 532
British Association, The, 332, 340, 358, 361, 410, 422, 532, 723
British Association: Presidential address to the Engineering Section, by H. S. Hele-Shaw, F.R.S., 332, 361
British business methods which must go, by John Marks, 807
British co-operation in Russia, 834
British electrical and allied industries, 641
British Electrical and Allied Manufacturers' Association, 818
British Electrical and Allied Manufacturers' Association discussion on After the war, 827
British Electrical and Allied Manufacturers' Association annual dinner, 690
British engineering industry, Organising, 691, 707
British Industries Fair, 845
British industry, The war and, 577, 596
Budget and business, The, 404
Bullets, A simple radiographic method for localising, by L. Crouch, 155
Business methods as I knew them, German, by F. W. Wile, 667
Business methods which must go, British, by John Marks, 807

CABLE Makers' Syndicate, The German, 174, 774
Cable telegraphy and alternating-current, by E. Raymond Barker, 250
Cable telegraphy, On an unbroken alternating current for, by Lieut.-Col. G. O. Squier, 156, 187
Cables, Multicore, by "Commercial," 774

Cables, Notes on faults in, by E. P. Austin, 540
Cadmium-vapour arc-lamp, The, by Dr. H. J. S. Sand, 426
Calorising: A protective treatment for metal, by H. B. C. Allison and L. A. Hawkins, 158
Canada, Electric furnaces for, 437
Canada, Electrolytic alkali manufacture in, 838
Canada, Notes from, 8, 521, 745
Canadian water powers, 276
Car starting and lighting equipments in the States, 296
Case for the electrification of cane sugar mills and refineries, The, by E. P. Hollis, 163, 195
Cathode-rays in practice, 98
Cathode-ray tube, An investigation of dielectric losses with the, by J. P. Minton, 91, 124
Central station standpoint, Half-watt lamps from the, by "Lux," 603
Charging electric vehicle batteries, 404
Chicago, Milwaukee and St. Paul Railway, The electrification of the, 605
Chile, Import trade of, 271
China, 11, 74, 237, 429, 526
China: German engineers in, A glance at their methods, by Prof. C. A. M. Smith, 294
China, British trade in, 718
China, Electrical opportunities in, 50
China, Electrical standardisation in, 17
China, Electricity supply in, by W. G. L. Riddle, 607
China, German scheming in, 290
China, Import trade of, 640
China Light & Power Co., The new plant of the, 858
China, Machinery maintenance in, 341
China, Our trade in, 367, 494, 646
China, The electrical position in, 546
China, The electrical trade position in, by G. R. Archdeacon, 185; by W. G. L. Riddle, 556
Chinese market: Long credit, The, 304
Circuit-breakers: Notes on arc phenomena and tendencies in design, Oil, by K. C. Randall, 317

CITY NOTES—
Aberdeen Suburban Tramways Co., 279, 343
Adelaide Electric Supply Co., 248, 502, 790, 822
Aldershot Gas, Water & District Lighting Co., 148
Allen & Co., E., 23
Allgemeine Elektricitats Gesellschaft, 694, 725, 853
Amalgamated Wireless (Australia), 473
Amazon Telegraph Co., 634, 662
Anderston Foundry Co., 567
Anglo-American Telegraph Co., 89, 535
Anglo-Portuguese Telephone Co., 695
Auckland Electric Tramways Co., 601, 632
Automatic Telephone Manufacturing Co., Ltd., 758
Austrian Electrical Companies, 22, 118
Babcock & Wilcox, 473
Barbados Electric Supply Corporation, 534, 600
Belgian Buenos Aires Tramways, 634
Bell Telephone Co., of Canada, 56
Berlin Electricity Works, 662
Blackpool & Fleetwood Tramroad Co., 183
Blackpool, St. Annes and Lytham Tramways Co., 791, 822
Bombay Electric Supply & Tramways Co., 23, 52, 181, 823
Bordeaux Electric Tramways Co., 601
Bournemouth & Poole Electricity Supply Co., 148
Brazilian Traction, Light & Power, 148, 310, 535, 759
Brisbane Electric Tramways Investment Co., 567
Bristol Tramways & Carriage Co., 148
British Aluminium Co., 375
British Columbia Electric Railway Co., 182, 278, 823, 852
British Electric Traction Co., 20, 90, 117, 151, 632
British Electric Transformer Co., 343
British Ever-Ready Co., 632
British Insulated & Helsby Cables, 376
Brompton & Kensington Electricity Supply Corporation, 217
Buenos Aires Port & City Tramways Co., Ltd., 632
Bullers, 759
Burmah Electric Tramways & Lighting Co., 823, 855
Calcutta Electric Supply Corporation, 20, 343, 473, 633, 759
Calcutta Tramways Co., 535
Calgary Power Co., 148
Callender's Cable & Construction Co., 535
Callender's Share & Investment Trust, 695
Canadian General Electric Co., 344, 791
Cape Electric Tramways, 566, 633, 661
Cape Town Consolidated Tramways and Land Co., 89
Castner-Kellner Alkali Co., 663
Central London Railway Co., 148
Charing Cross, West End & City Electricity Supply Co., 184
Chelsea Electricity Supply Co., 217
Chili Telephone Co., 54, 116, 855
Chilian Electric Tramway & Light Co., 473

CITY NOTES—*continued.*
City & South London Railway Co., 148
City of Buenos Aires Tramways Co., 183, 601
City of London Electric Lighting Co., 183
City Supply Co., of Victoria, 310
Cleveland Trust, 633
Clyde Valley Electrical Power Co., 343
Companies struck off the register, 119, 503, 759, 822
Consolidated Electrical Co., 54
Cordoba Light, Power & Traction Co., 758, 821
Costa Rica Electric Light & Traction Co., 790, 855
County of Dorset Electric Supply Co., 181, 247
County of Durham Electrical Power Distribution Co., 442, 663
County of London Electric Supply Co., 148
Crompton & Co., 22, 53
Crossley Bros., 279
Cuba Submarine Telegraph Co., 504
Cuban Telephone Co., 535
Davey, Paxman & Co., 55
Davis & Timmins, 312
Delabole Electric Light Co., 567, 602
Dick, Kerr & Co., 502, 566
Direct Spanish Telegraph Co., 374
Direct United States Cable Co., 89, 473
Direct West India Cable Co., 376, 407
Drake & Gorham, 601, 662
Dublin United Tramways Co., 89
Dumbarton Burgh & County Tramway Co., 312
Dumbarton Tramways Co., 343, 375
Dundee, Broughty Ferry & District Tramways Co., 375, 440
Eastern Extension, Australasia and China Telegraph Co., 343, 759
Eastern Telegraph Co., 408, 791
Edison & Swan U.E.L. Co., Ltd., 632, 694
Edmundsons Electricity Corporation, 21, 88
Electric & General Investment Co., 119, 148
Electric Construction Co., 695
Electric Light & Power Supply Corporation (Sydney), 86
Electric Supply Corporation, 181
Electrical & Industrial Investment Co., 54
Electrical Securities Trust, 759
Electro-Bleach & By-Products, 248, 376
Empire District Electric Co., 568
Fairbairn Lawson Combe Barbour, 312
Ferranti, 535, 600
Fraser & Chalmers, 89, 599
French electrical companies, 22, 216, 758
Fuller Accumulator Co., 823
General Electric Co., 54, 86
German electrical companies, 53, 118, 342, 441, 502, 726, 791, 854
Globe Telegraph & Trust Co., 407, 442
Halifax & Bermudas Cable Co., 375, 407
Harris, J. F. & G., 184
Henley's Telegraph Works Co., W. T., 248
Holophane Co., 375, 599
Hornsby & Sons, R., 695
Huelva Gas & Electricity Co., 567
Humphrey Pump Co., 855
Hurst, Nelson & Co., 504
Hydro-Electric Power & Metallurgical Co. (Tasmania), 632
Indian Electric Supply & Traction Co., 504
India-Rubber, Gutta-Percha & Telegraph Works, 790, 853
Indo-European Telegraph Co., 504
International Light & Power Co., 375, 663, 726, 792
Isle of Thanet Electric Tramways and Lighting Co., 821
Italian electrical companies, 535, 727
Italian Westinghouse Co., The, 120
Kalgoorlie Electric Power & Lighting Corporation, 442
Kalgoorlie Electric Tramways, 118
Kaministiquia Power Co., 24, 567
Kensington & Knightsbridge Electric Lighting Co., 183
Lanarkshire Tramways Co., 118
Lancashire Dynamo & Motor Co., 442
Lisbon Electric Tramways, 567
Liverpool District Lighting Co., 343, 376
Liverpool Overhead Railway Co., 120
London & N.-W. Railway Co., 217
London & Suburban Traction Co., 183
London Electric Railway Co., 148
Lower Thames Land & Power Co., 440
Mackay Companies, 312, 727
Madras Electric Supply Corporation, 23
Madras Electric Tramways (1904), 442
Manaos Tramways & Light Co., 279, 310
Manila Electric Railroad & Lighting Corporation, 374
Manx Electric Railway Co., 759, 820
Marconi International Marine Communication Co., 21, 87, 791
Marconi's Wireless Telegraph Co., 117, 149, 246, 791, 822
Marconi's Wireless Telegraph Co. of Canada, 822
Mather & Platt, 246

CITY NOTES—*continued.*
Melbourne Electric Supply Co., 248, 790, 852
Metallic Seamless Tube Co., 632
Metropolitan District Railway Co., 148
Metropolitan Electric Supply Co., 183
Metropolitan Railway Co., 148
Mexican Tramways, Light & Power Companies, 695
Monterey Railway, Light & Power Co., 632
Montevideo Telephone Co., 534, 599
Montreal Light, Heat & Power Co., 535
Montreal Tramways Co., 279
Municipal Tramways Trust of Adelaide, 823
Nairobi Electric Power & Lighting Co., 374
National Electric Construction Co., 21
National Gas Engine Co., 148
National Telewriter Co., 599
Newcastle-upon-Tyne Electric Supply Co., 54, 758
New issues, 119, 504
New St. Helens & District Tramways Co., 567
Northampton Electric Light & Power Co., 217
Northern Ontario Light & Power Co., 148
North Melbourne Electric Tramways and Lighting Co., 19
Norwegian Hydro-Electric Works, 727
Norwich Electric Tramways Co., 601
Oerlikon Machinery Works, 789
Official notices *re* companies, 19, 183, 246, 503
Oldham, Ashton & Hyde Electric Tramways Co., 217
Oriental Telephone & Electric Co., 23, 503
Oxford Electric Co., 312
Pacific Gas & Electric Co., 218
Para Electric Railways & Lighting Co., 183
Parsons Marine Steam Turbine Co., 567
Petrograd Electric Lighting Co. of 1886, The, 440, 663
Portarlington Electric Light & Power Co., 759
Power Gas Corporation, 695, 759
Provincial Tramways Co., 695
Puebla Tramway, Light & Power Co., 55, 217
Quebec Railway, Light, Heat and Power Co., 501
Rangoon Electric Tramway & Supply Co., 19
Reduction of capital, 535, 601, 663
Rosario (Argentina) Electricity Co, 148
Roumanian A.E.G., 148
Russian (1886) Co., The, 555
Russian electrical companies, 54, 182, 408, 440, 442, 758, 823
Russian joint stock companies, 148
Russian Rubber & Telegraph Co., The, 120
Ruston, Proctor & Co., 695
Ruthin Electric Supply Co., 791
Ryland's Electro-Plating Co., 280
St. James' & Pall Mall Electric Light Co., 56
Sao Paulo Tramway, Light & Power Co., 118, 473
Shawinigan Water & Power Co., 407
Sheerness & District Electric Power and Traction Co., 20
Shropshire, Worcestershire, & Staffordshire Electric Power Co., 601
Siemens and Schuckert Group of Companies, 854
Singapore Electric Tramways, 87
South American Light & Power Co., 55
South Metropolitan Electric Light and Power Co., 217, 312, 374, 568, 601
Southern Brazil Electric Co., 663, 694
Southern Electric Tramways (Buenos Ayres), 374
Standard Waygood Hercules (Australia), 89
Stewarts & Lloyds, 279
Stock Exchange notices, 23, 184, 376
Stone & Co., J., 89
Swiss Brown, Boveri Co., The, 473
Swiss Escher, Wyss & Co., 562
Telegraph Construction & Maintenance Co., 54
Telephone Development Co., 217
Trafford Park Estates, 568
Tucuman Tramways, Light & Power Co., 474
Tyneside Electrical Developments Co., 248
Tyneside Tramways & Tramroad Co., 216
Underground Electric Railways Co., of London, 152
United Electric Car Co., 343, 407
United Electric Tramways of Caracas, 633
United River Plate Telephone Co., 504
Venezuela Telephone & Electrical Appliances Co., 791
Vickers, 183
Victoria Falls & Transvaal Power Co., 216, 278, 695, 822
Waste Heat & Gas Electrical Generating Stations, 248
Waygood-Otis, 56
West India & Panama Telegraph Co., 567, 601, 661
Western Telegraph Co., 599, 601, 661, 759
Western Union Telegraph Co., 120, 217
Westinghouse Brake Co., 567

CITY NOTES—*continued.*
Westminster Electric Supply Corporation, 183
White, J. G., & Co., 22, 791
Winnipeg Electric Railway Co., 442
Yates & Thom, 567
Yorkshire Electric Power Co., 182
Yorkshire (West Riding) Electric Tramways Co., 791
"Z" Electric Lamp Manufacturing Co., 633

Coal and the use of electricity in mines, Output of, 538
Coal mining, 289
Coal prices, 323
Coal supplies, 114
Coal supplies, Electricity supply works and, 738
Coinage and the metric system, Decimal, 481, 485, 516, 570, 580, 735, 649, 644, 698, 771, 834
Coke as a boiler fuel, 838
Colliery pumping, Turbine pumps for, by R. H. Willis, 316
Combustion engines, Convertible, by A. E. L. Chorlton, 328
Commercial electrical association, A, 674
Commutating device, A self-adjusting, by Prof. Miles Walker, 414
Companies in war-time: European electrical, 609
Compressed air explosions, 691
Condenser auxiliaries, Energy consumption in, 508
Congress, 1915, The Tramways and Light Railways Association, 102
Consular notes, 10, 109, 237, 428, 526, 587
Consular reports: Ought we to grumble, 419
Consular service again, The, 323
Consumer, Increasing the cost to the, 569
Consumption in condenser auxiliaries, Energy, 508
Contract to supply machinery, Damages on breach of a, 459
Contract, The suspension of a, 178
Contracting industry, Apprenticeship in the electrical, by A. H. Dykes, 573

CONTRACTS CLOSED—
Aberdeen, 46
Aberdeen line, 786
Aldershot, 211, 849
Argentina, 498
Ashton-under-Lyne, 112
Australia, 78, 112, 177, 212, 275, 307, 338, 372, 403, 469, 498, 563, 596, 721, 786, 849
Aylesbury, 372, 436, 656
Barnsley, 112, 436
Barrow, 144, 469
Batley, 46
Battersea, 144, 564
Bedford, 78, 689
Beleek, 436
Belfast, 307
Bethnal Green, 113, 372, 436
Bexhill-on-Sea, 403
Blackpool, 275
Bolton, 15
Bootle, 436
Bradford, 78, 498
Brentford, 17
Brighton, 15, 818
Bristol, 144, 307, 436, 627, 818
Broadstairs, 656
Bundoran (Co. Donegal), 177
Burnley, 469
Bury, 46, 403
Buxton, 436
Cape Town, 530, 531
Chester, 177
Chesterfield, 113
Chorley, 563
Coatbridge, 307
Colchester, 78, 530
Coniston, 144
Coventry, 307
Dartford, 212, 339, 498, 754
Derby, 46, 469
Doncaster, 113
Dover, 78
Dublin, 563
Eccles, 46, 78
Edinburgh, 498, 689
Elland, 627
Erith, 177, 469
France, 275
Fulham, 78
Gillingham (Kent), 78, 786
Glamorgan, 469
Glasgow, 144, 212, 275, 339, 470, 530, 627, 656, 689, 786, 818
Glass Houghton, 627
Government contracts, 113, 241, 403, 530, 689, 818
Grangemouth, 78
Great Northern Railway, 78
Great Yarmouth, 403, 656
Grimsby, 754
Halifax, 470
Hammersmith, 436, 564
Hampshire, 212, 596
Haslingden, 436
Hebden Bridge, 46
Hereford, 498
Heywood, 113, 241
Holmfirth, 177, 530
Holyhead, 144
Holywell, 275
Horsham, 307
Hull, 15, 213
Ilford, 849
Keighley, 78, 470
Kendal, 46
Kingston-on Thames, 178

CONTRACTS CLOSED—*continued.*
Ledbury, 113
Leeds, 78
Leek, 78
Leith, 144
Liverpool, 47, 339
London, 15, 47, 78, 113, 144, 275, 372, 403, 436, 498, 530, 563, 627, 657, 690, 786, 818
London County Council, 47, 78, 113, 144, 498, 530, 563, 627, 657, 786, 818
Lowestoft, 403
Luton, 15, 818
Maidenhead, 47
Malvern, 531
Manchester, 47, 178, 470, 564, 627, 721
Margate, 531
Menston, 178
Merthyr Tydfil, 113
Metropolitan Water Board, 657
Middleton, 339, 754
Mirfield, 78
Morley, 786
Muizenberg (Cape Province), 531
Napier (N.Z.), 307
New Zealand, 47, 275, 307, 564, 657, 818
Newport (Mon.), 531, 786
Nuneaton, 15, 144, 786
Oldham, 15, 113
Oswaldtwistle, 144
Peterborough, 78
Plymouth, 113, 564
Ramsbottom, 531
Rawtenstall, 564
Reading, 212
Reigate, 307
Rochford (Essex), 144
Rotherham, 78, 178, 212, 498
Rugby, 15
Ryde, 849
St. Marylebone, 95
St. Pancras, 15, 372, 690
Salford, 47, 78, 178, 212, 307, 339, 470, 564, 721
Sheffield, 78, 212, 403, 754
Southampton, 15, 47, 178, 499, 754
Spain, 818
Spenborough, 47
Stepney, 437, 627
Stirling, 275
Stockport, 78, 339, 754
Stratford-on-Avon, 531
Stretford, 372, 627
Sunderland, 113, 241, 372, 531, 657
Sydney, 78, 498
Tasmania, 113, 498, 721
Taunton, 564
Torquay, 499, 786
Tynemouth, 531
Venezuela, 818
Walsall, 372, 638
Walthamstow, 690
Watford, 15, 47, 178, 499, 628
Wellington (N.Z.), 47, 657
West Bromwich, 47, 531, 628
Weymouth, 372, 628, 754
Wigan, 212
Willesden, 178
Wimbledon, 78, 596
Winchester, 47
Wolverhampton, 78, 437, 499, 786
Woodford, 178
Woolwich, 178, 499
Worcester, 144, 531, 786

CONTRACTS OPEN—
Aberdare, 307
Aberdeen, 595, 627, 656
Adelaide, 14, 46, 78, 112, 143, 177, 211, 240, 274, 307, 627, 656, 689, 721, 753, 786, 817, 848
Aldershot, 689
Athy, 627, 656, 689, 721
Australia, 14, 46, 78, 112, 143, 177, 211, 240, 274, 307, 338, 371, 402, 436, 469, 498, 530, 563, 595, 627, 656, 689, 721, 753, 786, 817, 848
Aylesbury, 112, 240
Barking, 14, 46, 78
Barrow-in-Furness, 595
Beaufort West (Cape), 46, 78, 112
Beckenham, 721, 753
Birkenhead, 469, 785
Birmingham, 307
Blackpool, 177
Bootle, 469
Bow, 307, 338, 371
Bradford, 112, 530, 562, 596, 627
Brighton, 753
Brisbane, 240, 274, 307, 469, 627, 656, 689, 721, 753, 786, 817, 848
Bristol, 112, 144, 177, 211, 240, 338, 371, 847
Burnley, 338, 371
Canada, 627, 656
Cape Town, 530, 562
Castletown-Bere, 338
Chatham, 596, 627, 656
Darlington, 144, 469, 498, 818, 848
Dublin, 14, 46, 78, 112, 498, 530, 563, 596, 627
Dundee, 371, 402, 498, 689
Dunedin, 275, 307, 338, 371, 402, 436, 530, 563
Durham, 721
Earby, 177, 211
Eccles, 46
Edinburgh, 14, 46, 78, 307, 338, 371
Enniskillen, 596, 627, 656, 689
Erith, 14, 46, 78
Exeter, 402
France, 275
Glasgow, 177, 530
Goulburn (N.S.W.), 498, 595, 627, 656
Greystones (Co. Wicklow), 436, 469, 498
Grimsby, 530, 563
Guildford, 112

CONTRACTS OPEN—*continued.*
Halifax, 371, 436
Hammersmith, 436, 469, 530
Hampstead, 818, 848
Hawthorn (Vic.), 211, 240, 275, 307, 338
Hawthorn, 211, 240, 275, 307, 338
Hull, 46, 78
Ilford, 656
Islington, 307, 847
Japan, 627
Johannesburg, 144, 177, 211, 240, 275, 307, 338, 371, 403
Keighley, 402
Kensington, 338, 371
Kingston-upon-Hull, 14, 46
Kirkcaldy, 275, 307
Lanark, 530, 563
Launceston, 15
Leeds, 498
Leith, 112
Littleborough, 436, 469, 498
Liverpool, 371, 402, 818
London, 112, 177, 211, 240, 307, 338, 371, 402, 436, 530, 563, 596, 689, 721, 753, 818, 848
London County Council, 112, 240, 402, 436
Manchester, 14, 307, 371, 402, 530, 563, 596, 627, 656, 721, 818, 848
Melbourne, 14, 46, 78, 144, 177, 211, 240, 275, 402, 436, 469, 498, 530, 563, 595, 627, 656, 689, 721, 753
Merthyr Tydfil, 371
Middleton, 112, 144, 177
Morecambe, 14, 46, 78, 112
Napier (N.Z.), 596
Natal, 689, 818
New Zealand, 144, 240, 275, 307, 338, 371, 402, 436, 469, 498, 530, 563, 596, 721, 848
Newport (Mon.), 338
Newton-in-Makerfield, 848
Nuneaton, 753, 786, 818
Nottingham, 211
Office of Works, H.M., 371, 402, 436, 721
Paris, 275
Perth (W. Australia), 14, 46, 78, 112, 144, 177, 211, 240, 274, 469, 498, 530, 563, 595, 627, 656
Pontardawe, 177
Portsmouth, 78, 240, 275
Rangoon, 14
Redditch, 753, 786, 818
Reigate, 307, 338, 753
Rochdale, 14, 240, 563, 627
Rotherham, 78, 112
St. Helens, 563, 596, 627
St. Pancras, 818, 848
Salford, 46, 112, 177, 403, 436, 498, 627, 656, 786
Shanghai, 240, 275, 307, 338, 371, 403
Sheffield, 78, 112, 144
South Africa, 14, 46, 78, 112, 144, 177, 211, 240, 275, 307, 338, 371, 403, 627, 689, 721, 753, 786, 818, 848
Spain, 46, 211, 275, 307, 371, 403, 469, 498, 530, 563, 596, 689, 721, 753, 786, 818, 848
Stanley, 338
Swindon, 307, 338, 372
Sydney, 78, 112, 144, 177, 211, 240, 274, 307, 402, 436, 469, 498, 530, 563, 595, 627, 656, 689, 721, 753, 786, 817, 848
Tasmania, 15
Taunton, 275
Trowbridge, 15
Upper Loughnor, 627
Victorian Railways, 371, 402, 498
Wakefield, 338, 627
Walsall, 15
Walthamstow, 721, 754
Warrington, 15, 338, 372, 403, 596, 627
Watford, 498
Wellington (N.Z.), 144, 721
West Bromwich, 15
West Ham, 241, 275, 721, 753
Whittingham, 372
Wigan, 177
Wolverhampton, 372
York, 275, 498, 530

Control apparatus for steel mill, Auxiliary rolls, 7
Control gear for A.C. motors, E.A.C. drum type, 131
Control gear for electric lifts, by A. L. Hawes, 857
Controlled establishments, 755
Convention at San Francisco, Electrical, 49
Convertible combustion engines, by A. E. L. Chorlton, 328
Cooking and heating, Electric, 385, 783
Cooking in American apartment houses, Electric, 723
Cooking installation, Electric, 783
Cooking problem: An American experiment, The electric, 199
Co-operation between engineers and contractors, 355
Co-operative electric vehicle garage, New York's, 4
Copper, 3, 49, 98, 194, 245, 291, 341, 386, 482, 579, 643, 675, 770
Copper, Germany's reserve of, 114
Copper in German electricity works, The, 418
Copper in Germany, Electrolytic, 204, 564
Copper production, Russian, 17

CORRESPONDENCE—
Advertising, by "River Plate," 331

CORRESPONDENCE—*continued.*
A.E.G. meeting, The, by "Inquisition," 365, 455, 618, 811; "Impatient," 428; "Unitas," 428; "No Furtiveness," 428; E. Brook, Ltd., 455; "Union Jack," 511, 652, 811; "E," 521; "British Electrician," 522; E. P. Allam and Co., 522, 585, 652, 767; "Anti-Humbug," 558, 652, 778; "Tariff," 585; Wilson-Wolf Engineering Co., 585; H. Marryat, 618, 711; "Vigilant," 652; L. G. Tate, 712, 778; T. B. Wright, 712
American trade, by E. W. Stevenson, 105, 330
Automatic electric cooker, An, by F. W. Fisher, 396
Automatic lift accidents, by H. E. Lintott, 330
"Autres temps, autres moeurs," by "P.R.," 136
Branch offices, by "Erimus," 137; by "R.M.M.," 170
British Electrical & Allied Manufacturers' Association and foreign firms, by C. W. Crosbie, 617
British manufacturers criticised, by "Æquo Animo," 557
Church lighting, by "Lux," 366; by J. H. Oxley, 397
Colonial advice to our advertisers, by B. Sankey, 10
Consular service again, by "Viator," 776
Contractor's complaint, A, by "J.S.L.," 619; by A. W. Kimber, 681; by J. Denver, 766
Dardanelles, From the, by "M.Inst. M.S.," 269
Decimal coinage and the metric system, by W. Sisson & Co., 585; by "Aurora Borealis," 618; by E. Merry, 652, 680; by J. A. Merrett, 680; by C. H. Elliott, 680; by H. M. Sayers, 680; by C. Turnbull, 777; by H. Planchon, 777
Economising on audits, by Urban Electricity Supply Co., 653
Edinburgh extension, The, by "W.H.B.," 521
Electric heating, by "Wholesale Supplier," 559
Electric power in India, by "Accuracy," 104; "British Representative," 105; "A Ditcher," 105; by Speyer & Co., 365
Electric signalling in mines, by J. D. Morgan, 136
Electrically heated soldiers, by R. Falshaw, 681
Electrolytic copper, by T. Bolton, 811
Extraction of oil from feed water," by "Cloth," 295
Finchley breakdown, by "Consumer," 778
"For those in peril on the sea," by Lord Radstock, 330
Gas *v.* electricity, by W. El-les, 73
Hammond, The late Mr. R., by Harry South, 236
Increased charges and special contracts, by "Inquirer," 366
Institution and alien enemy members, The, by "Station Engineer," 511, 558, 680, 767, 810; "A.M.I.E.E.," 559, 681, 778; J. E. Gray, 585; "A Member," 585; "M.Insts.C. & E.E.," 585; "Another Station Engineer," 619, 681, 810; W. Ellerd-Styles, 712; C. A. Baker, 843
Lifting magnet, An improvised, by P. H. Browne, 558
Lighting developments, by Wm. A. A. Burgess, 366
Limitation of price Coal Bill, by R. Marshall, 199
London electrical trades arbitration, by W. Ellerd-Styles, 296
Noisy motor generator, A, by "Troubled," 618; D. D. Rayner, 653
Pitting of generator brushes, by H. Fowler, 10
Pocket dry batteries, by "Dry Battery Manufacturer," 73; H. Berry, 396; R. Porrill, 427
Railway carriage problem, The, by H. L. Dobson, 10
Receipt forms on cheques, by "Accountant," 455
Reserve Officers' Training Corps, by "Station Engineer," 42
Russia, Trade with, by Russian Society for Electrical Enterprises, Ltd., 618
Russian market, To investigate the, by W. H. Beable, 811
Ruhleben, More news from, by W. E. Swale, 776
Selling organisation in the electrical industry after the war, by R. Steylaers, 331
Shop window lighting, by F. Willcox, 137
Shortage of labour, by "London Lad," 105
Signalling bell, New battery, by A. H. Marsh, 296
South Africa, An invitation from, by J. H. Alex. Brown, 618
Staff engineers and Labour Exchanges, by "Alcor," 236; "Staff," 268; "Salary," 269
Swiss or German, by "A.M.H.," 712; by J. D. Colvin, 767
Telegraph and telephone tariffs, by "Economy and Efficiency," 427

CORRESPONDENCE—*continued.*
Trade entente after the war: The other side of the question, by "Commercial," 331
Trade with Russia and the metric system, by J. A. Merrett, 679
Transformer query, A, by "M.M.," 455
Tungsten Lamp Association, The, by The Secretary, T.L.A., 681
Units from refuse, by A. J. Abrahams, 236, 295; J. B. Morgan, 269
Who will assist? by H. Scholey, 681, 788
Wrinkles on the operation of alternators, by "Switchman," 295; E. P. Pausey, 366

Corrosion of steel smokestacks, by R. I. Elkin, 774
Cost to the consumer, Increasing the, 569
Costs, Overhead, 144
Cracked and seized pistons on Diesel engines, by G. E. Windeler, 70
Cranes, Electric shipping, 691
Cuba, 10

DECIMAL coinage and the metric system, 481, 485, 516, 570, 580, 635, 643, 644, 698, 771, 834, 864
Deeds of assignment, 204
Development, The trend of electrical, 292, 345
Dielectric losses with the cathode-ray tube, An investigation of, by J. P. Minton, 91, 124
Diesel engine, New, 483
Diesel engines, Cracked and seized pistons on, by G. E. Windeler, 70
Diesel engines, Lubrication of, 557
Direct-current 5,000-volt railway operation, 722
Direct-current motor maintenance, by S. Lees, 836
Disaster in U.S.A., 146
Disinfectant, Electrolytic, 51
Dissolutions, 42, 110, 238, 272, 304, 400, 461, 526, 718, 783, 814
Distance at sea, Estimating, 723
Dockyard overtime, 531
Domestic electric heating, 801
Doors for furnaces, Chain screen, 849
Double audion receiver for continuous waves, The, 347
Dredge, A steam-electric, 50
Dublin electrical workers, 787, 824
Dublin electricians, Strike of, 373, 721
Dumbreck, Glasgow, Electrical houses at, 268
Dust vans: Birmingham electric, 15

E.A.C. drum type control gear for A.C. motors, 131
"Earth resistance," A note on, by Prof. E. W. Marchant, 415
Economic problems after the war, by W. Cunningham, 413
Economic problems suggested by the war, 513
Economics and the war, 359
Economy, Fuel, 515
Edison celebration, An, 709
Edison electric vehicle, New 7-cwt., 500
Educational, 17, 50, 115, 145, 178, 214, 276, 308, 339, 372, 438, 756, 804
Efficiency of a gas engine, Thermal, by Professors G. Asakawa and J. E. Petavel, 365
Egypt, Batteries for, 83
Egypt, British electrical trade with, by "Anglo-Egyptian," 283
Egypt, 1914, Trade statistics of, 299
Electric Construction Co.'s Horticultural Show, 273
Electric driving of sawmills, The, 57
Electric elevator, The modern, by D. Lindquist, 486
Electric light, The, 113
Electric motor vehicles, Encouraging the use of, 313
Electric remote indicators for rifle ranges, 326
Electric shipping cranes, 691
Electric Vehicle Association of America, The, 213, 458
Electric vehicle companies amalgamation, 146
Electric Vehicle Committee, The, 511, 721, 819
Electric vehicle progress, 260
Electric vehicle run, A 500-mile, 499
Electric vehicles in laundry service, 377
Electrical accidents in 1914, Mr. G. R. Scott Ram's report, 690, 713, 747
Electrical Contractors' Association of Scotland, 84
Electrical development in Germany after the war, 775
Electrical equipment of submarines, The, by W. O. Horsnaill, 3
Electrical industry in the United States, The, by "Contango," 483
Electrical properties of pure silicon iron, The magnetic, 705
Electrical trade position in China, The, by G. R. Archdeacon, 185, 556
Electrical Trades' Benevolent Institution, 287
Electrically-driven mill, An, 29
Electricians and instrument repairers wanted, 754
Electricity and the munitions output, 545
Electricity at Stowmarket, The supply of, 433
Electricity in agriculture, Its national aspects, 729

Electricity in mines, Output of coal and the use of, 538
Electricity in submarine mining, 454
Electricity in wool, 564
Electricity on the South African railway system, 405
Electricity outclassed, 34
Electricity supply in China, by W. G. L. Riddle, 607
Electricity supply, The selling side of, 228, 348
Electricity tax, Russia's proposed, 723
Electricity works apprenticeship scheme, 470
Electricity works, Ilkley, 262
Electricity works, Shanghai, 591, 624, 665
Electricity works statistics, Russian, 701
Electrification of cane sugar mills and refineries, The case for the, by E. P. Hollis, 163, 195
Electrification of the Chicago, Milwaukee and St. Paul Railway, The, 605
Electrification, L. & S.-W. Railway, 390, 431, 449, 548
Electrochemical industry, The Russian, 303, 470
Electrochemistry as a day load, 691
Electro-Harmonic Society, 437, 500
Electrolysis, Extraordinary, 819
Electrolysis, Removing iron scale by, 850
Electrolytic alkali manufacture in Canada, 838
Electrolytic disinfectant, 51
Electro-magnetic vacuum balance, An, by Dr. J. S. Anderson, 267
Electrometallurgical alloys, 170
Electro-metallurgy and French connections, Swiss, 404
Electrometallurgy of zinc, The, 404
Elevator, The modern electric, by D. Lindquist, 486
Employment in the electrical industry, Enlisting and, 628
Enemy debts notice, 717
"Enemy" goods passing as "neutral," 322
Enemy manufactures prohibited, 2
Enemy, Trading with, 813
Energy consumption in condenser auxiliaries, 508
Engine starters, Electric, 691
Engineering and other societies: The 1915-16 session, 484
Engineering Congress at San Francisco, 15
Engineering industry, Organising British, 691, 707
Engineering Standards Committee, 145
Engineers, Earnings of, 788
Engineers for the Artists' Rifles O.T.C., 788
Engineers, The Navy's need for skilled, 565
Engineers wanted, 242
Enlisting and employment in the electrical industry, 628
European electrical companies in war-time, 609, 616
Excess profits tax, 596
Excessive freight rates, 673
Exhibition, New Zealand, 717
Exhibition, New York electrical, 372
Exhibition, Panama-Pacific, 271
Explosions, Compressed air, 691
Export trade, America and, 327, 660
Export trade, The future of, 219
Exports and imports of electrical goods during June, 1915, 121; July, 249; August, 409; September, 537; October, 697; November, 825
Exports of electrical goods, American, 475, 718
Exports, Preferential rates for, by F. Broadbent, 444
Exports, Swedish electrical, 294
Extensions at Stepney, Electricity, 552

FACTORIES and workshops, The lighting of, 340, 355, 356
Fair, British Industries, 845
Fatalities, 16, 51, 145, 179, 214, 245, 277, 308, 339, 470, 532, 597, 629, 724, 756, 788, 819, 850
Fatigue, Industrial, 423
Faults in cables, Notes on, by E. P. Austin, 540
Federated Malay States, 313
Ferry, An electric, 346
Fibrox, 114
Field telephones, 213
Field telephones, by C. R. Darling, 377
Finance, War credit and, 412
Fire at American works, 664
Fire caution, 754
Fire, South African power station, 531
Fires, 32, 179, 389, 588, 718, 783, 845
Fires due to air raids, 373
Fittings on leasehold premises, Electrical, 842
Fixation of nitrogen, The, 691
Foreign and Colonial tariffs on electrical goods, 127, 159, 255, 320, 383, 479, 608, 832
Foreign trade, 83, 213, 339, 499, 629, 756
France, 10, 109, 238, 620
France, Wiring methods in, 437
Frequency measurements, Stroboscopic, 186
Freight rates, Excessive, 673
French electrical industry, 863
Fuel, Coke as a boiler, 839
Fuel consumption, The control of, by Prof. W. A. Bone, 415
Fuel economy, 515
Fuel economy, British Association Committee on 532
Fuel problems, German, 257

Furnaces, Chain screen doors for, 849
Furnaces, Electric heating and electric, 630, 692, 724, 754, 818
Furnaces for Canada, Electric, 437
Furnaces, New electric steel, 451
Furnaces, Two American electric, 233
Future of the electrical industry, War and the, 35

GARAGE, New York's co-operative electric vehicle, 4
Gas engine, Thermal efficiency of a, by Profs. G. Asakawa and J. E. Petavel, 365
Gas-filled lamp in photography, The, 95
Gas for generating electricity, Sewer, 114
Gas-producer for steam boilers, A, by E. C. Mills, 365
Gas turbine, The, 755
Gaseous explosions, Committee on, 426
Gear-driven D.C. turbo-generator set, 165
General Electric Co., of New York, The research laboratory of the, 518
Generating stations, Air raids and, 98
German business methods as I knew them, by F. W. Wile,
German Cable Makers' Syndicate, The, 174, 774
German confidence in the future, 813
German electricity works, The copper in, 418
German espionage, 258
German fuel problems, 257
German engineers in China: A glance at their methods, by Prof. C. A. M. Smith, 294
German influence, Russia and, 387
German interests in British companies, 692
German scheming in China, 290
German stocktaking of electrical machinery, 547
German, Swiss or, 675
German trade, 471
German trust, A, 718
Germany after the war, Electrical development in, 775
German yoke, Italian engineers and the, 706
Germany and wireless world service, 1
Germany, Electric steel in, 607
Germany, Electrolytic copper in, 204, 564
Germany, Nationalisation of electricity supply in, 771
Germany, The monopoly question in, 835
Germany's reserve of copper, 114
Girl electrician, A, 596
Government and inventions, The, 658
Greece, 428, 587
Greely and his patent insulator, Lieut., 214
Gretna railway disaster, 434
"Guard wires," Electric, 850

HALF-WATT lamps from the central station standpoint, by "Lux," 603
Hammond & Son, Messrs. R., 245
Hammond, R., The late, 207
Harmonics in oscillograms, 804
Harmony, Industrial, 360, 411
Heated soldiers, Electrically, 658
Heating, Domestic electric, 801
Heating and electric furnaces, Electric, 630, 692, 724, 754, 818
Heating, Electric cooking and, 385
Heating houses by electricity in Sweden, 729
Heating of iron when magnetised at very high frequencies, The, by N. W. McLachlan, 423
Heating units, Sheathed-wire, by C. P. Randolph, 37
Heating water electrically, Efficiency considerations in, 397
Heavy tonnage electric service on the Norfolk and Western Railway, U.S.A., 134
Hefner lamp, Corrections for, 723
High-frequency alternators, Progress in, 314
High-tension transmission line, Four years' operating experience on a, 189
Hints to applicants for situations, by E. C. McKinnon, 243
Hospital fund, King Albert's civilian, 219
House of Lords, After the war, Discussion in, 826
Houses at Dumbreck, Glasgow, Electrical, 268
Hughes induction balance, The, 660
Hydro-electric scheme, a New Zealand, 772

IDEAL light source, The, 160
Ideal transmitter, The, 569
Ignition magnetos, 145, 509, 541
Ilkley electricity works, 262
Import trade of Chile, 271
Imports and exports of electrical goods during June, 1915, 121; July, 249; August, 409; September, 537; October, 697; November, 825
Imports during the war, Electrical, 35, 39
Imports, South African electrical, 560

Incorporated Municipal Electrical Association: Annual report and reports of the Development Committee and Electrical Vehicle Committee, 58
Increasing the cost to the consumer, 569
India, Trade statistics of, 381
Indian notes, 114, 159, 736
Indian trade, 179
Indicating instruments, A machine for scale-marking of, 387
Indicators for rifle ranges, Electric remote, 326
Industrial fatigue, 423
Industrial harmony, 360, 411
Industrial research, Scientific and, 146
Industries, British electrical and allied, 641
Industry, A new British (dry batteries), 57
Industry and the war, German, 225
Industry, The French electrical, 863
Industry, The war and British, 577, 596
Industry, War and the future of the electrical, 35
Inquiries, 50, 84, 245, 277, 406, 437, 471, 500, 533, 564, 691, 756, 819
Inquiries from Lyons for British accessories, 527

INSTITUTION AND LECTURE NOTES—
  Association of Mining Electrical Engineers, 726, 850
  Association of Mining Electrical Engineers (West of Scotland Branch), 437, 500, 756
  Association of Supervising Electricians, 405
  British Association, 214
  British Science Guild, 405
  Canadian Electrical Association, 145
  Diesel Engine Users' Association, 17, 144, 724, 849
  Electrical Association of Australia, 500, 819, 850
  Faraday Society, 659, 724
  Illuminating Engineering Society (U.S.A.), 84
  Institute of Marine Engineers, 340
  Institute of Metals, 214, 659
  Institution of Civil Engineers, 787
  Institution of Civil Engineers of Ireland, 630
  Institution of Electrical Engineers, 470, 597, 691, 756
  Institution of Electrical Engineers (Students' Section), 724
  Institution of Electrical Engineers (Western Local Section), 532, 787
  Institution of Electrical Engineers (Yorkshire Local Section), 532, 630
  Institution of Electrical Engineers (Scottish Local Section), 532
  Institution of Electrical Engineers (Birmingham Local Section), 532
  Institution of Electrical Engineers (Newcastle Local Section), 564, 630
  Institution of Electrical Engineers (Manchester Local Section), 597, 724, 756
  Institution of Electrical Engineers (Manchester Students' Section), 787
  Institution of Electrical Engineers (Dublin Local Section), 597
  Institution of Heating and Ventilating Engineers, 500
  Institution of Mining Engineers, 308
  Iron and Steel Institute, 308, 437
  Junior Institution of Engineers, 659
  Liverpool Engineering Society, 819
  National Illumination Committee of Great Britain, 564
  North-East Coast Institution of Engineers and Shipbuilders, 659
  Northampton Institute, 630, 788, 819
  Nottingham Society of Engineers, 405
  Physical Society of London, 84
  Röntgen Society, 532, 630, 724
  Royal Institution of Great Britain, 84, 597, 756, 787
  Royal Society of Arts, 659, 850
  Rugby Engineering Society, 819
  Society of Engineers (Inc.), 15, 470, 819
  South African Institution of Electrical Engineers, 145, 373
  Tramways and Light Railways Association, 15
  University College, London, 532, 597, 630
  University of London, 437, 500

Insulation of aluminium wire, The electrolytic, 114
Insulators in Australia, The manufacture of, 178
Insurance against hostile aircraft, 389, 834
Inventions and research, Admiralty Board of, 115, 114, 755
Inventions Board, Munitions, 214
Inventions, The Government and, 658
Iron for electrical purposes, Russian, 849
Iron scale by electrolysis, Removing, 850
Iron when magnetised at very high frequencies, The heating of, by N. W. McLachlan, 423
Isolation of vibrational disturbances, The, by F. H. Davies, 505
Italian electrical industry, The, 514
Italian engineers and the German yoke, 706
Italian market, The, 380
Italy, National electrical development in, 802

Italy, Trade statistics of, 254
Italy's electrical trade in 1914, 16

JAPAN, Trade of, 762
Japan, 1914, Trade statistics of, 543
Japanese electrical exporting, 832
Japanese railway electrification, A, 208
Journalism, Standards in trade, 475

KETTERING electricity works, extensions at, 676
Kinematograph operators, Female, 115
Kite and a transmission line, A, 658

LABORATORY of the General Electric Co., of New York, The research, 518
Labour after the war, 417, 422
Labour disputes, Engineering, 596
Labour problem, The tramway, 419
Ladder, Lamp-trimmer's, 499
Lamp and lighting developments in the near past and future, by L. Crouch, 227, 281
Lamp factories in Spain, New, 718, 782
Lamp in photography, The gas-filled, 95
Lamp-trimmer's ladder, 499
Lamps, New incandescent, 739
Lantern slides for lectures, 532
Lancashire and Yorkshire-Manchester-Bury Line, Third-rail construction on the, 315
Laundry service, Electric vehicle in, 377
Law of negligence, Electric railways and the, 270
Lead, 130, 226, 245, 323, 418, 514, 611, 706, 802
Lead position, The, 34
Leasehold premises, Electrical fittings on, 842

LEGAL—
  Adams & McLean *v.* Adnil Electric Co., 67
  Adnil Electric Co., 524
  Albion Electrical Co. *v.* L. K. W. Syndicate, 844
  Alderman sentenced, 658
  Alloa, The Burgh of, *v.* Alloa Theatre Co., 67
  Attwell v. West Ham Corporation, 32, 138, 146, 805
  Aublett, Harry & Co. *v.* Dresdens, 586
  Baldock's Telegraph Instrument Co. *v.* British Telegraph Instruments Co., 493
  Battery Co.,– H. N., *v.* Harvey, Taylor & Co., 30
  Beattie *v.* Barton Wright, 524, 531
  Bodie prosecuted, Walter, 723
  Bristol Tramways & Carriage Co., 70
  British Electric Traction Co., 704, 748, 781
  Broken lamp standard, 427
  Brook *v.* Burnard, 524
  Brown *v.* Mayor, etc., of Lambeth, 586
  Charge of stealing electricity, 532
  City Importing Co. *v.* Defries and Goldman, 49
  Compensation claim, Widow's, 619
  Concordia Wire Co. heavily fined, 308
  Contract, A consulting engineers', 138
  Contract difficulty with interned patentee, 416
  Cotton Spinning Co. *v.* Siemens Bros. Dynamo Works, 42
  Dexter *v.* Aldershot U.D.C., 650, 703
  Dissolution of partnership, 138
  Dublin electricians fined, 478
  Electric accessories dispute, 237
  Electric pocket lamp prosecution, 296
  Electrical & Industrial Investment Co., 108
  Electrical machinery for China stopped, 748
  Electrical work and council's test, 237
  Electrical worker fined at Tynemouth, 649
  Electro-Generator Co. *v.* Erman, 748
  Electrolytic zinc for Government supply, 781
  Grosse, 42
  Hamilton *v.* Marconi's Wireless Telegraph Co., 68, 107, 137, 168
  Harrison *v.* Ottley and others, 559
  Kingstown, W. C., *v.* Dublin Southern District Electric Supply Co., 805
  Lockyer Lampson *v.* Isaacs, 619, 716
  Lundberg & Sons *v.* Western Electric Co., 68
  Manchester, Tramway compensation award, 703
  Marconi shares, Dealings in, 523, 559, 805
  Mexican Light & Power Co., 523
  Morris Herbert, Ltd., appeal, 715
  Motor supply used for lighting, 749
  Munitions cases, 333, 416, 427, 493, 658, 703, 715, 749, 805
  New Phonopore Telephone Co. *v.* E.S. Co., 49
  Newhouns and others *v.* Northern Light, Power & Coal Co., 523
  Oppenheim *v.* Grewing, 42
  Osram Lamp Works *v.* Merryweather and Sons, 703
  Osram Lamp Works *v.* Pope's Electric Lamp Co., 30, 40, 69, 106, 524, 650, 704, 715, 784, 806, 843

- LEGAL—*continued.*
  - Pembroke U.D.C. *v.* The Diesel Engine Co., 659
  - Phœnix Telephone Co. fined, 493
  - Pit youths fined, 804
  - Renewing lapsed policies, 658
  - Roberts Bros. & Holloway *v.* Brown, Vickers & Co., 844
  - Shrimpton *v.* Northern Power, Light and Coal Co., 806
  - Smoke prosecution, 138
  - Sunderland *v.* Economisers, 524
  - Taylor & Farley *v.* West Bromwich Corporation, 806
  - Theft of copper, 237
  - Tramway accident claims, 749, 781
  - Tramway companies and lost property, 704
  - Turner & Co., G. H., 42
  - Underground Electric Railways of London *v.* Inland Revenue Commissioners, 715
  - Unobscured lighting, 492
  - Vandervell *v.* A. P. Lundberg and Sons, 716, 782
  - Wages claim, An interesting, 478
  - Wells, Rayner & Co. *v.* Bovis, 586
  - West Ham Corporation *v.* Hart Accumulator Co., 781
  - Western Electric Co. prosecuted, 619, 704
  - What is serious and wilful misconduct? 492
  - Wilkins *v.* Engineering Works, 715
  - Winstanley *v.* Macartney, McElroy and Co., 782
  - Wolf, S., & Co., *v.* Auto-Wheels, 805 492, 585, 757, 805
  - Workman fined, 500
  - Workmen's compensation, 138, 339, 492, 585, 757, 805

- Legal Query Column, Our, 383, 479
- Letter-sealing machine, Electrically-driven, 308
- Lifts, Control gear for electric, 857
- Light from power, 67
- Light source, The ideal, 160

- LIGHTING AND POWER NOTES—
  - Aberdeen, 174, 335, 429, 462, 588, 783
  - Abertillery, 429
  - Aberystwyth, 238, 527, 846
  - Abingdon, 2, 204
  - Accrington, 335, 400, 462, 560, 750
  - Acton, 620
  - Aldershot, 43, 74
  - Amble, 335
  - Argentine, 110, 174, 238, 335, 400, 462, 494, 560, 620, 686, 750, 815
  - Armagh, 305
  - Ashstead, 368
  - Ashton-under-Lyne, 238, 783
  - Atherton, 174, 588, 718, 783
  - Australia, 110, 140, 174, 23, 238, 273, 335, 369, 400, 462, 588, 620, 653, 718, 783, 846
  - Aylesbury, 110, 238, 588, 653, 686
  - Ayr, 400, 527
  - Bacup, 74, 335, 621
  - Ballymote (Sligo), 621
  - Banbridge, 494, 560
  - Barking, 204, 462, 621, 846
  - Barnes, 110, 527
  - Barnet, 11, 369, 462
  - Barnsley, 111, 238, 527, 560, 686, 815
  - Barrow, 74, 494, 527, 751
  - Basingstoke, 238, 400
  - Bath, 111, 141, 273, 750
  - Batley, 43, 305, 846
  - Battersea, 401, 621
  - Bawnboy (Co. Cavan), 560
  - Beckenham, 653
  - Bedford, 74, 462
  - Belfast, 74, 204, 273, 305, 462, 621, 719, 751
  - Belgian Congo, 43
  - Belturbet, 273
  - Bentham, 12
  - Bermondsey, 44, 75, 528
  - Bethnal Green, 430
  - Bexhill, 11, 400, 560
  - Bidford-on-Avon, 527
  - Birkenhead, 462
  - Birmingham, 621
  - Bispham, 305, 719
  - Bitterne, 43
  - Blackburn, 204, 305, 494
  - Blackpool, 12, 305, 335, 560
  - Bolton, 12, 305, 335, 783
  - Bo'ness, 527, 588, 621, 686
  - Bootle, 204, 429
  - Bradford, 12, 74, 174, 495, 560, 689, 846
  - Bradford-on-Avon, 205, 653
  - Braintree, 369
  - Brandon, 369
  - Bredbury and Romiley, 205, 751
  - Bridge (Kent), 141
  - Bridlington, 12, 205, 273
  - Brierfield, 686
  - Brighton, 175, 495, 815
  - Bristol, 43, 141, 429
  - Broadstairs, 462, 589, 654
  - Bromley (Kent); 75
  - Broughton, 369
  - Brymbo, 305
  - Buckhurst Hill, 687
  - Bungay, 527, 719
  - Burnley, 43, 238
  - Burton-upon-Trent, 75, 751, 783
  - Bury, 141, 335, 429, 686
  - Bury St. Edmunds, 111
  - Buxton, 429, 687
  - Callan (Co. Kilkenny), 238, 462, 495
  - Canada, 12, 43, 75, 141, 205, 238, 273, 305, 335, 400, 495, 560, 589, 751, 815
  - Canberra (N.S.W.), 653
  - Canterbury, 654
  - Cardiff, 305

- LIGHTING AND POWER NOTES—*continued.*
  - Carlisle, 175
  - Carmarthen, 719
  - Carnarvon, 815
  - Carrickmacross, 430
  - Castletown Berehaven, 467
  - Castlewellan, 429, 846
  - Charleville (Co. Cork), 430
  - Cheadle and Gatley, 560, 687
  - Cheam, 75
  - Chelmsford, 175, 589
  - Cheltenham, 495
  - Cheriton, 495
  - Chesham, 430
  - Chester, 43, 175, 205, 589, 815
  - Chesterfield, 75, 205, 527, 560, 784
  - Chester-le-Street, 205
  - China, 205, 846
  - Chichester, 815
  - Chippenham, 205
  - Chislehurst, 141
  - Church Stretton, 75, 846
  - Clacton-on-Sea, 75
  - Clayton, 621, 751
  - Clifton, 400
  - Clones, 560
  - Colchester, 75, 430
  - Colne, 43
  - Coniston (Lancs.), 467, 687, 815
  - Connah's Quay, 336
  - Consett, 75
  - Continental, 12, 44, 75, 111, 141, 205, 305, 400, 430, 467, 495, 527, 589, 654, 687, 783, 815
  - Cork, 273
  - Coventry, 43, 141, 305, 560, 815
  - Crayford (Kent), 141, 400
  - Crewe, 205, 589
  - Croydon, 141, 273
  - Dalkeith, 44
  - Darcy Lever, 560
  - Darlington, 12, 141, 205, 560, 654, 784
  - Dartford, 205, 369, 751
  - Darwen, 44, 111, 467
  - Denby, 273
  - Denny, 336
  - Derby, 467
  - Dewsbury, 12, 336
  - Dodworth, 654, 846
  - Donaghadee, 75
  - Doncaster, 430
  - Dover, 495, 528, 621, 784
  - Downham Market, 621, 784
  - Draperstown (Co. Derry), 369
  - Dublin, 12, 175, 205, 495, 687, 719
  - Dundalk, 369, 495
  - Dundee, 238
  - Durham, 75, 654
  - Ealing, 175
  - Easington (Co. Durham), 238
  - Eastbourne, 751
  - East Ham, 430, 621, 751
  - Eccles, 336, 560
  - Ecuador, 846
  - Edinburgh, 44, 75, 175, 654, 687, 719
  - Elland, 75
  - Ellesmere Port, 75, 495, 784
  - Ellon, 467, 495
  - Erith, 44, 175, 273, 467
  - Eston, 528
  - Ewell & Worcester Park, 751
  - Exeter, 141
  - Fakenham, 560, 621, 751, 784
  - Farnham, 654
  - Farnworth, 495
  - Farsley, 654
  - Faversham, 141, 467, 589
  - Fermoy, 305, 400
  - Finchley, 44, 751
  - Fleetwood, 141, 430
  - Folkestone, 589, 784
  - Frome, 75
  - Fulham, 13
  - Germany, 687
  - Gillingham (Kent), 12, 141, 175, 495, 784
  - Glasgow, 12, 141, 238, 305, 467, 528, 815
  - Glass Houghton, 111
  - Glossop, 12, 560
  - Gloucester, 175, 495, 589
  - Godalming, 141
  - Gravesend, 238, 430, 528, 654, 719
  - Great Harwood, 75
  - Great Yarmouth, 401, 815
  - Greenock, 141, 561, 654, 678, 846
  - Grimsby, 430
  - Guildford, 336
  - Guiseley, 44
  - Gwersyllt, 589
  - Hackney, 430, 467, 621, 654, 719
  - Hale, 401
  - Halesworth, 815
  - Halifax, 44, 401, 467
  - Hammersmith, 75, 141, 430, 561, 815
  - Hampstead, 13, 784
  - Hanwell, 815
  - Harrington (Cumberland), 589
  - Harrogate, 175, 495, 751
  - Haslingden, 305, 589, 846
  - Hastings, 75, 430, 621, 751
  - Hawick, 430
  - Haworth, 12
  - Heckmondwike, 75, 467
  - Heidelberg (Victoria), 462
  - Hendon, 44, 75
  - Hereford, 205
  - Hertford, 784
  - Heston and Isleworth, 205
  - Hetton-le-Hole, 239
  - Heywood, 528, 621, 784
  - High Wycombe, 846
  - Hindley, 654
  - Hitchin, 239
  - Holland, 654
  - Holme, 654
  - Holmfirth, 111
  - Holyhead, 430
  - Holywell, 205, 528
  - Hong-Kong, 239
  - Hornsey, 12, 560, 751
  - Horsham, 261

- LIGHTING AND POWER NOTES—*continued.*
  - Houghton-le-Spring, 467
  - Hove, 239, 369
  - Hoylandswaine, 336, 621
  - Huddersfield, 12, 141, 589, 654
  - Hull, 560, 687
  - Hurst, 111
  - Hythe (Kent), 111, 589, 751
  - Ifield, 369
  - Ilford, 175, 401, 589, 687, 846
  - Ilkley, 206, 528
  - India, 44, 111, 206, 336, 369, 687, 815
  - Ingleton, 467, 621
  - Ipswich, 239, 467, 589
  - Ipswich (Queensland), 653
  - Irish water-power scheme, 561
  - Irlam, 175
  - Islington, 175, 467, 784, 815
  - Italy, 12, 111, 400, 495, 654
  - Japan, 590
  - Keighley, 369, 401, 467, 784, 846
  - Kensington rating appeal, 687
  - Kettering, 495
  - Kharkoff electric supply system, 500
  - Kilkeel (Co. Down), 111
  - Killorglin (Co. Kerry), 336
  - Kilmallock (Co. Limerick), 430
  - Kilmarnock, 784
  - Kilrea (Co. Derry), 528, 687
  - King's Lynn, 111, 273
  - Kingswinford, 815
  - Kingston-on-Thames, 175, 239, 784, 815
  - Kirkcaldy, 44
  - Kirkheaton, 435
  - Larne, 621
  - Latchford, 561
  - Leeds, 12, 44, 495, 654, 815
  - Leek, 495
  - Leicester, 141, 590
  - Leigh, 401, 528, 687
  - Lepton, 75
  - Lerwick, 273
  - Leyton, 175, 206, 621
  - Lincoln, 75, 206
  - Littleborough, 687
  - Liverpool, 561, 719
  - Llandudno, 175, 467
  - Llanelly, 784
  - Llanfair Caereinion, 687
  - Llanfyllen, 621
  - Loftus-in-Cleveland, 784
  - London, 13, 44, 75, 111, 141, 175, 239, 369, 401, 430, 467, 496, 528, 561, 590, 621, 654, 687, 719, 751, 784, 815, 846
  - London County Council, 44, 142, 430, 561, 687, 784, 816
  - Loughborough, 435, 784
  - Lowestoft, 401
  - Luton, 44, 435, 621, 816
  - Lymington, 401, 561
  - Lytham, 44, 206
  - Maidenhead, 44, 175
  - Maidstone, 44, 561, 846
  - Malvern, 621, 654
  - Manchester, 13, 44, 206, 305, 468, 528, 621, 687, 719, 751, 784, 816, 846
  - Mansfield, 13, 142
  - Mansfield Woodhouse, 13
  - Market Drayton, 75, 239, 305
  - Market Weighton, 142
  - Marsden, 206
  - Mayo, 687
  - Melbourne (Derbyshire), 75
  - Meltham, 239
  - Merthyr Tydfil, 590
  - Mexborough, 175, 590
  - Middlesbrough, 590, 846
  - Middleton, 336
  - Milnrow, 369
  - Monaghan, 621
  - Morley, 784, 847
  - Mossel Bay (C.P.), 176
  - Motherwell, 369
  - Mutford and Lothingland, 719
  - Nantwich, 75
  - Narvan, 239
  - Nelson, 206, 621
  - Newcastle (Co. Down), 621, 784
  - Newcastle-on-Tyne, 435, 590
  - Newcastle-under-Lyme, 76, 496
  - New Earswick, 369
  - Newport (Mon.), 401, 528, 687
  - New Quay, 751
  - Newton Abbot, 13
  - New Zealand, 111, 336, 369, 468, 561, 719, 751, 847
  - Northampton, 467
  - North Sydney, 653
  - North Wales, 142
  - Norwich, 142
  - Nottingham, 45, 239
  - Nuneaton, 142, 654, 784
  - Redditch, 76, 784
  - Oldham, 45, 496, 561
  - Ormskirk, 590
  - Padstow, 751
  - Pembroke (Co. Dublin), 496, 561
  - Penang, 528
  - Perth, 435
  - Perth (W.A.), 462
  - Peterborough, 369, 621, 688
  - Plymouth, 45, 239, 336, 751
  - Poplar, 430, 590, 687, 815
  - Portadown, 847
  - Portaferry (Co. Down), 719
  - Portpatrick, 847
  - Portrush, 305, 496
  - Portsmouth, 111, 816
  - Portstewart, 528
  - Preston, 468
  - Queensbury, 76, 751
  - Rawtenstall, 401, 561
  - Reading, 496
  - Reigate, 13, 45, 273
  - Ripon, 45
  - Rochdale, 45, 206, 336
  - Rotherham, 76, 468, 719, 784
  - Rugby, 590
  - Runcorn, 45, 369

- LIGHTING AND POWER NOTES—*continued.*
  - Russia, 44, 111, 141, 205, 430, 527, 783, 815
  - St. Annes, 206, 337, 370, 752
  - St. Helens, 76, 206, 305
  - St. Marylebone, 239, 467, 621, 751
  - St. Pancras, 13, 111, 369, 561, 687, 784
  - Salford, 13, 175, 306, 435, 561
  - Sandgate, 369, 621, 654
  - Scarborough, 13
  - Scottish power proposal, 719
  - Settle, 76
  - Sevenoaks, 76
  - Shanklin (I.O.W.), 76, 206, 621, 688
  - Sheerness, 496
  - Sheffield, 76, 401, 435, 752, 784
  - Shelf, 622
  - Shipley, 45, 336, 719
  - Shoreditch, 111, 401, 590, 654
  - Sligo, 528
  - South Africa, 13, 76, 142, 176, 273, 336, 369, 528, 590, 622, 816
  - South Brisbane (Queensland), 653
  - South Shields, 306, 751
  - South Wales, 337
  - Southampton, 142, 176, 751
  - Southborough, 176
  - Southend-on-Sea, 142, 239, 401, 435
  - Southport, 622
  - Sowerby (Yorks.), 176
  - Spain, 12, 75, 305, 400, 430, 495, 528, 589
  - Spenborough, 45, 847
  - Spennymoor, 45
  - Stafford, 76, 816
  - Stalybridge, 13, 45, 688, 719
  - Stamford, 111
  - Steeton, 590
  - Stepney, 430, 532
  - Stirling, 13
  - Stockport, 337, 496, 752
  - Stockton-on-Tees, 76, 206
  - Stoke Newington, 430
  - Stoke-on-Trent, 13, 142, 590, 719
  - Straits Settlements, 590
  - Stratford-on-Avon, 111
  - Street, 239, 401
  - Stretford, 239, 274, 468, 496, 622, 784
  - Stroud (Glos.), 528
  - Sunderland, 45
  - Surbiton, 239, 401
  - Sutton, 561, 590, 752
  - Sutton Coldfield, 176
  - Swansea, 76, 111, 337, 496, 752
  - Swindon, 401, 528, 622
  - Swinton and Pendlebury, 111, 654
  - Switzerland, 467
  - Sydney, 140, 369, 400, 462, 653
  - Tarporley, 752
  - Tasmania, 111, 590, 752
  - Taunton, 401
  - Thornley (Durham), 111
  - Thirsk, 816
  - Tonbridge, 752
  - Torpoint, 45
  - Torquay, 76, 206, 687, 784, 847
  - Trowbridge, 142, 337, 496
  - Tunbridge Wells, 13, 239, 496, 654
  - Turton, 206, 622
  - Tynemouth, 816
  - Warminster, 622
  - Warrington, 561
  - Whitstable, 401
  - United States of America, 176, 240, 274, 306
  - Wakefield, 370
  - Walkden, 111
  - Wallasey, 13, 370
  - Walsall, 76, 370, 785
  - Walthamstow, 688
  - Wanstead (Essex), 176, 752
  - Warminster, 655
  - Warrington, 76, 142
  - Waterford, 206
  - Watford, 176, 435
  - Wednesbury, 206
  - West Bromwich, 45, 142, 528, 654, 784, 816
  - West Ham, 76, 784
  - West Yorkshire, 76, 111
  - Westhoughton, 76
  - Westminster, 13
  - Wetherby, 111, 435
  - Weymouth, 76, 752, 816, 847
  - Whitby, 435
  - Whitehaven, 785
  - Whitstable, 688
  - Wigan, 435, 590, 655, 785
  - Wilmslow, 496
  - Wimbledon, 76, 206, 468, 590, 752
  - Winchester, 111, 622
  - Windsor, 370, 435, 529
  - Wirksworth, 176
  - Wirral, 142, 688, 847
  - Wisbech, 816
  - Wolverhampton, 206, 496, 590, 688, 785
  - Woodford, 816
  - Woolwich, 44, 175, 496, 846
  - Worcester, 370, 528, 688, 785
  - Worksop, 142
  - Worthing, 468
  - Wrexham, 13, 785
  - Yarmouth, 468
  - York, 142, 401, 752
  - Yorkshire, 655

- Lighting developments in the near past and future, Lamp and, by L. Crouch, 227, 281
- Lighting national colours on neutral ships, 722
- Lighting of factories and workshops, The, 340, 355, 356
- Lighting of trams, The, 373, 819
- Lighting, Railway station, 11
- Lighting regulators, New motor-car, 849
- Lineman, A resourceful, 373

Liquidations—
  Adnil Electric Co., 174, 238
  Aluminium Patent Non-flux Solder, 42, 139
  Baldur Engineering & Supply Co., 174
  Brighten, Malcolm & King, 718
  British Diesel Motor Vessel Co., 750
  British Drawn Wire Lamp Co., 461, 494
  British Electric Automatic Machines, 334, 400
  Bryant Trading Syndicate, 139
  Central Wireless Co., 653
  Cicoy Magneto Co., 845
  Consolidated Diesel Engine Manufacturers, 74, 174, 304, 588
  " Dac " Accumulator Syndicate, 619
  Eureka Patent Gas Engine Starter Co., 750
  Felgate Installation Co., 11, 750
  Fleetwood & District Electric Light and Power Syndicate, 74
  Holborn Electric Fires, 718
  Leskole Co., 272
  Marsh, Son & Co., 845
  Maxim Lamp Works, 750
  Meldrum Bros., 560
  Phœnix Electric Heating Co. (1914), 272
  Prested Miners' Gas-Indicating Electric Lamp Co., 204
  Renew Electric Lamp Co., 783, 845
  Seear, Scott & Co., 334
  Sheffield Electrical Engineering Co., 845
  Spanish National Submarine Telegraph, 174
  Spiral Regulating Dynamo Co., 368
  Stolz Electrophone Co. (1913), 718
  Straus & Co., 304, 334
  Teleradio Electric Co., 686
  Turbine Development Co., 272
  Venner's Electrical Cooking & Heating Appliances, 74, 304, 526

Localising bullets, A simple radiographic method for, by L. Crouch, 155
Locomotives, Comparative costs of various types of pit, 234
London & South-Western Railway electrification, 390, 431, 449, 548
London-Birmingham-Liverpool Telephone, 340
London County Council electrical employés: War wages, 658
London County Council Tramway wages, 179
London Electrical Engineers (Territorial Force), 471, 787
Lorries, Electric, 658
Lorry, A co-operative society electric, 629
Loss as affected by triple harmonics, Transformer core, by H. M. Lacey and C. H. Stubbins, 424
Loss on the rates, Putting the, 610
Low-priced electric vehicle, A, 79
Lubrication of Diesel engines, 557

MACHINE tools, Importing, 770
Machinery, The British standardisation rules for electrical, 741, 803
Madeira, 526
Magnetic and electrical properties of pure silicon-iron, The, 705
Magnetisation by rotation, 244
Magnetism, Arranging nails by, 37
Magnetos for ignition purposes, 145, 500, 540
Maintenance, Direct-current motor, by S. Lees, 836
Manchester-Bury Line, Third-rail construction on the L. & Y., 315
Manchester Corporation gas undertaking, The, 414
Manchester electricity supply undertaking, by S. L. Pearce, 413
Manchester dispute, A, 824
Manufacturers' association, New, 845
Manufactures prohibited, Enemy, 2
Marine engines, Remote control of, 628
Mathematical notation, 404
Measurements, Stroboscopic frequency, 186
Melbourne, Electricity supply in, 229
Metal brokers, The Admiralty, 437, 471
Metal, Calorising, A protective treatment for, by H. B. C. Allison and L. A. Hawkins, 158
Metal market, 57, 219, 313, 475, 603, 729
Metal spray processes in engineering, by J. Calder, 391
Meters approved, 335
Metric system and decimal coinage, 481, 485, 516, 570, 580, 635, 643, 644, 698, 771, 834, 864
Mexican tramways.—Two managements, 471
Mexico, 265
Mexico, Good news from, 773
Mill, An electrically-driven, 29
Mill auxiliary rolls, Control apparatus for steel, 7
Mills and refineries, The case for the electrification of cane sugar, by E. P. Hollis, 163, 195
Mines, Electric signalling in, 65
Mines, Electrical accidents in, 710, 761, 793
Mines, Output of coal and the use of electricity in, 538
Mining, Coal, 289
Mining engineers, 471
Mining, Electricity in submarine, 454
Mining plant, The use and abuse of oils on, by T. C. Thomsen, 284
Modern electric elevator, The, by D. Lindquist, 486
Monopoly question in Germany, 835
Mosquito exterminator, An electrical, 138
Motor-car fittings in the U.S., Standardising electrical, 93
Motor-car lighting regulations, New, 849
Motor-car running costs, Electric, 126
Motor maintenance, Direct-current, by S. Lees, 836
Motor-starting by wireless, 437
Motors, E.A.C. drum type control gear for A.C., 131
Motors I have met, Some, by E. F. Butler, 259
Multicore cables, by " Commercial," 774
Municipal Electrical Association, Incorporated.—The use of electric vehicles in municipal service, 25
Municipal electrical trading in Australia, 709
Municipal service, The use of electric vehicles in.—I.M.E.A., 25
Municipal Tramways Association (Inc.), Annual conference, 405, 420
Municipalities, Excess profits of, 760
Munitions, Metropolitan, 290
Munitions output, Electricity and the, 545
Munitions, The appeal from the Trenches for more, 482
Munition workers and recruiting, 803

NAILS by magnetism, Arranging, 37
Nation, Science and the, 769
National Physical Laboratory in 1914-15, The work of the, 6, 61
Nationalisation of electricity supply in Germany, 771
Navy's need for skilled engineers, The, 565
Negligence, Electric railways and the law of, 270
" Neutral," " Enemy " goods passing as 322
New British industry (dry batteries), 57

New Companies—
  Accumulators, 215
  Addison, W. J., 598
  Andover & District Electricity Co., 278
  Anglo-American Metals Syndicate, 598
  Anglo-Russian Engineering Co., 820
  Arcorundum Abrasives, 789
  Bachelet French Syndicate, 52
  " Ballantyne " Submarine-Craft Detector and Telegraphs, 246
  Beacon Carbons, 116
  Berry & Hayward, 116
  Birmingham Central Supply Co., 86
  Butt, F. R., & Co., 757
  Cahirciveen Electric Light & Power Co., 52
  C.E.C., Ltd., 472
  Comparri Wireless Control, Syndicate, 147
  Copper Depositing & General Engineering Co., 820
  Cresol Chemicals, 472
  Electric Lamp Repairs Co., 18
  Electric Safety Hoists, 246
  Electrical Manufacturers' Co. of Great Britain, 851
  Electro Alloys, 278
  Electrode Company of Sheffield, 439
  Farr & Co., J., 86
  Feltham & District Electric Lighting Co., 501
  H.S.M. Patent Belt Fastening Co., 472
  Husband, F., 86
  Ilford Dry Battery Co., 472
  Industrial Invention, 246
  Institute of Industry (of Great Britain and Ireland), 439
  Irish Hydro-Electric Syndicate, 216
  Jacobs, W. A. & R. J., 501
  Killorglin Electric Light & Power Co., 246
  Leach & Co., S. G., 534
  Lindsay & Williams, 278
  London Glass Works, 19
  Lowa Engineering Co., 18
  Marsh Bros. (Electricians), 406
  Mica Lubricant Co., 534
  Milton Accumulators, 309
  Motor Engineering Co. (Nottingham), 598
  New Era Signs, 116
  Newtons (Camborne), 789
  O'Neil's Recorder Syndicate, 789
  Patent Lighting Co., 246
  Peerless Seamless Rubber Co., 19
  Phœnix Armouring & Cable Co., 147
  Productive Engineers, 820
  Quasi Arc Co., France, 725
  Ramsden Green, 180
  Runbaken Magneto Co., 278
  Russell & Co., J., 116
  Sanders & Co., W., 661
  Seear, Scott & Co., 342
  Siluminite Insulator Co., 52
  Smethwick Machine Shops, 147
  Smith, Lemon & Stewart, 342
  Snyder Electric Furnace Co., 215
  Staines Projectile Co., 406
  Telepad, 147
  Telephone Manufacturing Co., 631
  Tredelect Engineering Co., 725
  United Tube Corporation, 598
  Watson & Sons (Electro-Medical), 18
  Westwood Electrical Co., 342
  Whipp & Bourne, 309
  Wholesale Electrical Co., 86

New Electrical Devices, Fittings and Plant—
  Advertising window signs, 523
  Australian automatic cut-out, An, 197
  Automatic cooker, An, 394
  Ball-bearing factory, Electric supply in a, 235
  Boiler-cleaning machine, A, 325
  B.T.H. lighting at West African House, 457
  Calculating illumination, Simplified method for, 109
  Cantie switch, 617
  Chairs, Electrically-propelled, 234
  Circulator for economiser, 108
  Clip for line conductor, 394
  Condenser protection against surges, 265
  Condensers, Helsby patent, 235
  Conduit spacing support, 651
  Contact strips, Electric, 583
  Corrosion-proof fittings, 651
  Couch autophone system, 780
  Cut-out, An Australian automatic, 197
  Dental motor, Small, 62
  " D.G." four-heat griller and cooker, 267
  Dough mixed, Electrically-driven, 490
  " Ediswan " circuit-breakers, 167
  Ediswan lighting fittings, 491
  Ediswan silk shades, 297
  Electrical driving in cement works, 139
  Ferranti bar fires, 456
  Furnace, Electric laboratory, 458
  General Electric Co.'s dust bellows, 64
  General Electric Co.'s flame-proof and water-tight bell for mines, 297
  General Electric Co.'s industrial fittings, 685
  General Electric Co.'s mining telephone, New, 167
  Glasshouse pot and " Vitrite " cap making at the Ediswan works, 198
  Half-watt lamps, New, 63
  Half-watt lamp fittings, 583, 714, 780
  Heater and fan, Combined, 714
  Heating resisters, Electric, 166
  " Hemming " grip fittings, 298
  Hoffmann roller bearings, 235, 522
  Holophane industrial fittings, 325
  Impermeability tester, 108
  Induction pipe heater, 63
  Inspection lamp for shell work, 617, 714
  Insulating and heat-resisting material, New, 394
  Insulator bracket, New, 650
  Jackson heating apparatus, 809
  Lelios lamps, 298
  Lighting plants, Small electric, 62
  Line conductor clip, 394
  Magneto for 12-cylinder engines, 491
  " Migas " detector, The, 746
  Mono-meter tinning furnace, 685
  Motor control panel, 492
  Multi-pole isolating switches, 265
  Multiple-break tumbler switch, 456
  Parsons paraffin lighting set, 522
  Photographic meter records, 297
  Picture lighting fitting, 583
  Pocket lamps (Ward & Goldstone), 297
  " Pointolite " lamp, 809
  Portable searchlamp, 197
  Portable X-ray apparatus, 426
  Power demand, Keeping down the, 64
  " Quead " electric fires, 63, 427
  " Razzo " hand lamp, 746
  Reducing gearing, 382
  " Revo " electric fires, 457
  Revolving-disk grate stoker, 393
  Seamless tubing, 198
  Search lamp, Portable, 197
  Searchlight, An Italian motor, 108
  Sewing bench lighting, 457
  Showroom window lighting, 395
  Single-tumbler double-pole switches, 298
  Stern-condensite, 746
  Switch and indicator, Combined, 382
  Switches and fuses, Robust, 325
  Table wiring, 63
  Tire heater, Electric, 393
  Tramway differential gears, 616
  Tree insulator, 651
  Tubing, Seamless, 198
  Tungsten for telegraph keys, 139
  Turbine gear, Large, 456
  Uni-Lectric machine, The, 394
  Union flexible coupling, 5
  Vacuum tube lamp, Moore carbon-dioxide, 779
  " Vesper " heating pillar, 109
  " Vitrite " cap making at Ediswan works, Glasshouse pot and, 198
  Water heating, Domestic, 234
  Window lighting, Showroom, 395
  " Witton " ironclad high-pressure switchgear, 5

New York, Electric taxicabs for, 604
New York Electrical Exhibition, The, 372
New York's co-operative electric vehicle garage, 4
New Zealand Exhibition, 717
New Zealand hydro-electric scheme, A, 772
New Zealand imports, 429
New Zealand, Trade of, 794
New Zealand's water-power, 125
Nickel anodes, Utilising scrap, 288
Nickel-chromium alloy, 145
Nickel, Russian, 404
Nitrogen fixation in Russia, 754, 827
Nitrogen, The fixation of, 691
Nobel prizes, 659
Norfolk & Western Railway, U.S.A., Heavy tonnage electric service on the, 134

OBITUARY—
  Agnew, C. S., 501
  Alston, Ex-Bailie J., 693
  Barnes, H., 660
  Barrell, Prof. F. R., 757
  Bastian, Dr. H. C., 693
  Beaumont, A., 309
  Callender, E. R., 85
  Campbell, H., 309
  Clarkson, G., 725
  Coote, A., 180
  Crompton, Lieut. N. G., 631
  Crooks, H., 309
  Donovan, H. C., 725
  Ducretet, M. E., 598
  Evans, G. T., 342
  Fleming, Sir S., 147
  Gale, F. J., 180
  Gardner, J., 438
  Gill, J. C., 180
  Gray, M. H., 324
  Greiner, M. Adolphe, 725
  Hammond, R., 180, 207
  Harold, H. C., 116
  Hartjen, E., 566
  Hartmann, E., 757
  Hawkins, F., 693
  Hellyar, T. L., 246
  Higgins, F. H. W., 341
  Huber, Col. P. E., 631
  Hurtzig, A. C., 18
  Iago, F., 789
  Kingsford, W. B., 660
  Lewes, Prof. V. B., 566
  Long, E., 52
  Luntley, W. A., 566, 598
  Mavor, H. A., 116
  Mayne, E. J., 215
  Miller, W. H., 246
  Mitchell, H., 309
  Moore, C. E., 660
  Nicholson, J. W., 342
  Noble, Sir A., 566
  Owen, Capt. Halsall, 52
  Parker, T., 758
  Patton, G., 598
  Potts, L., 631
  Rasehorn, Dr. P., 693
  Restarick, W. A., 631
  Roscoe, Sir H., 820
  Rucker, Sir A. W., 598
  Salomons, Capt. D. R. P. H., 631
  Seager, J. A., 246
  Shea, W., 789
  Shellshear, J. T., 820
  Shillito, A., 18
  Smith, J., 180
  Spagnoletti, C. E., 18, 52
  Taylor, H. A., 851
  Thomas, Wm., 406
  Vickers, C.B., Col. T. E., 534
  Webb, A. T., 851
  Widener, P. A. B., 631
  Wollaston, C. J., 757

Official Returns—
  African Direct Telegraph Co., 407
  Alert Electrical Co., 116
  Altrincham Electric Supply, 86
  Anchor Cable Co., 147
  Anglo-Foreign Tramway Syndicate, 116
  Ardee Electric Co., 851
  Auto-Electric Transmission, 472
  Babcock & Wilcox, 407
  Ball, Albert A., & Co., 851
  Banbury & District Electric Supply Co., 278, 440
  Barraclough Bros., 758
  Barsi Light Railway Co., 820
  Bath Electric Tramways, 19
  Beardmore & Co., W., 278
  Birmingham Central Supply Co., 147
  Birmingham District Power & Traction Co., 472
  Blackburn, Starling & Co., 534
  Bland Light Syndicate, 501
  Bracuhy Falls & Metallurgical Syndicate, 631
  Bray, Markham & Reiss, 631
  Brecknell, Munro & Rogers, 278
  Brilliant Arc Lamp & Engineering Co., 19, 52
  Brilliant Sign Co. (1907), 407, 440
  Brimsdown Lamp Works, 661
  Brisbane Electric Tramways Investment Co., 407
  British Accumulator Co., 180
  British Arc Welding Co., 534
  British Sherardizers, 52
  Brook, Hirst & Co., 52
  Brooker & Co., T. H., 472
  Bude Electric Supply Co., 310
  Cable Accessories Co., 52
  Carbone Arc Lamp Syndicate, 52
  Carleon Electrical Co., 19
  Carville Site & Power Co., 52, 216, 342, 501, 661, 758
  " Cedes " Electric Traction, 407
  Chamberlain & Hookham, 374
  Chepstow Electric Lighting & Power Co., 789
  Chili Telephone Co., 631
  Chiswick Electricity Supply Corporation, 342
  Chloride Electrical Storage Co., 278
  Christy Bros. & Co., 534
  Colley's Patents, 216
  Colne Valley Electric Supply Co., 789
  Consolidated Electrical Co., 342
  Contraflo Condenser & Kinetic Air Pump Co., 374
  Creedon & Co., W. A., 851
  Crompton & Co., 631
  Cryselco, 661
  Davis & Son (Derby), J., 501
  Defries & Goldman, 19, 342
  Delabole Electric Lighting & Supply Co., 472
  Direct United States Cable Co., 310
  D.P. Battery Co., 631

OFFICIAL RETURNS—*continued.*
Drycells, 407
Dynamic Electrical Co., 472
Edmundson's Electricity Corporation, 661
Electric & General Investment Co., 342, 661
Electric Supply Co. of Western Australia, 181
Electrical Oil Refining Co., 534
Electricity Supply Co. for Spain, 342
Electro Chlorination Syndicate, 137
Electro Flex Steel Co., 278, 342, 534, 631
Electro-Mechanical Brake Co., 661
Electromotors, 342
Enfield Electric Cable Mfg. Co., 534
Europe & Azores Telegraph Co., 342
Evered & Co., 342
Evershed & Vignoles, 661
Everett, Edgcumbe & Co., 278
Exchange Telegraph Co., 534
Ferranti, 472
Frinton-on-Sea and District Electric Light & Power Co., 147
Gell Telegraphic Appliances Syndicate, 52
General Cable Manufacturing Co., 52
Greenwood and Batley, 180
Guildford Electricity Supply Co., 181
Halifax & Bermudas Cable Co., 694
Hart Accumulator Co., 216
Hastings & District Electric Tramway Co., 181
Healing & Co., L. J., 660
Henley's (South Africa) Telegraph Works, 661
Hexham & District Electricity Supply Co., 660
Hong-Kong Tramway Co., 116, 310, 631
Hydro-Electric Power & Public Services Trust, 660
Imperial Light, 440
International Dowsing Electric Heating & Appliances, 661
Jacobs, W. A. & R. J., 631
Jarrow & District Electric Traction Co., 758
Jeal & Co., W. S., 407
Jones & Co., F., 661
La Plata Electric Tramways Co., 216
Lancashire Electrical Engineering Co., 661
Lancashire Power Construction Co., 661
Lawson's Non-Conducting Composition, 374
Leatherhead & District Electricity Co., 116
Lithanode, 820
Liverpool Electric Cable Co., 820
Llangollen & District Electric Light and Power Co., 661, 693
London Aluminium Co., 310
London Electrical Trading Co., 52, 661
Malaga Electricity Co., 661
Manaos Tramways & Light Co., 660
Marconi International Marine Communications Co., 661
Maxim Lamp Works, 661
Merthyr Electric Traction & Lighting Co., 278
Nairobi Electric Power & Lighting Co., 216
Nalder Bros. & Thompson, 52
National Alloys, 147
National Conduit & Cable Co., 820
Naylorgraph, 147, 789
New Liverpool Rubber Co., 694
New St. Helens & District Tramways Co., 820
New System Private Telephone Co., 86
Newtons, 820
Northallerton Electric Light & Power Co., 407
Northampton Electric Light and Power Co., 758
North-Eastern Electric Smelting Co., 19
North Melbourne Electric Tramways and Lighting Co., 694
North Metropolitan Electrical Power Distribution Co., 52
Northwood Electric Light & Power Co., 52
Oldham, Ashton & Hyde Electric Tramway, 52
Oriental Telephone & Electric Co., 19, 440, 851
Oxford Electric Co., 52
Pacific & European Telegraph Co., 820
Pernambuco Tramways & Power Co., 147
Phillips Commutator Grinder Co., 86
Pintsch's Electric Manufacturing Co., 116, 501
Pitter's Ventilating & Engineering Co., 310
Pope's Electric Lamp Co., 147
Porlock & District Electric Supply Co., 147
Pritchett and Gold and Electrical Power Storage Co., 216, 342
Ramsden Green, 278
Rawlings Bros., 278, 758
Renew Electric Lamp Co., 407, 693
Rhondda Tramways Co., 758
Salford Electrical Instruments, 661
Sanders & Co., W., 820
Sax, J., & Co., 147
Sheerness and District Electric Power & Traction Co., 440
Simmonds Bros., 216
Simplex Conduits, 19
South London Electric Supply Corporation, 19
Standard Electric Co., 86
Sterling Telephone & Electric Co., 758

OFFICIAL RETURNS—*continued.*
Sykes Interlocking Signal Co., W. R., 661
Telephone Co. of Egypt, 19, 440, 851
Tilling-Stevens, 374
Trafford Power & Light Supply (1902), 116
Tramways, Light & Power Co., 789
Turner & Co., G. H., 116
Tyer & Co., 440
Urban Electric Supply Co., 19, 472
Vactite Wire Co., 52
Van Raden & Co., 52
Vera Cruz Telephone Construction Co., 52
West Naples Tramways & Valfortore Railway Co., 52
Western Electric Distributing Corporation, 116
Winscombe Electric Light & Power Co., 278
Wrexham Motor & Electrical Engineering Co., 116

Oil circuit-breakers: Notes on arc phenomena and tendencies in design, by K. C. Randall, 317
Oils on mining plant, The use and abuse of, by T. C. Thomsen, 284
Operating experience on a high-tension transmission line, Four years', 189
Opportunities throughout the world, Our trading, 612, 646, 678, 711, 762, 794
Organisation, Foreign trade, 737
Organisation of science, The scientific, 33
Organisation of war material supplies in Germany and incidental—robbery, The scientific, by R. Steylaers, 48
Organising British engineering industry, 691, 707
Oscillograms, Harmonics in, 804
"Overhead costs," 144
Over-specialisation, by J. Marks, 172
Overtime, Dockyard, 531

PANAMA-PACIFIC Exhibition, 271
Park Royal Engineering Works, The, 745

PARLIAMENTARY—
Bristol Tramways Act, 16
Metropolitan District Railway Act, 16
Ormskirk Gas and Electricity Act, 16
Royal Assent, 51, 596
Sheffield Corporation Tramways Act, 16
Patent applications, 43, 335, 365, 400, 692
Patent restoration, 512, 728, 814
Patents and alien enemies, 50, 84, 381, 405, 724, 756, 788, 853
Patents in war time, 756
Patents, New and published specifications, 32, 64, 96, 128, 160, 192, 224, 256, 288, 320, 352, 384, 416, 448, 480, 512, 544, 576, 608, 640, 672, 704, 736, 768, 800, 832, 864
Peat fuel for Russian electric stations, 760
Peru, 428
Petrograd electric light economies, 692
Phenomena, Arc, by A. G. Collis, 446
Photography by aid of quartz lamps, Submarine, 126
Photometry of stars, The electrical, 373
Pistons on Diesel engines, Cracked and seized, by G. E. Windeler, 70
Plant growth, Radium and, 499
Platinum, New source of, 372
"Point Five" Association, The, 27
"Point five" tariff, The practical result of the, by T. Roles, 132, 162
Point five tariff, The problem of the, 443, 476
Poisoning in storage battery making, 403
Post Office war bonus, 340
Power, Light from, 67
Power plant, A wrecked, 313
Power station of the Randfontein Estates, The Central, by R. T. Mawdesley, 80, 100, 154
Power station, West Australian Government, 96
Power stations to be "controlled" establishments, Electric, 659
Power supply to the Rand Mines, 220
Preferential rates for exports, by F. Broadbent, 444
Press, The very non-technical, 387
Prices, Advance in, 494
Prisoners of war, Books for, 692
Prisoners of war at Ruhleben, News of, 657
Private arrangements, 11, 204, 308, 334, 368, 461
Prize competition, Spanish, 499
Prizes, Nobel, 659
Problem of the "Point-Five" tariff, The, 443, 476

PROCEEDINGS OF SOCIETIES AND INSTITUTIONS—
Aerials of the umbrella type, The capacity of, by Prof. G. W. O. Howe, 426
Aluminium alloys, Exposure tests of light, by Prof. E. Wilson, 426
Apprenticeship in the electrical contracting industry, by A. H. Dykes, 573
Arc-lamp, The cadmium-vapour, by Dr. H. J. S. Sand, 426

PROCEEDINGS OF SOCIETIES AND INSTITUTIONS—*continued.*
Arc phenomena, by A. G. Collis, 446
Arc phenomena and tendencies in design, Oil circuit-breakers: Notes on, by K. C. Randall, 317
Argentine battleship *Moreno*, The electrical equipment of the, by H. A. Hornor, 348, 380
Balance, An electromagnetic vacuum, by Dr. J. S. Anderson, 267
Bars, The magnetic testing of, by A. Campbell and D. W. Dye, 859
Batteries, The installation and working of storage, by R. Rankin, 638
Battery exchange system for electric vehicles, 614
Battleship *Moreno*, The electrical equipment of the Argentine, by H. A. Hornor, 348, 380
Birmingham Local Section, I.E.E., Address by Lieut.-Col. J. F. Lister, 582
British Association: Presidential address to the Engineering Section, by H. S. Hele-Shaw, 332
British industry after the war, by H. B. Rowell, 773
Cable telegraphy, On an unbroken alternating current for, by Lt.-Col. G. O. Squier, 156, 187
Cadmium-vapour arc-lamp, The, by Dr. H. J. S. Sand, 426
China, Electricity supply in, by W. G. L. Riddle, 607
Circuit breakers: Notes on arc phenomena and tendencies in design, Oil, by K. C. Randall, 317
Colliery pumping, Turbine pumps for, by R. H. Willis, 316
Commutating device, A self-adjusting, by Prof. M. Walker, 414
Contracting industry, Apprenticeship in the electrical, by A. H. Dykes, 573
Convertible combustion engines, by A. E. L. Chorlton, 328
Copper, The production and properties of electrolytic, by B. Welbourn, 647, 700
Design of high-speed generators, Some difficulties of, by Prof. A. B. Field, 732, 764, 797, 841
Design of high-pressure distribution systems, by J. R. Beard, 829, 861
Diesel engines, Cracked and seized pistons on, by G. E. Windeler, 70, 748
Diesel engines, Lubrication of, 557
Domestic electric heating, by Prof. A. H. Barker, 775
"Earth resistance," A note on, by Prof. E. W. Marchant, 415
Economic problems after the war, by W. Cunningham, 413
Economics and the war, 359
Efficiency of a gas engine, Thermal, by Profs. G. Asakawa and J. E. Petavel, 365
Electrical industry and the war, The, by H. Hodgson Wright, 670; by D. A. Starr, 735
Electricity supply, by C. P. Sparks, 682
Electricity supply in China, by W. G. L. Riddle, 607
Electrolytic copper, The production and properties of, by B. Welbourn, 647, 700
Electromagnetic vacuum balance, An, by Dr. J. S. Anderson, 267
Elevator, The modern electric, by D. Lindquist, 486
Engineering, The relation of science to practice in, by Prof. E. W. Marchant, 637
Fatigue, Industrial, 423
Field telephones, by C. R. Darling, 377
Finance, War credit and, 412
Fuel consumption, The control of, by Prof. W. A. Bone, 415
Gas engine, Thermal efficiency of a, by Profs. G. Asakawa and J. E. Petavel, 365
Gas-producer for steam boilers, A, by E. C. Mills, 365
Gaseous explosions, Committee on, 426
Generators, Some difficulties of design of high-speed, by Prof. A. B. Field, 732, 764, 797, 841
Heating, Domestic electric, by Prof. A. H. Barker, 775
Heating, Electric, by G. Wilkinson, 828
Heating of iron when magnetised at very high frequencies, The, by N. W. McLachlan, 423
High-pressure distribution systems, The design of, by J. R. Beard, 829, 861
Incandescent lamp, A new high-efficiency, by E. A. Gimingham and S. R. Mullard, 743
Industrial fatigue, 423
Industrial harmony, 360, 411
Iron, The transformations of pure, 731
Iron when magnetised at very high frequencies, The heating of, by N. W. McLachlan, 423
Labour after the war, 422
Lamp, A new high-efficiency incandescent, by E. A. Gimingham and S. R. Mullard, 743
Lifts, Electric, by H. Marryat, 861
Loss as affected by triple harmonics, Transformer core, by H. M. Lacey and C. H. Stubbings, 424
Lubrication of Diesel engines, 557

PROCEEDINGS OF SOCIETIES AND INSTITUTIONS—*continued.*
Magnetic testing of bars, by A. Campbell and D. W. Dye, 859
Manchester Corporation gas undertaking, The, 414
Manchester electricity supply undertaking, by S. L. Pearce, 413
Metal spray processes in engineering, by J. Calder, 391
Mining plant, The use and abuse of oils on, by T. C. Thomsen, 284
Modern electric elevator, The, by D. Lindquist, 486
Municipal Electrical Association, Incorporated.—Vehicles in municipal service, The use of electric, 25; Annual report and report of the Development Committee and Electric Vehicle Committee, 58
Municipal Tramways Association (Inc.), Annual conference, 405, 420
Oil circuit-breakers: Notes on arc phenomena and tendencies in design, by K. C. Randall, 317
Oils on mining plant, The use and abuse of, by T. C. Thomsen, 284
Pistons on Diesel engines, Cracked and seized, by G. E. Windeler, 70, 748
Point Five tariff, The practical result of the, by T. Roles, 132
Power station switchgear, by P. V. Hunter, 669
Production and properties of electrolytic copper, The, by B. Welbourn, 647
Pumps for colliery pumping, Turbine, by H. R. Willis, 316
Radiotelegraphic investigations, 425
Science to practice in engineering, The relation of, by Prof. E. W. Marchant, 637
Signalling, Submarine, by R. F. Blake, 28
Spray processes in engineering, Metal, by J. Calder, 391
Stave Falls power development, 639
Submarine signalling, by R. F. Blake, 28
Switchgear, Power station, by P. V. Hunter, 669
Telephones, Field, by C. R. Darling, 377
Testing of bars, The magnetic, by A. Campbell and D. W. Dye, 859
Tests of light aluminium alloys, Exposure, by Prof. E. Wilson, 426
Textile Institute, The, 574
Thermostat for moderate and high temperatures, A, by J. L. Haughton and D. Hanson, 489
Training of an engineer, The, by A. E. A. Edwards, 639
Tramways Association annual conference, The Municipal, 405, 420
Tramways during war time, by J. W. Dugdale, 102
Transformation of pure iron, The, 731
Transformer core loss as affected by triple harmonics, by H. M. Lacey and C. H. Stubbings, 424
Turbine pumps for colliery pumping, by R. H. Willis, 316
Unbroken alternating current for cable telegraphy, On an, by Lt.-Col. G. O. Squier, 156, 187
Vacuum balance, An electromagnetic, by Dr. J. S. Anderson,
Vehicle Committee, Report of the Electric, 60
Vehicles, Battery exchange system for electric, 614
Vehicles in municipal service, The use of electric, 25
War credit and finance, 412
War, Economic problems after the, by W. Cunningham, 413
War, Economics and the, 359
War, Labour after the, 422
War time, Tramways during, by J. W. Dugdale, 102
War, The electrical industry and the, by H. Hodgson Wright, 670; by D. A. Starr, 735

Professional classes war relief, 724
Professional etiquette, 115
Profits, Limitation of, 407, 760
Profits of municipalities, Excess, 760
Propulsion of battleships, Electric, 755
Protecting bright articles from rust, 757
Prosperity week, Electrical, 16, 690
Puebla, Mexico, An underground telegraph cable installation in, by W. D. Hale, 708
Pumps for colliery pumping, Turbine, by R. H. Willis, 316
Pyrometry, Electrical, 194
Pyrometry, Recent progress in, by C. R. Darling, 200

QUARTZ lamps, Submarine photography by aid of, 126

RADIOTELEGRAPHIC investigations, 425
Radiographic method for localising bullets, A simple, by L. Crouch, 155
Radium and plant growth, 499
Radium in the United States, 277
Radium spring discoveries, 340

RAILWAY NOTES—
Australia, 112, 206, 370, 402, 561, 752, 816
Belgium, 274

RAILWAY NOTES—*continued.*
  Brierley Hill, 176
  Canada, 142, 370, 816
  Chicago, Milwaukee & St. Paul Railway electrification, 436, 605
  City & South London Railway, 46
  Continental, 13, 77, 142, 274, 337, 402, 435, 529, 595, 655, 753
  Dover, 622
  Formby, 143
  France, 655
  Gloucester, 176
  Italy, 77, 402, 435, 529, 655, 753
  Japan, 595, 688
  London, Brighton & South Coast, 720
  Lancashire & Yorkshire Railway electrification, 77
  London Electric Railway Co., 77
  London & South-Western Railway electrification, 240, 274, 529, 688, 720
  Lancashire & Yorkshire Railway electrification, 753
  Newcastle-on-Tyne, 848
  New Zealand, 655
  North-Eastern railway, 370
  Portugal, 655
  Rowley Regis, 46
  Sicilian Railway electrification, 337
  Spain, 143
  Sweden railway electrification, 847
  Switzerland, 13, 142, 595, 847
  Waterloo & City Railway, 688
  Wharfedale, 595

Railway disaster, Gretna, 434
Railway electrification, A Japanese, 208
Railway electrification, London and South-Western, 390, 431, 449, 548
Railway operation, Direct-current 5,000-volt, 722
Railway shunting engine telegraph, 629
Railway station lighting, 11
Railway, The electrification of the Chicago, Milwaukee and St. Paul, 436, 605
Railway, U.S.A., Heavy tonnage electric service on the Norfolk and Western, 134
Railways and the law of negligence, Electric, 270
Railways, Australian, 84
Rain-making, Electrical, 145
Rand, Electricity on the, 193
Randfontein Estates, The central power station of the, by R. T. Mawdesley, 80, 100, 154
Rand mines, Power supply to the, 220
Rates, Putting the loss on the, 610
Rays, Bottle, 261
Receiver for continuous waves, The double audion, 347
Recruiting, Munition workers and, 803
Refuse, Units from, by A. J. Abraham, 94; J. B. Morgan, 196
Reinforced concrete construction, 849
Remote control of marine engines, 628
Register, The national, 34
Research Board of Inventions, Admiralty and, 115, 144, 755
Research laboratory of the General Electric Co. of New York, The, 518
Research, Scientific and industrial, 146
Review of 1915, 833

REVIEWS—
  Alignment Charts, by E. S. Andrews, 11
  Alternating-current Electricity and its Application to Industry, First Course, by W. H. Timbie and H. H. Higbie, 212
  Analyst and Client, by C. H. and N. D. Ridsdale, 559
  Arithmetic of Alternating Currents, by E. H. Crapper, 439
  Automatic Telephony, by A. B. Smith and W. L. Campbell Fellow, 212
  British Standard Specification for Electricity Meters, 368
  British standard specification for wall plugs and sockets, 845; for Charging plug and socket, 845
  British standardisation rules for electrical machinery, 620, 741, 803
  Constant Voltage Transmission, by H. B. Dwight, 241
  Continuous-current Electrical Engineering, by W. T. Maccall, 461
  Dynamics of Surfaces, The, by Prof. Leonor Michaelis, 171
  Dynamometers, by F. J. Jervis-Smith, 213
  Elements of Electro-plating, The, by J. T. Sprague, 796
  Electrical Conductivity and Ionisation Constants of Organic Compounds, The, by H. Scudden, 276
  Electrical Engineering, by Dr. T. C. Baillie, 460
  Electrical Instruments in Theory and Practice, by W. H. F. Murdoch and U. A. Oschwald, 276
  Electricity in Gases, by Prof. J. S. Townsend, 172
  Electricity in Mining, by D. R. Shearer, 153
  Electric Light Fitting, by S. C. Batstone, 153
  Elementary Principles of Illumination and Artificial Lighting, by A. Blok, 171
  Graphical Determination of Sags and Stresses for Overhead Line Construction, by Guido and Marco Semenza, 439
  Hand Lettering for Engineers, Architects, Surveyors, and Students, by W. J. Lineham, 803

REVIEWS—*continued.*
  Konstruktion und Prüfing der Elektrizitätszähler, by A. Königswerther, 153
  Manual of Electrical Undertakings and Directory of Officials, 1915-16, by E. Garcke, 140
  Mathematical analyses of electrieal and optical wave motion on the basis of Maxwell's equations, by Dr. H. Bateman, 839
  Modern Boiler Practice and Smoke Abatement, by J. T. Hodgson, 302
  Modern Illuminants and Illuminating Engineering, by L. Gaster and J. S. Dow, 795
  Motor Cycles: A Practical Handbook on their Building, Care, and Management, by B. E. James, 213
  Overhead Transmission Lines, by F. Kapper, 840
  Principles and Practice of Electrical Engineering, by A. Gray, 302
  Reports of Experiments on Tungsten Filament Glow Lamps: Parts I and II, 171
  School electricity, A, by C. J. L. Wagstaff, 242
  Slide Rule, The, by C. N. Pickworth, 43
  Standard Handbook for Electrical Engineers, by F. F. Fowle, 796
  Tramway Track Construction and Maintenance, by R. B. Holt, 839
  Treatise on the Theory of Alternating Currents, A, by A. Russell, 796
  Universal Directory of Railway Officials, 1916, 140
  Wireless Telegraphists' Pocket Book of Notes, Formulæ, and Calculations, by J. A. Fleming, 400
  Wireless Telegraphy, by A. B. Rolfe-Martin, 171
  Wiring of Finished Buildings, by T. Croft, 241
  Year-book of Wireless Telegraphy and Telephony, 1915, The, 242

Rifle club friendly, 690
Rifle ranges, Electric remote indicators for, 326
Roll of Honour, 51, 85, 116, 180, 246, 278, 341, 374, 406, 438, 472, 501, 533, 566, 598, 630, 660, 693, 725, 757, 789, 820, 851
Royal Engineers (Wireless Section), 308
Royal Society of Arts, 245
Rubber, 66, 162, 258, 355, 450, 546, 643, 739, 835
Rubber, Artificial, 850
Ruhleben, News of prisoners of war at, 657
Rules for electrical machinery, British standardisation, 741, 803
Running costs, Electric motor-car, 126
Russia, 237
Russia and foreign capital, 129
Russia and German influence, 387
Russia, British co-operation in, 834
Russia, Electrical trade in, 276
Russia, Future trade with, 786
Russia, Nitrogen fixation in, 754, 827
Russia, On trading with, 99
Russia, Steel wire for; An urgent inquiry, 630
Russia, The trade of, 711
Russia, Trade between the United Kingdom and, 140
Russian copper production, 17
Russian Customs tariff, New, 6, 38, 91
Russian electric stations, Peat fuel for, 760
Russian electrical plant, Removing, 499
Russian electricity supply, The war and, 353
Russian electricity works statistics, 701
Russian electrochemical industry, The, 303, 470
Russian iron for electrical purposes, 849
Russian language, The, 564
Russian nickel, 404
Russian tax on electricity, A, 547, 723
Rust, Protecting bright articles from, 757

SALESMAN, The, by E. P. Bennett, 525
San Francisco, Electrical convention at, 49
San Francisco, Engineering congress at, 15
Santiago rumour, A, 813
Saw mills, The electric driving of, 57
Scale-marking of indicating instruments, A machine for, 387
Science and the nation, 769
Science and the war, 97, 321
Scientific and industrial research, 146
Scientific organisation of science, The, 33
Scrap nickel anodes, Utilising, 288
Screws, Standardisation of B.A., 84
Sea, Estimating distance at, 723
Searchlight plant, An American motor, 676
Selling side of electricity supply, The, 228, 348
Sequestration, 272
Sewer gas for generating electricity, 114
Shanghai electricity works, 591, 624, 665
Sheathed-wire heating units, by C. P. Randolph, 37
Sheffield, Municipal "hustle" at, 597
Ships, Lighting national colours on, 722
Shirkers fined, 308
Short-circuit, Nearly a dead, 723
Siam, Trade statistics of, 572
Signalling in mines, Electric, 65
Signalling, Submarine, by R. F. Blake, 28
Silicon-iron, The magnetic and electrical properties of pure, 705
Situations, Hints to applicants for, by E. C. McKinnon, 243
Smelting of tin, Electric, 731
Smoke abatement, 214, 736
Smokestacks, Corrosion of steel, by R. I. Elkin, 774
Societies and Institutions (a directory of names and addresses), 93
Societies: The 1915-16 session, Engineering and other, 484
Soldiers, Electrically-heated, 658
South Africa, American trade in, 428
South Africa, Trade in, 610, 613
South African electrical imports, 560
South Africa, Trade statistics of, 367, 445
South African power station, 531
South African railway system, Electricity on the, 405
South America, Trade with, 50
Spain, New lamp factories in, 718, 782
Spanish electrical industry, The, 450
Spanish prize competition, 499
Sparks, Chas. P. (President of the I.E.E.), 623
Specialisation, Over-, by J. Marks, 172
Specifications and New Patents, Published, 32, 64, 96, 128, 160, 192, 224, 256, 288, 320, 352, 384, 416, 448, 480, 512, 544, 576, 608, 640, 672, 704, 736, 768, 800, 832, 864
Spray processes in engineering, Metal, by J. Calder, 391
Standardisation in China, Electrical, 17
Standardisation of B.A. screws, 84
Standardising electrical motor-car fittings in the United States, 93
Standardisation rules for electrical machinery, The British, 741, 803
Standards Committee, Engineering, 145
Stars, The electrical photometry of, 373
Starters, Electric engine, 691
Starting and lighting equipments in the States, Car, 296
Steam-electric dredge, A, 50
Steel, Australian, 331
Steel furnaces, New electric, 451
Steel in Germany, Electric, 607
Steel mill auxiliary rolls, Control apparatus for, 7
Steel works, Electricity in, 372
Stepney, Electricity extensions at, 552
Sterilising equipment, A simple, 356
Stokers, Large capacity, 74
Stowmarket, The supply of electricity at, 433
Straits Settlements, Trade statistics of, 812
Strike at Schenectady, 480
Strike of Dublin electricians, 373
Stroboscopic frequency measurements, 186
Submarine mining, Electricity in, 454
Submarine photography by aid of quartz lamps, 126
Submarine signalling, by R. F. Blake, 28
Submarine telegraphy, New methods in, 161
Submarines, The electrical equipment of, by W. O. Horsnaill, 3
Sugar mills and refineries, The case for the electrification of cane, by E. P. Hollis, 163, 195
Supply problems, The large turbine and, 739
Supply works and coal supplies, Electricity, 738
Suspension of a contract, The, 173
Sweden, Heating houses by electricity in, 729
Sweden, New electrical manufacturing in, 551
Swedish electrical exports, 294
Swiss electro-metallurgy and French connections, 404
Swiss or German? 675
Switzerland, Exports to, 846

TARIFF, New Russian Customs, 6, 38, 91
Tariff, The problem of the "Point-Five," 443, 476
Tariffs and trade "capturing," Australia on, 405
Tariffs on electrical goods, Foreign and colonial, 127, 159, 255, 320, 383, 479, 608, 832
Tax, Excess profits, 596
Tax on electricity, A Russian, 547, 723
Taxicabs for New York, Electric, 604
Technical colleges and war work, 50
Telegraph cable installation in Puebla, Mexico, An underground, by W. B. Hale, 708

TELEGRAPH NOTES—
  Argentina, 595
  Australia, 371, 529, 656, 720
  British cable-ship lost, 143
  Cable censorship, 177, 785
  Cable repair, 529
  Canada, 46, 274
  Cocos Island, 402
  Code telegrams, 689, 720
  Colombian neutrality, 177
  Duplex Marconi wireless, 848
  German cables, 14
  Illicit wireless apparatus, 77, 436, 785

TELEGRAPH NOTES—*continued.*
  Italy, 211, 240
  Japan, 143, 240, 753
  Long-distance wireless, 848
  Mexico, 274
  New cable, 274, 497
  Norway, 306, 497
  Pacific cable, 817
  Panama Canal, 14
  Paraguay, 656
  Postal servants, 46
  Recording wireless signals, 595
  Reduced wireless rates, 306
  Revision of tariffs, 529
  Russia, 46, 785, 817, 848
  Secret wireless, 143, 177, 274, 689
  Singapore, 689
  Submarine detectors, 785
  Suit against American Marconi Co., 274
  Swedish telautograph, A, 720
  Swedish wireless station, 143
  Telegraph and telephone tariffs, 402
  Telegraph plot, 307
  Telegraph service, The, 77, 371
  Telegraphic blockade, A, 469
  Telegraphists' cramp, 469
  Tireless wireless, 14
  United States, 143, 274, 371, 627
  Uruguay, 656
  West Indies, 627
  Wireless control, 177
  Wireless experiences at Gallipoli, 307
  Wireless in Australia, 77
  Wireless in territorial waters, 656
  Wireless in the air service, 436
  Wireless libel, 177
  Wireless news, 274
  Wireless on board ship, 595, 656
  Wireless station sequestrated, 77
  Wireless telegraph relay, 785
  Wireless tower wrecked, 627
  World's wireless, 371, 720

Telegraph, Railway shunting engine, 629
Telegraph system, A new printing, 230, 263
Telegraphy, Alternating-current cable, by E. Raymond Barker, 250
Telegraphy, New methods in submarine, 161

TELEPHONE NOTES—
  Argentina, 656
  Australia, 211, 371, 436, 497, 720, 848
  Berlin-Sofia, 848
  Brighton, 720
  Chorley, 240, 497
  Eccles, 240
  Hull, 656, 720, 753
  Italy, 656
  Japan, 497
  Leyton, 753
  London-Birmingham-Liverpool telephone cable, 340
  Long-distance telephony, 402
  New telephone, 497
  New telephone subscribers, 371
  New York Telephone Directory, 274
  Postal servants, 46
  Russia, 753
  South America, 211
  Spain, 497, 595, 656
  Spanish Guinea telephones, 306
  Stockport, 307
  Telephone and telegraph tariffs, 402
  Telephone service economies, 177
  Telephone service, The, 436, 469
  Telephoning in French, 497
  Telephone interruptions, 848
  Telephones in warfare, 177
  Throat telephones, 143
  Wireless telephony, 469, 529, 562, 689, 753, 785

Telephone cable, London-Birmingham-Liverpool, 340
Telephone number, The *Electrical Review*, 213
Telephone service, The, 67
Telephones, Field, 213
Telephones, Field, by C. R. Darling, 377
Telephony on airships, 672
Telephony, Wireless, 547
Temperatures, A thermostat for moderate and high, by J. L. Haughton and D. Hanson, 489
Territorial Force.—London Electrical Engineers, 471
Tests of light aluminium alloys, Exposure, by Prof. E. Wilson, 436
Textile Institute, The, 574
Thermocouples, Making and using, by F. G. Coburn, 748
Thermostat for moderate and high temperatures, A, by J. L. Haughton and D. Hanson, 489
Third-rail construction on the L. and Y. Manchester-Bury line, 315
Time, Knocked out of, 197
Tin, Electric smelting of,
Trade after the war—"Be prepared," 258
Trade announcements, 204, 238
Trade, Australia's invitation to, 675
Trade, Capturing foreign, 214
Trade conditions after the war, by C. F. Mottram, 543
Trade entente after the war, 293
Trade Fair abandoned, 527
Trade, Foreign, 83, 213, 339, 499, 629, 756
Trade, German, 471
Trade in China, British, 718
Trade in 1914, Italy's electrical, 16
Trade in Russia, Electrical, 276
Trade in South Africa, 610, 613
Trade, Indian, 179
Trade journalism, Standards in, 475
Trade of Australia, The, 678
Trade of China, Import, 610, 646

Trade of Japan, 762
Trade of New Zealand, 794
Trade of Russia, 711
Trade organisation, Foreign, 737
Trade outlook, The British, 783
Trade position in China, The electrical, by G. R. Archdeacon, 185; W. G. L. Riddle, 556
Trade relations with Latin America, United States, 115
Trade statistics of Brazil, 164
Trade statistics of Egypt, 1914, 299
Trade statistics of India, 381
Trade statistics of Italy, 254
Trade statistics of Japan, 1914, 543
Trade statistics of Siam, 572
Trade statistics of South Africa, 445
Trade statistics of the Straits Settlements, 812
Trade, The future of export, 219
Trade union alliance, 788
Trade with Egypt, British electrical, by "Anglo-Egyptian," 283
Trade with Russia, Future, 786
Trade with South America, 50
Trading opportunities throughout the world, Our, 612, 646, 678, 711, 762, 794
Trading with Russia, On, 99
Trading with the enemy, 813
Train lighting, 373, 819
Transmission line, A kite and a, 658

TRAMWAY NOTES—
  Aberdeen, 142, 240, 306, 561, 590
  Accrington, 240, 337, 468
  Ambleside, 370
  Argentina, 468
  Ashton-under-Lyne, 112, 370, 655, 816
  Australia, 13, 176, 240, 435, 468, 496, 752, 847
  Ayr, 402, 561
  Barrow, 77, 176
  Belfast, 45, 274, 306, 752
  Bexley, 688
  Bingley, 274, 688, 785
  Birkenhead, 370, 622
  Birmingham, 13, 77, 561, 655, 712, 785, 816
  Birtley, 240
  Blackburn, 306, 590
  Blackpool, 13, 112, 142, 176, 274, 306, 435, 529, 561, 590, 719, 753, 847
  Bolton, 13, 468
  Bournemouth, 45, 688, 785
  Bradford, 77, 370, 468, 496, 688, 720, 752, 847
  Bristol, 370
  Burnley, 45, 77, 206, 337, 562, 688, 816
  Bury, 142, 496, 655
  Canada, 370
  Castleford, 142
  Chester, 435
  Colchester, 753
  Colne, 720
  Continental, 77, 112, 142, 211, 274, 306, 435, 496, 655, 720, 785, 848
  Croydon, 143, 436, 562, 688
  Cuba, 496
  Dartford, 337
  Darwen, 112, 562, 785
  Derby, 753
  Dewsbury, 529
  Doncaster, 45, 77, 436, 496
  Dublin, 211
  Dundee, 45, 306, 590, 720
  East Ham, 435
  Edinburgh 720, 816, 848
  Exeter, 143
  Germany, 306, 848
  Glasgow, 13, 143, 274, 337, 402, 562, 655, 688, 848
  Hackney, 143
  Halifax, 143, 176, 468, 562, 595, 655, 816, 848
  Hastings, 622
  Hove, 240
  Huddersfield, 176, 274, 306, 595, 655
  Hull, 14, 77, 816
  Hyde, 655, 816
  Ilford, 14, 595
  India, 496
  Ipswich, 468, 816
  Irlam, 176
  Italy, 142, 211, 655
  Keighley, 14, 468, 753
  Kirkcaldy, 45
  Lanarkshire, 785
  Leeds, 77, 496, 529, 595
  Leicester, 143, 562
  Leyton, 45, 176, 785
  Liverpool, 306, 497,
  London, 14, 46, 112, 143, 337, 370, 497, 529, 562, 622, 655, 688, 785
  London County Council, 14, 112, 143, 337, 562, 622, 688, 817
  Lowestoft, 402, 655, 689
  Manchester, 45, 176, 211, 306, 338, 402, 497, 529, 562, 720, 817
  Meltham, 436
  Mexborough and Swinton, 338
  Mexican tramways.—Two managements, 471
  Middlesex, 689
  New Zealand, 497, 562, 817
  Newcastle-on-Tyne, 143, 475, 562, 753, 848
  Newport (Mon.), 689
  Normanton, 720
  Northampton, 46, 785, 817
  Northenden, 720
  Nottingham, 370
  Oldham, 240, 436, 497, 562, 622, 817
  Penang, 529
  Perth, 529
  Portsmouth, 274
  Portugal, 306
  Preston, 689
  Ramsbottom, 46
  Rawtenstall, 112, 402, 436, 468
  Reading, 338, 720

TRAMWAY NOTES—*continued.*
  Rochdale, 77, 211, 338, 497, 529, 562, 622, 655, 817
  Russia, 112, 785
  Salford, 211, 274, 338, 720, 817
  Sheffield, 176, 240, 753, 785
  South Africa, 14
  South Lancashire, 529, 817
  South Shields, 77, 176, 337
  Southampton, 176, 371, 497
  Southend-on-Sea, 402
  Southport, 371, 497
  Spain, 77, 274, 435, 496, 655, 720
  Stalybridge, 46, 595
  Stockport, 689, 753
  Stoke-on-Trent, 595
  Stockport, 14, 77, 338, 848
  Sunderland, 720
  Swanscombe, 112
  Swansea, 143, 720
  Tottenham, 143
  Tynemouth, 817
  Uruguay, 402
  Walsall, 77, 371, 497
  Walthamstow, 817
  Warrington, 77, 338
  West Ham, 176, 689
  West Hartlepool, 14, 622
  Wharfedale, 306, 371, 656
  Wigan, 77, 176, 274, 371
  Wolverhampton, 77, 274, 622
  Worcester, 211
  York, 622

Tramway and Light Railways Association Congress, 1915, The, 102
Tramway labour problem, The, 419
Tramway Managers, Metropolitan Association of Electric, 50, 531
Tramways in the Commonwealth of Australia, Particulars of electric, 539
Tramways Association annual conference, The Municipal, 405, 420
Tramways during war time, by J. W. Dugdale, 102
Tramways.—Two managements, Mexican, 471
Transformer core loss as affected by triple harmonics, H. M. Lacey and C. H. Stubbings, 424
Transmission line, Four years' operating experience on a high-tension, 189
Transmitter, The ideal, 569
Trend of electrical development, The, 292, 345
Tungsten, Properties of, 690
Turbine and supply problems, The large, 739
Turbine pumps for colliery pumping, by R. H. Willis, 316
Turbine, The gas, 755
Turbo-generator set, Gear-driven D.C., 165

UMBRELLA type, The capacity of aerials of the, by Prof. G. W. O. Howe, 426
Unbroken alternating current for cable telegraphy, On an, by Lieut.-Col. G. O. Squier, 156, 187
Underground telegraph cable installation in Puebla, Mexico, An, by W. B. Hale, 708
United States electrical exports, 256, 475, 718
United States, The electrical industry in the, by "Contango," 483
United States trade relations with Latin America, 115
Units from refuse, by A. J. Abraham, 94; J. B. Morgan, 196

VACUUM balance, An electromagnetic, by Dr. J. S. Anderson, 267
Vehicle, A Boots electric, 755
Vehicle, A low-priced electric, 79
Vehicle Association of America, The Electric, 213, 458
Vehicle Committee, Report of the Electric, 60
Vehicle Committee, The Electric, 511, 721, 819
Vehicle, New 7-cwt. Edison electric, 500
Vehicle progress, Electric, 260
Vehicle run, A 500-mile electric, 499
Vehicle, The "Ward Special" electric, 532
Vehicles, Encouraging the use of electric motor, 313

Vehicles in laundry service, Electric, 377
Vehicles in municipal services, The use of electric.—I.M.E.A., 25
Vehicles, United States central station users of electric, 219
Vibrational disturbances, The isolation of, by F. H. Davies, 505
Voltage, A tidal, 144
Volunteer Notes, 17, 50, 83, 113, 146, 179, 214, 245, 277, 309, 340, 373, 405, 437, 471, 499, 533, 565, 597, 629, 659, 692, 722, 756, 787

WAGES arbitration, Electrical trades, 244
War and British industry, The, 577, 596
War and Russian electricity supply, The, 353
War and the future of the electrical industry, 35
War bonus, Post Office, 340
War, British electrical and allied manufacturers' discussion, After the, 826
War credit and finance, 412
War, Economic problems after the, by W. Cunningham, 413
War, Discussion in the House of Lords, After the, 826
War, Economic problems suggested by the, 513
War, Economics and the, 359

WAR ITEMS—
  A.E.G., 127
  A.E.G. as an oracle, The, 366
  A.E.G. men, 500 Iron Crosses for the, 9
  After the war problems, 615, 779, 843
  Air raid at Mülheim, The, 302
  Air raids and fire extinguishers, 512
  Aluminium exports prohibited, 616
  America and the Russian market, 367
  American electrical exports, The war and, 398, 575, 615
  American electrical industry, Effects of a year of war upon, 300
  American exchange, British exports and the, 523
  American Westinghouse orders, 334
  Australia, 9, 170
  Australia and enemy companies, 270, 301
  Australia and enemy goods, 334
  Australia and German trade, 616, 685
  Australia and metals, 72, 199
  Australia, Munitions manufacture in, 300, 447
  Australia taking stock of metals, 302
  Australia, The war spirit in, 478
  Australian definition, What is a "British" firm?, 587
  Australian Government and its contractors, 586, 616
  Australian inventions, 448
  Australian metal refining, 523
  Belgians as A.S.E. men, 301
  Belgium, The situation in, 139
  Berlin traffic conditions in war time, 170
  Board of Trade inquiries, 9, 72, 270, 367
  Bolton Munitions Court, Application to the, 367
  British Insulated & Helsby Cables, 39, 139
  Cable manufacturing in Australia, Proposed, 672
  Cain, The mark of, 717
  Calico Printers' Association, Excellent record of the, 849
  Callenders at the Front, 843
  Canada, 170
  Canadian view of the future, A, 72
  Canals in war time, The, 72
  Central station employés' munition workers? Are, 576
  Contraband of war, 522
  Controlled establishments, 367, 479, 616
  Copper for Germany, New sources of, 684
  Copper reserves of Germany, The, 269
  Copper shortage in Germany, 301
  County men with the Forces, 127, 334, 717
  Derby recruits, Appeal to, 814
  Disabled soldiers for the industrial war, Arming, 684
  Disgruntled technicists, 334
  Early zeal, 301
  Eastern Telegraph Co. and the war loan, The, 40
  Ecuador, 139
  Eight Hours Act, Suspending the, 270
  Electrical men wanted, 587
  Electrical plant contracts during war-time, 512
  Electrical treatment for wounded soldiers, 717
  Electrical Volunteers, 270
  Electrical works destroyed by French Artillery, 399
  Electricity workers and war badges, 40, 270, 616
  Electricity works and depleted staffs, 479, 615, 672
  Electricity works staffs and recruiting, 717, 767, 779, 814
  Employment of disabled sailors and soldiers, 9
  Enemy interests in English companies, 576
  Enemy lift, An, 399
  Exports to China and Siam during the war, 447, 512
  Exports to allied countries, 127
  Fans for military hospitals, Electric, 302
  Fatigue, War workers and, 399
  Fire brigades and enlistment, 814
  Foreign electrical firms and the manufacture of munitions, 478
  French Thomson-Houston Co., 127
  From the Front, 523, 768
  German activity in neutral countries, 616
  German capital in Russian electrical concerns, 399
  German confidence in the future, 813
  German connections in Australia, 512
  German electrical manufacturer, The views of a, 127
  German engineering during the war, 9
  German-owned companies, 768
  German preparations, After the war: 301
  German prices, A new advance in, 399

WAR ITEMS—*continued.*
  German shortage, 717
  German soldiers, Elementary mechanics for wounded, 367
  German war allowance, 684
  German war loan, The, 448, 479
  German workers, Artificial limbs for, 779
  Government and war badges, The, 302
  History repeating itself, 199
  Hot plates in submarines, 672
  Installation materials in Germany, 576
  Iron and Steel Institute and alien enemy members, 448
  Italy, 39, 139, 672
  Leeds roll of honour, A, 72
  Leipzig Fair, The, 334
  Licences to trade, 140
  Lighting of Armentieres, The, 448
  Lighting of London, The, 512
  Lighting precautions: Bridlington engineer fined, 302
  Lighting rules, New, 814
  Lighting supply in the war area, 170
  Limitation of output in war and in peace, 615
  London's restricted lighting, 448
  Machine guns from Canadian electrical men, 302
  Manchester companies with German capital, 72
  Manchester Corporation and enemy contractors, 586
  Miners on national service, 616
  Munitions Committee, Metropolitan, 301
  Munitions factories, Controlled, 367, 419, 616
  Munition volunteers, 40
  Munition workers, Scheme for training, 9
  Munitions workers to visit the Front, 302
  Munitions and engineers, 717
  New Zealand and enemy goods, 302
  New Zealand and inter-Imperial trade, 587
  Only real safeguard, The, 717
  Petrograd electricity works, 39
  Petrograd Lighting Co., The, 576
  Praise for the Signal Service, 399
  Price advance, A fresh German, 616
  Pro-German agents abroad, 127
  Prohibited exports, 814
  Provisional orders in war time, 616
  Rathenau optimist and the turning of the tables, 333
  Reserved occupations, 850
  Restricted lighting, 40, 72, 399, 672
  Riots on the Rand, The, 334
  Royal Engineers, 448, 575
  Royal Society's war register, The, 270
  Russia, 768
  Russia after the war, 586
  Russian, American electrical apparatus for, 768
  Russia, Enemy businesses in, 236, 779
  Russia electrical industry, 522
  Russian electricity students and the war, 768
  Russian market, America and the, 367
  Russian platinum, 170
  Russian trade, 684
  Santiago rumour, 813
  Scottish electrical contractors and munitions, 40
  Steel making at ——, 139
  South Africa, The war and electrical supplies for, 198
  Starred men, 684
  Station engineers, The war and, 478
  Steel exports? Prohibition of, 523
  Submarine, Fighting the, 302
  Switzerland, Exports to, 843
  Tasmania and enemy contracts, 843
  Trade after the war, 40, 671
  Trade openings abroad, 72, 139, 170, 270
  Trade openings in Italy, 448
  Trade service, Necessary, 716
  Trade union rules to be suspended, 399
  Trading with the enemy, 179, 367, 778, 813
  Tramway men, Patriotic, 236
  Tramway supplies in war-time, 523 767
  Tramway workers and the war loan, 170
  Unassuming Hun, The, 447
  Victoria Falls Power Co., 73
  Wages, Women munition makers', 236
  War and electrical supplies for South Africa, The, 198
  War lighting restrictions, 367
  War loan, 72, 127
  War profits, 684
  War relief funds, etc., 236
  War substitutes in Germany, 301
  War-time contract prices, 72
  War workers' theatre, 843
  Waste of brains, 843
  Westinghouse war relief fund, 367
  What is a "British" firm?, Australian definition, 587
  Wireless in the war, 139
  Women in German electrical factories, 72
  Zurich Bank for Electrical Undertakings, The, 575

War, America and trade after the, 628
War, Labour after the, 417, 422
War material supplies in Germany and incidental—robbery, The scientific organisation of, by R. Steylaers, 48

War period, Our electrical imports during the, 35, 39
War, Science and the, 97, 321
War-time: European electrical companies in, 609
War-time, Tramways during, by J. W. Dugdale, 102
War, Trade conditions after the, by C. F. Mottram, 543
War, Trade entente after the, 293
War wages, London County Council, Electrical employés, 658
War, Wireless telegraphy and the, 130
War work, Technical colleges and, 50, 843
"Ward special" electric vehicle, The, 532
Water-power, New Zealand's, 125
Water electrically, Efficiency considerations in heating, 397
Water powers, Canadian, 276
Weaverham and district electricity supply, The, 122
West Australian Government power station, 96
Western Electric Co.'s disaster, 244
Wills, 116, 180, 309, 342, 534, 660, 725, 758
Wine by electricity, Maturing, 723
Wire-drawing industries, The, 162, 354, 611
Wire for Russia, Steel: An urgent inquiry, 630
Wireless telegraph patents, 438
Wireless high-power stations, 146
Wireless, Motor-starting by, 437
Wireless telegraphy and the war, 130
Wireless telephony, 547
Wireless world service, Germany and, 1
Wiring methods in France, 437
Women workers, 745
Wool, Electricity in, 564
Workmen's compensation, 96, 339
Workshops, Lighting of factories and, 340, 355, 356
Wrecked power plant, A, 313

X-RAY gift to France, 180
X-rays, Detection of blowholes in castings by, 603

ZINC from Quebec, 565
Zinc, The electrometallurgy of, 404

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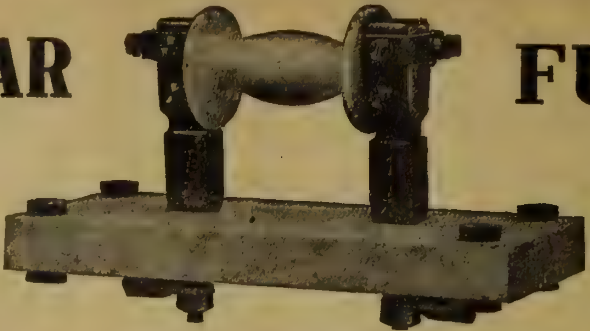

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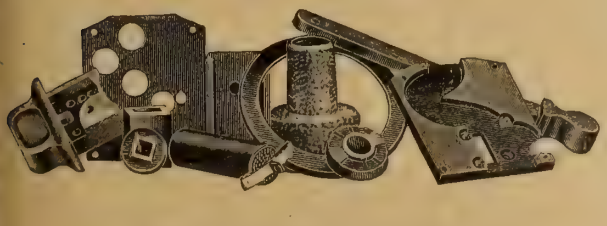

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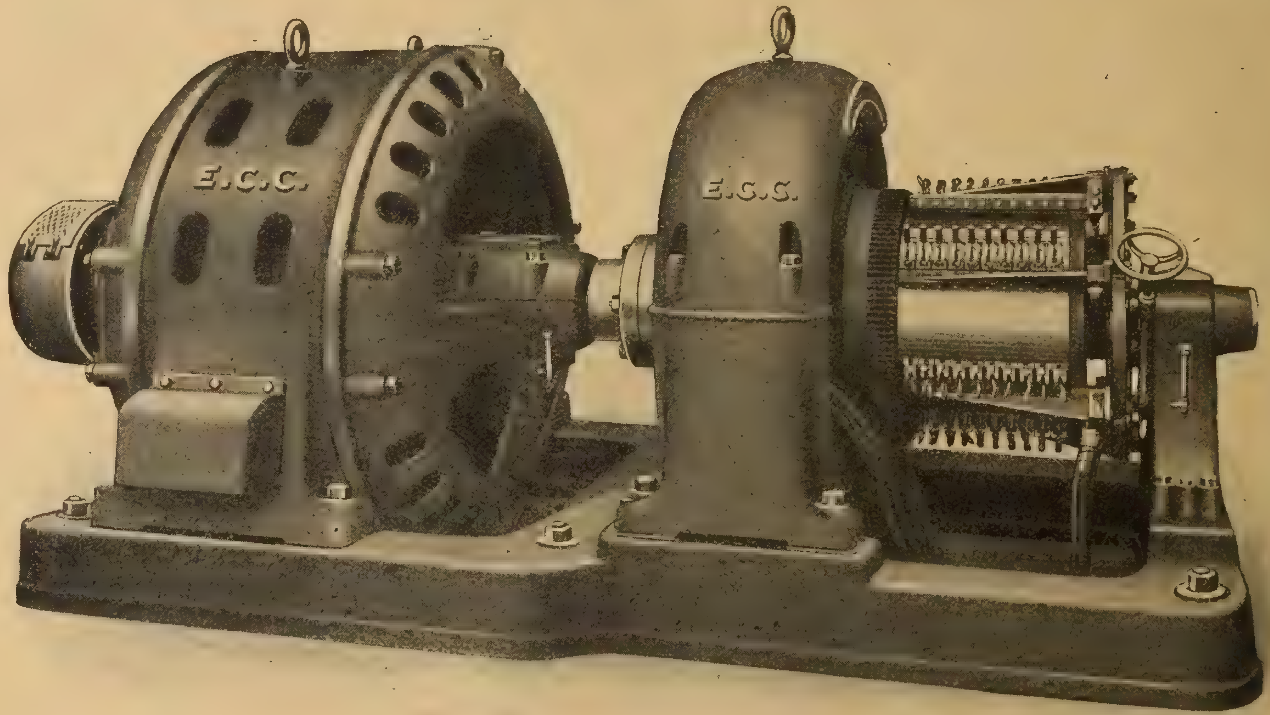

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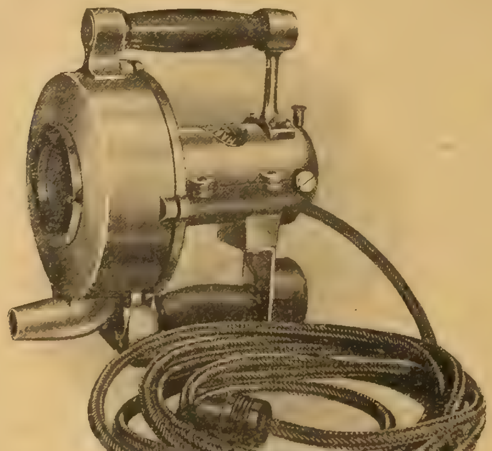

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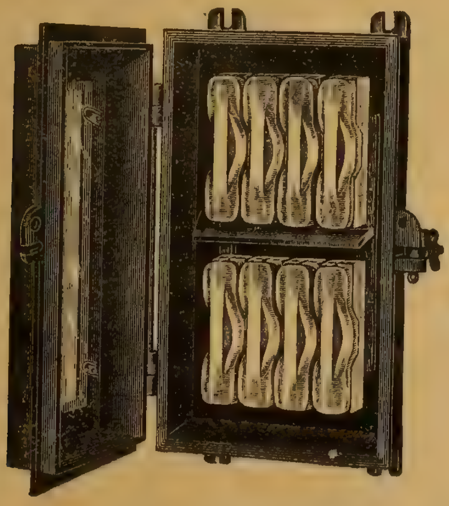

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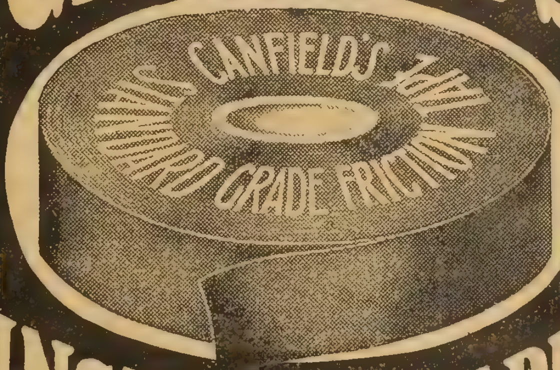

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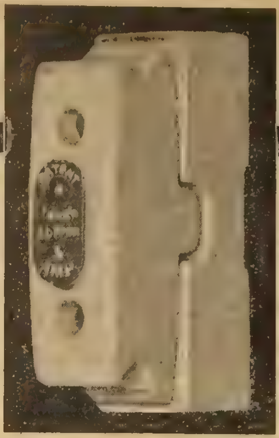

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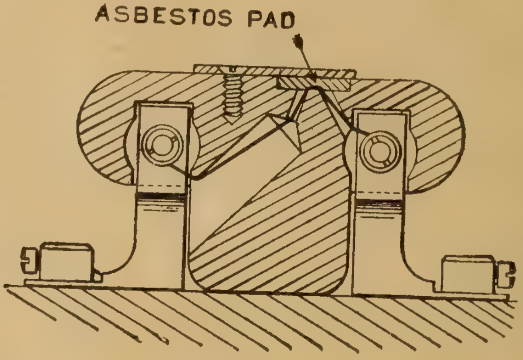

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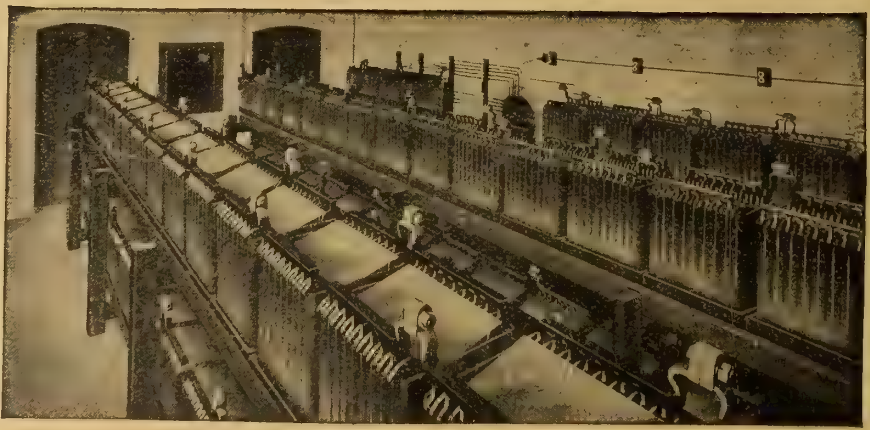

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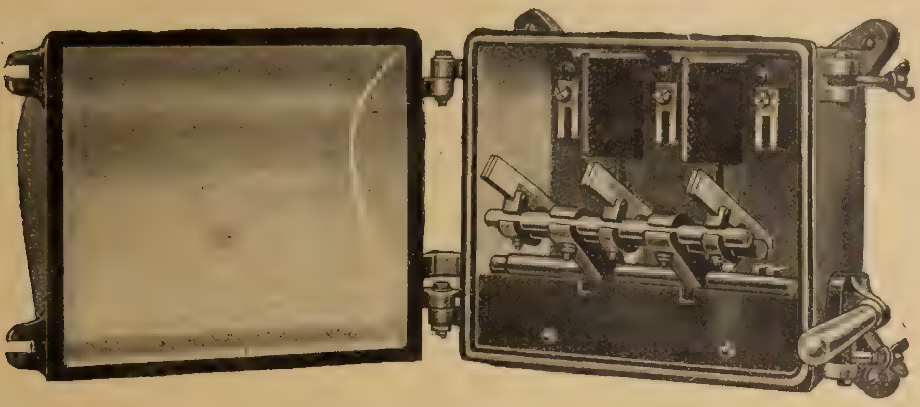

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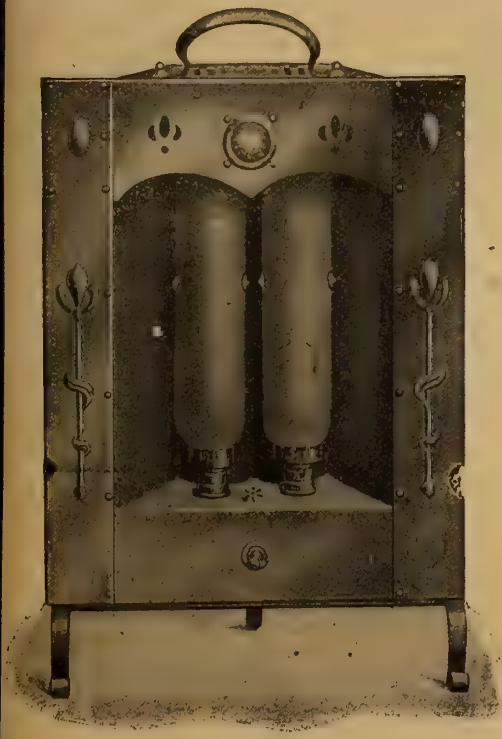

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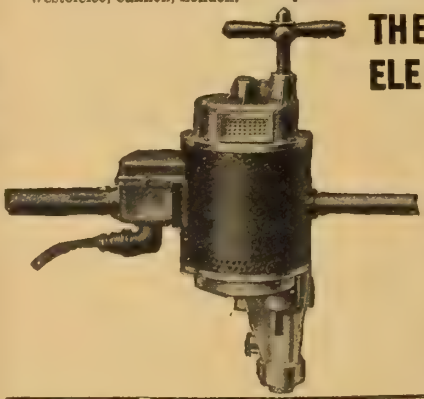

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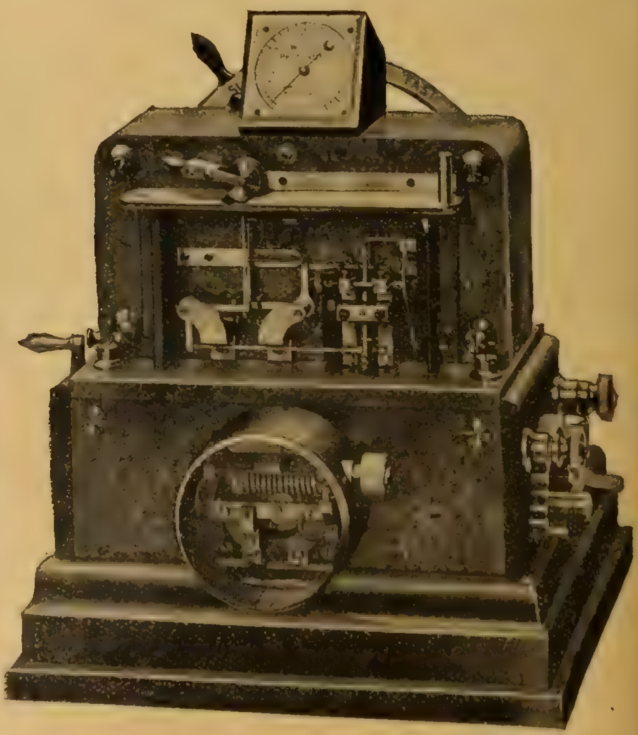

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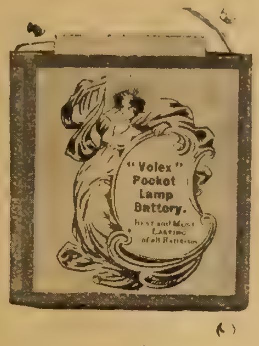
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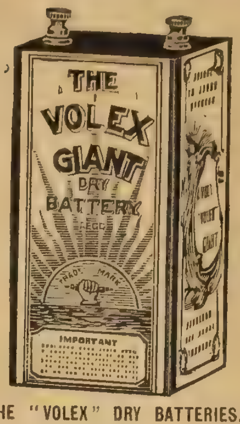
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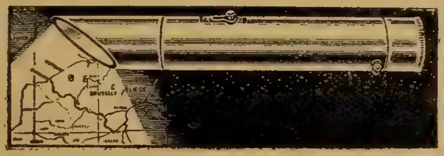

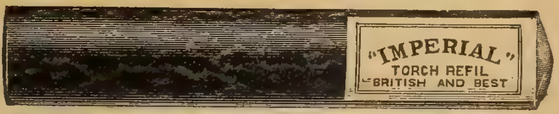

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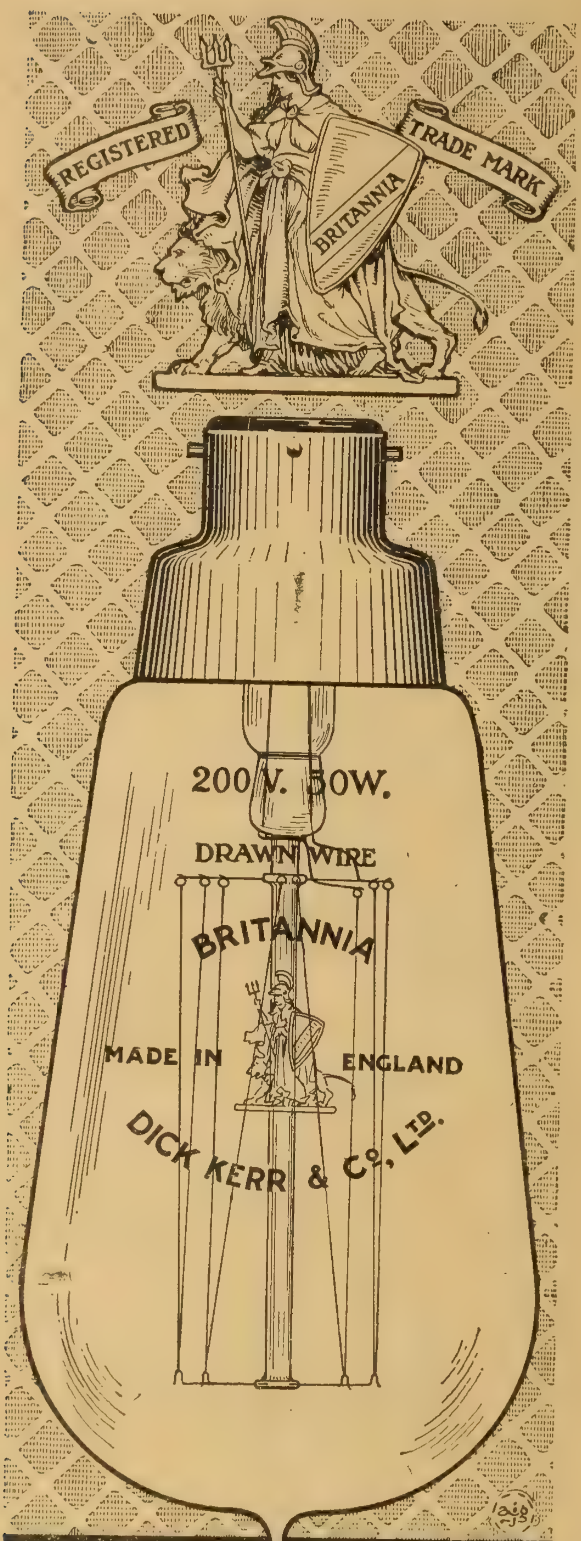

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DRAWN WIRE LAMPS
ARE MADE AT PRESTON BY
DICK KERR
AND Co., LIMITED,
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LICENSED UNDER BRITISH PATENTS NO 21313/06, 27712/08 AND OTHERS.

THE
CRESSALL
MANUFACTURING COMPANY,
40 & 41, STANIFORTH STREET,
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Manufacturers of

BRITISH-MADE
RESISTANCE MATERIALS.

RESISTANCE NETS for MOTOR STARTERS, CONTROLLERS, REGULATORS, ARC LAMPS, TESTING RESISTANCES and Special Resistances of Every Description.

"CORD" MATERIAL for ELECTRIC HEATING and COOKING APPARATUS, SLIDING RESISTANCES, and for General and Special HEATING ELEMENTS of Every Description.

ALL MATERIALS SUPPLIED BY US ARE ENTIRELY BRITISH MADE AT OUR OWN WORKS FROM MATERIALS OF BRITISH ORIGIN.

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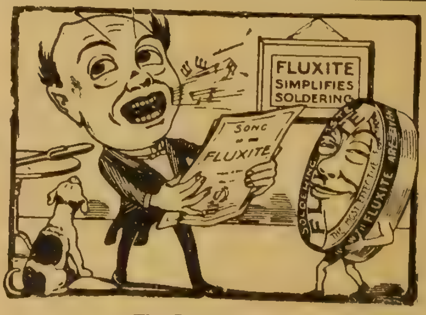
POWDERS & ELECTRODES
E. G. ACHESON, LTD.,
5, Chancery Lane, London, W.C.
See detailed Advt. last and next week's issues.



The Lusty Lung,
With all his might
The praise is sung
To friend Fluxite.

Electricians, Plumbers, Gasfitters, and other Metal Workers all sing the Praises of

FLUXITE

as the paste flux that solders even dirty metals without cleaning or corrosion, and joints lead without solder merely by the use of a blow-lamp or blow-pipe. In short, Fluxite

SIMPLIFIES SOLDERING
AND SUPERSEDES LEAD-BURNING.

If desired some solder can be filed into a little Fluxite and the two applied together. Fluxite is a necessity in every tool-kit.

YOU WANT SOME.

Of Ironmongers and Oilshops, in 6d., 1/-, and 2/- tins.
Made by THE AUTO-CONTROLLER CO., 64, Vienna Road, Bermondsey, S.E.

SULZER

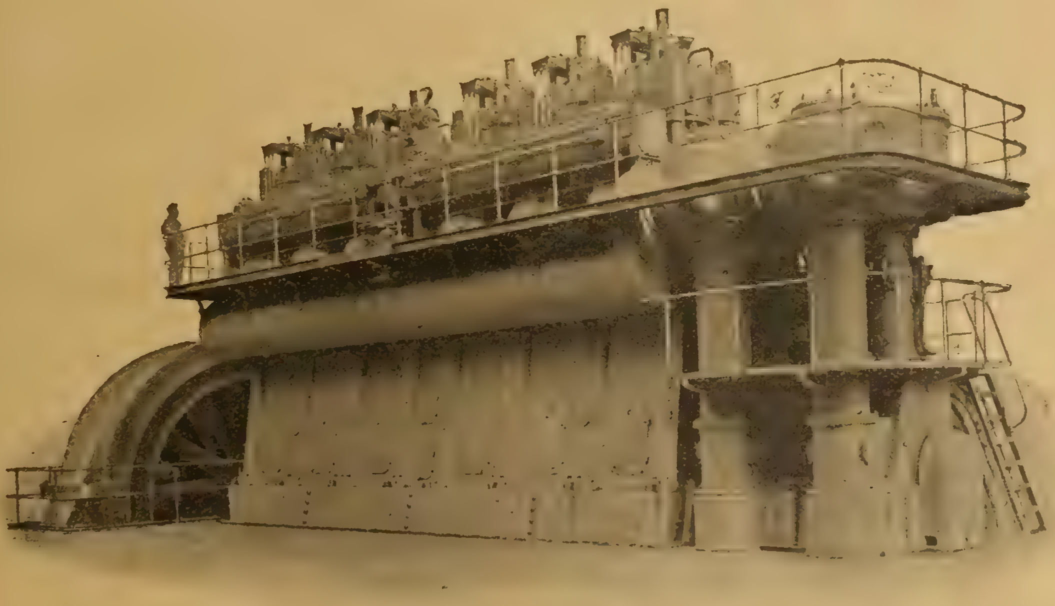
DIESEL ENGINES

For Electric Power Stations.

All sizes from 20 B.H.P. to 4,000 B.H.P.

The Sulzer Diesel Engine is particularly suitable for Electricity Works. Its compactness of design permits of inexpensive foundations and economises floor space; the simplicity of its construction and its reliability, the absence of auxiliary apparatus such as gas generators, steam boilers, etc., and the automatic regulation of fuel consumption are important advantages.

They mean
CONTINUITY OF OPERATION
A MINIMUM OF ATTENTION
& LOW MAINTENANCE CHARGES.



4,000 B.H.P. Two Cycle Diesel Engine.

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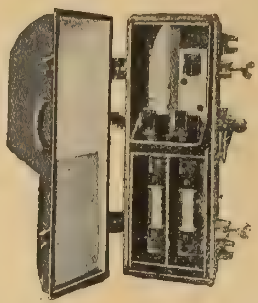
30, Norfolk Street, Strand, London, W.C.
The firm of Sulzer Brothers was founded in Switzerland in 1775.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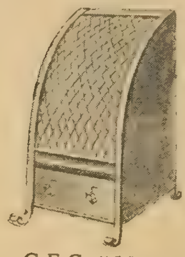
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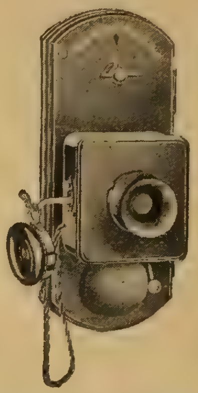
G.E.C.

The Hall Mark of Quality in everything Electrical

Every article featured on this page is British made to British Standards of workmanship. The G.E.C. have in their factories the most skilled workers, and on their staffs, scientists and specialist-consultants of exceptional ability and wide experience.


G.E.C. Telephones.

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Large Stocks held at all branches and agencies. Write for price lists and illustrated bulletins.

G.E.C. "Freezor" Electric Fans.

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G.E.C. Cables.

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The General Electric Co., Ltd.,

Head Office: **67, Queen Victoria Street, London, E.C.**

Telephone: London Wall No. 3600 (30 lines). Telegrams: "Electricity, Cent. London." Cablegrams: "Polyphase, London."

Home Branches: Manchester, Birmingham, Glasgow, Cardiff, Newcastle, Dublin, Belfast, Bristol, Swansea, Liverpool, Leeds, Sheffield, Nottingham, Hull, Southampton, Cork, Aberdeen, &c.

Branches and Agencies in the British Empire:—

British General Electric Co., Ltd., 257, Clarence Street, Sydney (N.S.W.), 590 and 590A, Bourke Street West, Melbourne (Victoria), and 8, Willesden St, Wellington (N.Z.). General Electric Engineering Co., 208 to 207, Murray St., Perth, (W.A.), and Kalgoorlie (W.A.). Norman H. Bell, 83, Eagle St., Brisbane (Queensland). Colton, Palmer & Preston, Ltd., 53, Currie Street, Adelaide (South Australia). The British General Electric Co., Ltd., 88 and 89, Castle Street, Capetown, and corner of Loveday and Anderson Streets, Johannesburg. The General Electric Co., Ltd. (India), 14, Old Court House Street, Calcutta, and 106, Armenian Street, Madras. The General Electric Co. of China, Ltd., 2, Queen's Buildings, Hong Kong, and 7, Jinkee Road, Shanghai. Bullock Bros. & Co., Rangoon (Burmah). Barbados Electric Supply Corporation, Ltd., Bridgetown, Barbados.

Foreign Branches and Agencies:—

General Electric de France, Ltd., 10—12, Rue Rodier, Paris. N. V. Van den Berg & Cos., Metaalhandel, 163, Prinz Hendrik Kade, Amsterdam. The General Electric Co., Ltd., of Belgium, 17, Rue Neuve, Brussels. Anglo-Argentine General Electric Co., Ltd., 1475—1489, Riva-davia, Buenos Aires (Argentina). Huth & Co., Valparaiso, Santiago and Concepcion (Chili). The Bangkok Dock Company, Bangkok (Siam).

THE "ELECTRICAL REVIEW"

CHEAP PREPAID ADVERTISEMENTS

Relating to Situations Vacant, Situations Wanted, Businesses Wanted, Businesses for Sale, Patents for Sale, Specific Articles of any kind Wanted, or for Sale or Exchange, are inserted at the rate of ONE PENNY per Word (minimum 1s.). Box Number and "Electrical Review" Address count as Seven Words.

Three Consecutive Insertions for the Price of Two, if ordered and prepaid with first Insertion.

LATEST TIME FOR RECEIVING 9.30 a.m. THURSDAYS.

Where Advertisements are to be answered to a given Number at the "Electrical Review" Office, applications for Names and Addresses of the Advertisers will be entirely disregarded, and Letters giving incorrect Box Numbers will be destroyed.

⁂ The Scale does not apply to Trade Advertisements, terms for which can be had on application to 4, Ludgate Hill, London, E.C.

OFFICIAL NOTICES, &c., 1s. per line in Column.

The ELECTRICAL REVIEW is the recognised medium of the Electrical Trades, and has by far the LARGEST CIRCULATION of any Electrical Industrial Paper in Great Britain.

Unless otherwise instructed, **ALL LETTERS** received in answer to Advertisements with a Box number **ARE FORWARDED NIGHTLY.** Postages incurred are charged at cost.

ELECTRICAL

PARTNERS and PARTNERSHIPS

can be obtained through

WHEATLEY KIRK, PRICE & CO.

(Established 1850).

46, Watling Street, London, E.C.

16, Albert Square,
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By Order of the Directors of Maxwell & Ponting, Ltd.

SALE BY AUCTION, WITHOUT RESERVE,

OF THE

COSTLY TRADE FITTINGS,

INCLUDING

THE ELECTRIC GENERATING PLANT

comprising 60-H.P. Otto Gas Engine; large Electric Dynamo, by Laurence, Scott & Co.; Switchboard, &c., complete and in full working order; installation of Electric Irons; Electric Light Fittings and Cable: 8-H.P. Omnium Motor Delivery Carrier; Telephone Transmitters; Iron Safes; Board Room and Office Furniture; valuable Show cases and other items.

B. NORMAN & SON

WILL SELL THE ABOVE ON THE PREMISES,

121 to 125, WESTBOURNE GROVE, W.,

ON

WEDNESDAY, JANUARY 12th, at ONE.

On View two days prior. Catalogues of the Auctioneers, 1, Gresham Street, London, E.C. Tel. No. 2846 Central. 9813

EDUCATIONAL NOTICES.

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A.M.I.E.E., A.M.I.C.E., A.M.I.M.E., Matriculation, B.Sc. (Engineering), secured with minimum expense and energy by "U.E.C." Individualised Correspondence Courses. Advice and guidance *free.*—Apply Advisory Secretary, UNIVERSITY ENGINEERING COLLEGE, 3, St. Mark's Crescent, Regent's Park, London, N.W. (Five Advertisements below.) 4281

CORRESPONDENCE Courses in Civil, Electrical, and Mechanical Engineering. Specially *Reduced* Fees during the War! Success *guaranteed!*—UNIVERSITY ENGINEERING COLLEGE. Advertisements above and below.) 4282

ELECTRICAL Engineers desiring *early* advancement will be well advised to send for the "U.E.C." Prospectus, see UNIVERSITY ENGINEERING COLLEGE advertisements, numbered 4281, 4282, 4283, 4284, 4286, *at once!* 4285

EDUCATIONAL NOTICES.—*Continued.*

FREE!! Send *immediately* for "U.E.C." Prospectus of Specialised Engineering, Mathematical and Examination Training. Unique system! Record series of successes.—UNIVERSITY ENGINEERING COLLEGE. (Advertisements above and below.) 4283

MATHEMATICS effectively mastered by the "U.E.C." *practical* Correspondence System. The *most profitable investment* on market. *Commercial Engineering,* Works Management, Installations, Electrical Design, Draughtsmanship, &c.; UNIVERSITY ENGINEERING COLLEGE, advertisements numbered 4281, 4282, 4283, 4284, 4285. 4286

WANTED Engineers—to fill responsible positions in the Trade Boom ahead! *Think!! Are you qualified?*—Let "U.E.C." particularly advise and quote you *free* concerning Course of Spare-Time Training to most profitably develop *your* abilities.—Write now to UNIVERSITY ENGINEERING COLLEGE. (Five Advertisements above.) 4284

SITUATIONS VACANT.

Latest time for receiving 9.30 a.m. Thursday.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

Original Testimonials should never be sent.

WAR DEPARTMENT.

Military Camps, Southern Command.

ELECTRIC LIGHTING.

THE following Positions are Vacant at Camps near Salisbury:—

Shift Engineers,
Station Fitters,
Wiremen,
Engine Drivers (Steam and Oil Engines).

Unfurnished single quarters can generally be provided.

Preference will be given to applications from men who have been discharged from the Army or Navy, or are not eligible for military service.

Applications, enclosing copies only of testimonials, and stating briefly training, experience and wages required, should be sent to the undersigned at once. Envelopes should be endorsed "Power House Staff."

CHIEF ENGINEER, Southern Command,
Radnor House, Salisbury. 9806

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

CORPORATION OF WAKEFIELD ELECTRICITY DEPARTMENT.

WANTED, two Switchboard Attendants at the Wakefield Corporation Electricity Works. Applicants must already have some experience of the working of a large A.C. switchboard. State salary required. The person engaged will be "on War Service," but no applications are desired from those so engaged at present without the full consent of their employers. Written applications, enclosing copies of testimonials, to be addressed to the City Electrical Engineer, Wakefield. 9816

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.

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A BOILER-House Foreman wanted in Corporation power station, experienced in efficiency testing, CO_2 recorders, &c.; required to undertake repairs to boilers and mechanical stokers, and act as reserve fireman on emergency.—Apply stating age, wages required and giving particulars of experience, to 9767, Electrical Review, 4, Ludgate Hill, London.

A CHARGE Engineer is required immediately for Power Station in London district. Must be first-class man, experienced in working of turbines, B. & W. Boilers and E.H.T. supply. Progressive salary for really suitable man.—Apply stating age, salary required, and giving full particulars of experience, technical and scholastic training, and when able to take up duties, to 9784, Electrical Review, 4, Ludgate Hill, London.

ARMATURE Winder wanted immediately for re-winding Traction Motors; long hours and high wages for a good man.—Manager, Corporation Tramways, Brighton. 9801

BOROUGH of Eccles.—The Electricity Committee require a Shift Engineer (for permanent engagement) in their generating station; wages 40s. per week, rising to 42s. per week at the expiration of six months' approved service; war service badge provided. —Applications endorsed "Shift Engineer," stating age, experience, and when able to commence duty, accompanied by copies of not more than three recent testimonials, to be addressed to the Borough Electrical Engineer, Electricity Works, Cawdor Street, Patricroft, Lancs., and forwarded so as to arrive not later than Wednesday, the 3rd prox. 9817

CHIEF Clerk, capable of taking charge of small clerical staff; must be good at figures and not eligible for army. A progressive appointment.—Full particulars to 4225, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN, good general experience in dynamo design, also in very small high-class machines. State age, salary, &c. Shepherd's Bush district. No person resident more than 10 miles away, or already engaged on Government work, will be engaged.—4269, Electrical Review, 4, Ludgate Hill, London.

DRAWING Office.—Junior Assistant wanted in large East-London electricity works; good handwriting, some knowledge of card systems and map tracing desirable. Must be ineligible for military service, and not on war work.—Full particulars to 9815, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN required for Factory within 20 miles of London; experienced in power, lighting and repairs. Wages 9d. per hour.—Write, giving experience, &c., to 4238, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN, practical, wanted for large motor repair and installation business; test-room experience in motor works desirable. Must be able to trace faults and be conversant with connections of A.C. motors, starters and accessories. Men ineligible for the Army and not on war work preferred.—Full particulars to 9814, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN-Wireman wanted to assist in maintenance of lighting and power plant. Wages 8½d. per hour and an additional allowance of 2s. 6d. weekly.—Applications to the Administrator, Graylingwell War Hospital, Chichester. 4278

ELECTRICIAN-Wiremen, screwed and slip tube, power and light; also good all-round jobbing hand. No person resident more than 10 miles away, or already engaged on Government work, will be engaged.—Apply Colley, 51, Great Ormond Street, W.C. 4290

ENGINE-Driver wanted, used to Diesel engines, one accustomed to direct-current, three-wire supply. Wages to start 30s., for 56 hours per week.—Application, stating age, experience and testimonials, to Engineer & Manager, Electricity Works, Basingstoke. 9808

FITTER wanted, must be accustomed to Water-tube Boilers.—Apply Electric Works, Wigan. 4277

SITUATIONS VACANT.—*Continued.*

FITTER-Driver required for central station. B.T.H. turbines. Wages 36s., plus 4s. per week for war bonus. Reply giving fittings experience. Man appointed will be classed a munition worker.—Box 419, c/o Messrs. R. F. White & Son, General Advertising Agents, 33, Fleet Street, E.C. 9823

FOREMAN wanted, by a firm of Engineers under Government control in London District, to take charge of a View Room dealing with small electrical parts. Applicant should have had good electrical manufacturing experience and a sound theoretical training. One used to the supervision of both male and female labour preferred. Those already on Government work need not apply.—Write or apply to nearest Board of Trade Labour Exchange, mentioning this paper and No. 9771.

REQUIRED at once, a capable Cable Operator, able to instruct, with knowledge of repairing and testing cable instruments; also some electrical knowledge.—Write E. L. C., c/o Horncastle's, 61, Cheapside, E.C. 4258

REQUIRED for Lift Work, capable Electrician for repairs; only men with good references and not on Government work need apply.—Apply your nearest Labour Exchange, mentioning this paper and No. A 1214. 9719

REQUIRED immediately for Gold producing Mine, West Africa, two competent Electricians with experience, three-phase installations.—Apply, with copies of testimonials, stating age, experience and salary required, 9803, Electrical Review, 4, Ludgate Hill, London.

SHIFT Engineer wanted in power house, South Wales; War badge granted; wages to start 40s.; A.C. and D.C. supply.—State fully training and experiences and when free, 9802, Electrical Review, 4, Ludgate Hill, London.

SHOWROOM Assistant required for West-End undertaking; ineligible.—9796, Electrical Review, 4, Ludgate Hill, London.

SUB-STATION Attendants of over military age, or who are otherwise ineligible for Naval or military service, wanted temporarily to take the place of men serving with the Forces. Wages £2 per week of 56 hours; overtime at single rates, and in addition 3s. per week war bonus.—Apply, with particulars of past experience, to General Manager, Electricity Offices, Dunning Street, Sunderland. 4203

SWITCHBOARD Attendant wanted at once, Slades Green Electric Light and Power Station (three-wire, D.C.). Knowledge of battery routine, wiring and arc lamps necessary. Average 56 hours weekly. State age, experience and pay required.—Apply, P. C. Tempest, S.E. & C. Rly., Tonbridge Station. 4268

TELEPHONE Fitters required; must be thoroughly experienced in intercommunication work; permanency for competent men.—Private Telephone Company, 28, Great Queen Street, Kingsway. 4239

TEST-Room Assistants required for testing electrical motor control gear of all kinds; also others for testing electrical meters.—Apply nearest Labour Exchange, mentioning this paper and No. A. 1087. No person engaged on Government work need apply. 4247

WANTED, an Electrician to take charge of D.C. installation, about 750 KW., for hauling and pumping purposes; must be 6 o'clock man and have had considerable colliery experience and state salary required.—Apply to Box 56, Wrexham. 9807

WANTED. Car Shed Fitter; preference given to one with a knowledge of B.T.H. equipment.—State wages, &c., to 9810, Electrical Review, 4, Ludgate Hill, London.

WANTED, Electrician-Wireman, thoroughly experienced.—Write, stating experience and wages required, to Burston, Sutton & Co., 87, Bishopsgate, E.C. 4256

WANTED, competent and experienced Engineer, to take charge of London sales and export department of Electrical Manufacturing Company; similar experience and intimate knowledge of motor control gear and meters desirable.—Apply stating age, qualifications and salary required, to 4248, Electrical Review, 4, Ludgate Hill, London.

WANTED immediately, fully-qualified Electrician to take complete charge of all electrical equipment in large seaplane works on the South Coast. Highest references required. Good rate of pay to suitable man. No man on Government work will be engaged.—Write to your nearest Labour Exchange, mentioning this paper and No. 9790.

WIREMEN for Lighting and Power, accustomed to casing and tube; permanency to suitable men.—Apply stating age, married or single, and wage required with copies of testimonials, Northampton Electric Light & Power Co., Ltd., 25, Bridge Street, Northampton. 4216

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

WORKING Resident Engineer wanted for Bargoed district (Glam.) by the Rhymney Valley & General Electric Supply Co., Ltd., to take charge three-phase sub-stations and underground and overhead distribution. Must be good cable jointer with knowledge of transformers, meters, installation work, &c.—Apply by letter, stating age, experience, salary required, to SECRETARY, Prudential Buildings, Cardiff. 9818

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.

ASSOCIATION of Electrical Station Engineers. (Founded January, 1913.) The protective organisation for Electricity Supply Engineers.—Write for particulars and a copy of "A.E.S.E. Progress" to A.E.S.E., 41, Warren Road, Leyton, E. 4275

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ADVERTISER, experienced in supervision and manufacture of electric cooking and heating apparatus, installation, plant work, &c., seeks position.—4257, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER (41), considerable experience with large firm manufacturing small motors, fans, accessories, &c., seeks position; charge of business and production side of similar department. Excellent references.—4201, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer, M.I.E.E., Assoc. M.I.C.E., thorough technical qualifications and large commercial experience home and abroad, desires responsible appointment. Tactful and energetic, used to taking initiative and control.—9819, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Construction Engineer (32), home and foreign experience, motors, telephones, arc lamps; disengaged.—GOLDEN, 7, Randolph Gardens, Maida Vale, London. 4211

ELECTRICAL Engineer (married), 20 years' good experience in installation work of every description, last situation as manager of electrical department of old-established business; excellent testimonials.—4263, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, disengaged, Westinghouse trained, 12 years' experience factory and large contracts, theoretical and practical experience in both A.C. and D.C. plant.—4280, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN (ineligible), married, thoroughly experienced in all branches, requires permanent responsible position; good testimonials for supervision and abilities.—4264, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN, disengaged; light, power, 'phones; would take charge.—W., 2, Montague Road, Hendon, N.W. 4267

ENGINEER-Electrician, charge private plant; wages £3. No cards.—IRELAND, Trulls Hatch, Rotherfield. 4287

ENGINEER-Electrician, Wireman, seeks situation; charge estate or works plant preferred.—BRAY, 146, Finborough Road, Kensington. 4266

ENGINEERING Draughtsman, versed electrical, mechanical and structural design.—4217, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ESTATE-Engineer, Electrician (40), married (ineligible), seeks appointment; competent man, any plant; 5 years present private situation; highly recommended.—PHILPOT, Oakhurst, Merstham, Surrey. 4288

FITTER'S Mate wants job; used to screwed tube work. Rate 8½d. per hour.—V. J. F., 32, Claremont Square, E.C. 4260

FOREMAN-Electrician, disengaged, seeks appointment, town or country, 20 years' all-round D.C. experience generators, motors, lifts, power distribution, automatic signalling telephones, construction and maintenance.—4213, ELECTRICAL REVIEW, 4, 4, Ludgate Hill, London.

TWO Electricians capable of taking charge of large Power Plant, Wiring, Motors, Dynamos, Switchboard, used to Suction Gas, also Oil, Town, Gas and Steam, seek situations.—"ELECTRICIAN," 2A, Broad Lane, Tottenham. 4289

SITUATIONS WANTED.—*Continued.*

WIREMAN wants job lighting, power, &c.; excellent refs. Navy discharge.—HOBBS, 117, Tufnell Park Road, Holloway. 4262

WIREMAN wants job; Government work preferred.—E., 10, Faraday Road, North Kensington. 4265

WIREMAN wants job, lighting, power, &c. Excellent references; Army discharge.—CARROL, 7, Winchester Street, Pimlico. 4261

WIREMAN wants job, casing, Simplex, barrel.—HARVEY, 41, Mildmay Street, Mildmay Park, N. 4259

WIREMAN, reliable, wants job; any system; refs.—"B," 63, Blandford Road, Beckenham. 4271

WIREMAN, competent, case or tube; London rate.—F. B., 18, Paddock Gardens, Upper Norwood. 4272

YOUNG Electrician (married), disengaged; all systems, contract or maintenance.—G., 17, Cloudesley Place, Islington. 4276

AGENCIES.

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AGENTS wanted in Colonies, allied and neutral countries, for sale of British-made fittings for half-watt lamps, &c.—9773, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR SALE.

SPECIAL CASH BARGAINS.

TWO Miles 2/16 Wire, twin twisted, red and black P.R., D.C.C. braided and compounded; 110 yd. coils. £10 mile for quick sale.

Telephone Cabinets.—We hold a large stock of new Cabinets, guaranteed sound-proof, well made and quite new; usually sold at £15 each. Offered at very low prices to clear. State requirements.

Hack-Saw Blades. Starrett make.—Large stock of 12″ and upwards. For hand or power. Offered at 55 per cent. off list prices. State requirements.

1 Ampmeter, up to 150 amps.
2 ditto, ditto 120 amps. } Nalder Bros.' make.
1 Voltmeter, reading up to 120 volts.

In perfect condition. Price 25s. each. Any one sent on approval.

3-H.P. Witton Motor, 200 V., A.C., 1460 revs., 50 periods, single phase, fitted with 7″ × 4″ pulley, complete with starter and slide rails. Price £15.

Recently taken out of use for larger power.

3-H.P. Motor, 110 V., D.C., fitted with 5″ pulley, complete with slide rails and starter, 1250 R.P.M. Electrical Co.'s make. Price £12.

THE LONDON METAL CO., LTD.,
1A, Forest Lane, Stratford, London, E. 4253

FOR SALE.

250-KW. High-class Generator, comprising Enclosed Inverted Compound Engine, by Galloways, 16 in. and 27 in. cylinders, 11 in. stroke, 360 revs., and Mather & Platt 6-pole Generator, compound or shunt wound, 550 volts. Modern first-class job; immediate delivery,

60-H.P. (two) D.C. Motors, by G.E.C., 250 volts, enclosed type.

26-H.P. D.C. Motor, by G.E.C., 250 volts.

30-KW. Brush Generator, Enclosed Inverted Engine and D.C. Multipolar Generator, 500 volts.

THOMAS MITCHELL & SONS, LTD.,
Edgar Street, Bolton. 9747

FOR SALE.

800-KW. Generating Set, D.C. 500 volts; 600-KW. Generating Set, D.C. 500 volts; two Sets Highfield patent reversible Boosters, each set comprising motor, booster and exciter. 175 amps., 0·150 volt, motor, D.C. 500 volts.

Also several Tanks.

Cheap before removal from London.

Particulars on application to JOHN JACKSON & Co., Scotstoun, Glasgow; or ALBERT BAIRD, 195, Clapham Road, London. 9740

(*Continued on next page.*)

FOR SALE.—*Continued.*

FOR SALE.

NEARLY new Hori. Boring and Facing Machine by the Atlas Engineering Co., with 4-in. boring bar.
Motor-driven Boring Machine, by the Bement Miles Co., with 5-in. self-act boring bar, arranged for Motor drive.
6-ft. arm Universal Radial Drilling Machine, by the Niles Tool Co.
42-in. Morton Drawback Shaping Machine, with quick return motion.
30-in. Vertical Boring and Turning Mill, by Butler.
Double-geared overhanging arm Horizontal Milling Machine, by Kendall & Gent, table 3 ft. 6 in. by 12 in.
No. 12 Lincoln type Milling Machine, by Kempsmith, table 2 ft. 6 in. by 12 in.
Automatic Twist Drill Grinder, up to 2 in. diameter, by Mayer & Schmidt.
"Gisholt" Universal Tool Grinder, fitted with Pump.
Treble-geared Boring and Facing Lathe, by Whitworth, 3 ft. 3 in. faceplate.

CATALOGUE of Stock MACHINERY. 2-3000 LOTS.
Free on application. Inspection invited.

THOS. W. WARD, LTD., ALBION WORKS,
Tel.: "Forward, Sheffield." SHEFFIELD.

FOR SALE.

ELECTRIC 3-phase, 440-volt, 50-period Motors.

One 40-H.P. Open Protected Type, Squirrel cage Motor, to run at 730 R.P.M., complete with one double-width Belt Pulley, 14″ × 9″, and one set of Slide Rails and Bolts.
One 40-H.P. Totally-enclosed Auto-Starter.

One 10-H.P. Slip-ring Motor, Totally Enclosed, Continuously Rated, speed 730 R.P.M. with free end shaft.
One 10-H.P. Reversing Controller, with 5 contacts on both sides, with phase switching-off arrangement on 2 phases, and with necessary separate resistance.

One 15-H.P. Slip-ring, Open Protected Type, Continuously-rated Motor, speed 730 R.P.M., fitted with back gear shaft through bedplate; having mounted: one machine cut steel reduction gear, ratio 4—1 with back gear shaft fitted, with Pulley 12″ × 8″ face; complete with one set of Slide Rails and Bolts.
One Protected Type Rotor Starter.

One 15-H.P. Squirrel-cage Motor, Open Protected Type, Continuously Rated, speed 730 R.P.M., fitted with Belt Pulley 12″ diameter × 8″ face; one set of Rails and Bolts.
One 15-H.P. Auto Transformer Starter.

One 5-H.P. Squirrel-cage, Open Protected Type, Continuously-rated Motor, complete with Belt Pulley 8″ diameter × 4½″ face; one set of Slide Rails and Bolts.
One Star Delta Starter.

One 40-H.P. Slip-ring Motor, Open Protected Type, 970 R.P.M., free end shaft.
One "Empire" Automatic Controller, by the Electrical Control, Ltd., Glasgow; suitable for 40-H.P., 440-volt, 50-cycle, 3-phase, slip-ring motor, open pattern, complete with one "Empire" pressure regulator to operate between a pressure of 74 to 82 lbs. for air-compressor use.

The above machines are brand new, all continuously rated. We could offer very low prices on application for delivery from stock in our Glasgow Warehouse.

PATERSON & SERVICE,
Engineers and Merchants,
38, Bath Street, Glasgow. 9743

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ALTERNATORS for Sale.—The Lancashire Dynamo and Motor Co., Ltd., size 8¼, one phase, 33⅓ periods per second, 400 volts, 40 amps., 1000 revolutions per minute, No. 11,224. Helios Elektricitäts Aktiengesellschaft, Koln Ehrenfeld, 6 KW., 1500 revs., 300 volts, 20 amps.; also two Switchboards.—Apply JOHN DEWSBURY & SON, LTD., Littleton Street, Walsall. 4188

FOR SALE.—*Continued.*

ARC Lamp Carbons for Sale; open, enclosed and flame; all sizes, ex stock.—M. O. HECKELS, 4, Northumberland Street, Newcastle-on-Tyne. 9283

DIRECT-Current Generating Sets.—One 50-KW. and two 100-KW., 250 volts; one 120, one 140 and two 260-KW., 500 volts. All enclosed high-speed engines and multipolar generators.—PHŒNIX ELECTRICAL CO., 40, Broomielaw, Glasgow. 9762

DIRECT-Current Motors: 40, 80 and 100 H.P., 230 volts; 110, 130, 150 and 450 H.P., 460—500 volts.—PHŒNIX ELECTRICAL CO., 40, Broomielaw, Glasgow. 9764

DYNAMOS, 3000, 1500, 1000 and 750 amperes at 6 volts, ready for delivery; also smaller sizes delivered from stock. Machines let out on hire.—CANNING & CO., Electro-Platers' Engineers, Birmingham. 7769

ELECTRIC Motors and Dynamos, Sale or Hire. Always a large stock of nearly new guaranteed machines. Immediate delivery.—ELECTRO-GENERATOR CO., 1A, Shepherd's Bush Road, W. 'Phone: 488 Hammersmith. 4194

ELECTRIC Motors (50) for Sale, 440/500 volts, D.C.; cheap. 'Phone: East Ham 693.—SUGDEN, Wakering Road, Barking. 4274

ELECTRIC Pulley Blocks for Sale; Three 1½-ton 200/250-volt Electric Pulley Blocks, first-class condition, complete, ready for immediate delivery. Particulars on application.—4229, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, three-line Compound Engine direct coupled to Multipolar D.C. Generator, both by Allens, of Bedford; steam pressure 160 lbs., voltage 460-560. In excellent condition and can be seen running at municipal power station in Midlands. Reason for disposal being too small for practical use in largely-extended power house.—9821, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, two Allen's Compound Engines, each 116 H.P., cyls. 11″ and 15″ × 7″ stroke, direct-coupled to Allen's compound wound 4-pole 70 KW. D.C.; Generators 110 volts, 636 amps. One Willans & Robinson's 3-crank Compound Central Valve Engine, 570 H.P., 300 R.P.M., direct-coupled to 3-phase Westinghouse Alternator, 2,200 volts, 25 periods.—R. H. LONGBOTHAM & CO., LTD., Wakefield. 9625

FOR Sale, 12-in. Centrifugal Pump, coupled direct to 60-B.H.P. Motor, 500 volts, 32-ft. head, 2,300 gal. per min. 14-in. ditto, coupled to vertical high-speed Engine, 32-ft. head, 2,650 gal. per min.—R. H. LONGBOTHAM & CO., LTD., Wakefield. 9643

FOR Sale.—370-KW. Steam Generating Set, 460—550 volts, D.C., can be seen fixed working.—WILLIAMS, 37, Queen Victoria Street, London, E.C. 9799

FOR Sale.—150-KW. Compound Enclosed Engine, with Siemens Dynamo, 500 volts, continuous current, compound multipolar machine; can be seen fixed.—WILLIAMS, 37, Queen Victoria Street, London, E.C. 9800

FOR Sale, three-phase Alternator, 240-KW. at ·85 power factor, at voltages between phases 2200, at 40 cycles; in excellent condition.—R. H. LONGBOTHAM & CO., LTD., Wakefield. 9254

FOR Sale, 240-KW. Generating Set, comprising three-crank Vertical Compound Engine, direct-coupled with three-phase alternator, 2200 volts, 40 cycles, up-to-date and in excellent condition.—R. H. LONGBOTHAM & CO., LTD., Wakefield. 9255

FOR Sale or Hire, high-class Dynamos, Motors, Alternators, Cable and Arc Lamps.—PERCY HUDDLESTON & CO., 72, Finsbury Pavement, E.C. 3203

FOR Sale.—One Turbo-Alternator, 1,000 KW., 50 cycles, 1,500 R.P.M., voltage 6,600, with Condenser and Edwards Air Pump.—R. H. LONGBOTHAM & CO., LTD., Wakefield. 8164

FOR Sale, one Willans & Robinson Three-crank Compound Central Valve Engines, 570 H.P., 300 revs., direct coupled to three-phase Westinghouse Alternator, 2,200 volts, 25 periods. Two Allen's Compound Engines, 116 H.P., 390 revs., cyls. 11 in. and 15 in. × 7 in. stroke, direct coupled to Allen's Compound-wound 4-pole 70 KW. D.C. Generators, 110 volts, 636 amps.—R. H. LONGBOTHAM & CO., LTD., Wakefield. 9418

FOR Sale.—43-KW. Generating Set, 500 volts, D.C.; 18-H.P. Motor and Turbine Pump for 12,000 gals. per hour, 550 volts, D.C.—RHYS HARRY, Llanelly. 4200

FOR Sale.—Four second-hand Excello pattern MUN 8-ampere 100-cycle Arc Lamps and choking coils, 700 pairs white carbons.—TAYLOR, Macaulay Street, Huddersfield. 4246

FOR Sale, a bargain, six Wall and six Desk Pattern Ericsson Intercommunication Battery Ringing 'Phones, metallic circuits, and about 220 yds. 15 double-way cable.—HUBBER & SON, South Street, Exeter. 4189

(*Continued on next page.*)

FOR SALE.—*Continued.*

FOR Sale, one 100-H.P. 500-volt, 550-R.P.M. shunt-wound Motor; one 10-H.P. 220-volt, 1200-R.P.M. compound-wound Motor. Arc Lamp Carbons, enclosed, open and flame, all sizes in stock.—4250, Electrical Review, 4, Ludgate Hill, London.

GENERATING Sets:—One Willans-B.T.H., 325 KW., 230 volts; one Belliss, 275 KW., 500 volts; one Belliss, 160 KW., 240 volts; one Willans, 160 KW., 220 volts; one Willans, 60 KW., 220 volts; one Willans, 50 KW., 220 volts. D.C. Motors from 2/30 H.P., A.C. Motors 10/15 H.P.—Jennings, West Walls, Newcastle-on-Tyne. 5939

HIGH speed Enclosed Engine, by Browett, Lindley & Co., cyls. 8½ in. and 14 in. × 8 in. stroke, forced lubrication for coupling to generator.—Apply Harry H. Gardam & Co., Ltd., Staines. 9217

METAL Filament Lamps, by renowned British Manufacturer; large quantity of 100 volts to 125 volts, 16 to 100 candle-power. Perfect delivery guaranteed. Cheap and good. —3957, Electrical Review, 4, Ludgate Hill, London.

MOTOR, A.C., 83 cycles, ½ H.P. (new).—Graham & Latham, Ltd., 104, Victoria Street, S.W. 4255

MOTORS.—One 10-H.P., 230-volt, protected type, shunt wound, 900 R.P.M.; one 12½-H.P., 230-volt, 680 R.P.M., shunt wound; one 20-H.P., 230-volt, 730 R.P.M., complete with Pulleys, Slide Rails, Starter, &c.—9812, Electrical Review, 4, Ludgate Hill, London.

THREE-Phase Motors:—7½, 12, 15, 17 and 20 H.P., 220 volts; 12, 15, 20, 60 and 150 H.P., 440 volts; 25, 50, 75, 100 and 300 H.P., 500 volts; all 50 periods.—Phœnix Electrical Co. 40, Broomielaw, Glasgow. 9763

THREE-Phase Plant for Sale.—Two 500-KW., 500-volt, Turbo-Generators, complete with condensing plant, switchboard, &c.; One 400-KW., ditto, but with H.S. Reciprocating Engine; also 100 and 140 KW. belt-driven Alternators. All 50 periods.—Phœnix Electrical Co., 40, Broomielaw, Glasgow. 9761

TO be Sold, Five Electric Motors, 440 V., D.C., low speed, 30, 30, 10, 6 and 2-H.P., complete with amp.-meter, switches, fuse-box, starter; all about new.—Apply by letter, Victor Bruyneil, 45, Horseferry Road, Westminster, London, S.W. 4270

TURBO-Alternator Set, comprising 1000-H.P. Willans Turbine, coupled to 750-KW. Siemens Alternator, 440 volts, three-phase, with surface condensing plant, Edwards air pumps, &c. In use for a short time only.—Apply Harry H. Gardam & Co., Ltd., Staines. 8892

TWO 80-KW. Generating Sets, comprising high-speed Engine, coupled to B.T.H. Generator, 460 volts D.C., for immediate sale and delivery from stock.—Harry H. Gardam & Co., Ltd., Staines. 9680

5-KW. Testing Set, 100 volts, D.C., to 100/2,000 volts A.C., including rotary converter, transformer, switchboard. Also about 30 Crompton enclosed Arc Lamps, with workshop lanterns, 100 volts, 5 amperes.—Apply Alfred Graham & Co., St. Andrew's Works, Crofton Park, London, S.E. 9779

10-KW. Motor-Generator, by E.C.C., Wolverhampton; done two months' work only; 460 to 230 volts D.C.—Harry H. Gardam & Co., Ltd., Staines. 9624

30-H.P. and 10-H.P., series-wound, 220-volt Motors; three 45-H.P., 220-volt, shunt-wound Motors; Tangye Radial Drilling Machine, 3-ft. 6-in. arm; Steam and Electric Pumps; two Generating Sets, 110 volts.—Martins, 320, Witton Road, Birmingham. 4222

87-KW., 220-volt, six-pole shunt Generator, 500 revs., suit belt or direct drive; two years old, but as new.—Drummond and Co., Commercial Street, Middlesbrough. 4221

150-KW. 500-volt Generating Set for Sale, Belliss engine. Seen at work by appointment. Price £600. —4241, Electrical Review, 4, Ludgate Hill, London.

180-B.H.P. Gas Engine, by the National Gas Engine Co., Ltd., No. 22,607, has done two months' work only, and for every practical purpose is equal to new.—Harry H. Gardam & Co., Ltd., Staines. 9681

200-KW. Generating Set, Belliss & Morcom three-crank six-cylinder Engine, coupled direct to Parker Dynamo, 210 volts, 900 amps., 420 revs., Switchboard and new spare Armature. Seen fixed in London for next few days.—Joseph Pugsley, 72, Queen's Circus, Battersea Park, London, S.W. 4196

200-KW. 10-pole Generator, by Sandycroft, 220 volts, D.C., 150 R.P.M., modern and first-class machine.—Harry H. Gardam & Co., Ltd., Staines. 9578

300-KW. Alternator, by Brush Electric Co., 6500 volts, three-phase, 50 cycles; was supplied new in 1912 and has done very little work indeed. In stock.—Apply Harry H. Gardam and Co., Ltd., Staines. 9268

ARTICLES WANTED.

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ACCUMULATORS wanted for refining purposes. Obsolete Generating Sets, Dynamos, Motors, and all kinds of Machinery. Scrap Cable, Arc Lamps, Meters, Metal Residues, and Scrap Metals of every description purchased for prompt cash, town or country.—Apply A. Brown & Sons, 142, Lower Clapton Road, London, N.E. Telephone, Dalston, 555. Telegrams, Secondhand, Lowclap, London. Established 1860. 2585

A. LEAROYD & Son, Bridge Works, Clapton, N.E.—Telephone: Dalston 2278; Telegrams: Frangible, Lowclap, London—buys for prompt cash every description of second-hand Generating Sets, Accumulators, Motors, Transformers, old Arc Lamps, Meters, Cable, Scrap Metals, Metallic Drosses, &c. &c. Enquiries solicited. Established over 50 years. 4001

A.C. and D.C. Motors (second-hand) any type, any condition, wanted for prompt cash.—A. Learoyd & Son, Bridge Works, Heatherley Street, Clapton, N.E. 4002

ALL kinds of disused Plant, Machinery, Scrap Metals, &c., purchased for cash. If you have any Generating Sets, Motor, Dynamos, Steam Engines, Boilers, &c., you wish to dispose of, kindly offer same to us. Complete works purchased for dismantling.—Harry H. Gardam & Co., Ltd., Staines. Telephone, Staines 98. 8579

ELECTRIC Motors, surplus stock, or good second-hand, wanted for cash. —4193, Electrical Review, 4, Ludgate Hill, London.

GAS Engine (Second-hand) required, 300 to 500 B.H.P., on producer gas.—Apply, giving full particulars, to 9811, Electrical Review, 4, Ludgate Hill, London.

OLD Electric Lamp Tops, any make, purchased. Any quantities for prompt cash per return; top price given. Sell your goods direct to the original buyers. We pay £9 15s. per oz. for scrap platinum in large or small quantities. We also extract platinum from any metal and pay the above price. Highest cash value paid for disused artificial teeth, old gold, silver and jewellery in any condition; parcels received by post. Prompt cash per return. Mercury bought. We are buyers of all kinds of old metals, aluminium, brass, copper, pewter, lead, zinc and old cables. We pay carriage by goods train. Cash returned immediately as goods received. Inquiries solicited.—J. Lee & Co., Metal and Rubber Merchants, 56, Green Street, Bethnal Green, London. 4251

ONE Electric 10-ton Derrick Crane, 500 voltage D.C., second-hand, in good condition. State price delivered f.o.r., and where seen.—"Electric," William Porteous & Co., Glasgow. 4291

PLATINUM in any form and quantity, purchased at highest prices by Derby & Co., Ltd., 44, Clerkenwell Road, London.

WANTED for quick delivery, a direct-coupled Steam Dynamo, D.C., 75 kilowatts capacity. Engine, non-condensing, suitable for 100 lb. steam pressure. Generator, shunt wound, 220 to 230 volts. A second-hand set, if in good condition, would be suitable. Offers to state price, earliest delivery, age of plant, where it may be seen, and name of makers of engine and generator, number and size of engine cylinders, stroke, speed of revolution; also particulars of generator.—9809, Electrical Review, 4, Ludgate Hill, London.

WANTED, 50 ft. or less ⅜-in. "Stabilit" Rod or near larger size.—Wilson Apparatus Co., Hendon, N.W. 4254

WANTED, Generating Sets, all sizes, Boilers, Accumulators, Dynamos, &c., for export; also Scrap Cable and Metals. Complete plants purchased.—Williams & Sons, 37, Queen Victoria Street, London. Telephone, 3938 City. 7000

WANTED, anything up to three tons of high conductivity Copper Strip, section 1″ × ¼″. Offers to 9820, Electrical Review, 4, Ludgate Hill, London.

WANTED, 60 to 70-KW. Compound Generator, 230 volts, belt-drive; must be in good order for war work.—9822, Electrical Review, 4, Ludgate Hill, London.

WANTED, Lancashire boiler; 80-KW., 220-volt Generating Set and two 50-H.P., 460-volt Motors.—Martins, 320, Witton Road, Birmingham. 4061

(*Continued on next page.*)

ARTICLES WANTED.—*Continued.*

WANTED, Gas Engine direct coupled to D.C. shunt-wound 20-KW. dynamo, 250 volts maximum for town's gas (550 B.TH.U.).—Full particulars and maker's name and number to J. W. GIBSON, Engineer and Manager, Gas and Electricity Works, Holsworthy, Devon. 4235

WANTED, 150 to 200 KW., 220-volt, D.C. Generating Plant. Alternative offers of engine and generator separately will be considered, but must be modern and price should accompany offer. —9579, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

2-HORSE direct 200-volt Motor.—Price and full particulars, GOLDSTON, Northampton. 4252

WORKSHOPS, PREMISES AND SITES TO LET OR WANTED.

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ELECTRICAL Engineer in South Wales will place at the disposal of Manufacturers or others Shop and Window in main thoroughfare, established 1887, for the sale of Electrical Fittings, Glassware, Novelties, if satisfactory terms can be arranged. —4279, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MISCELLANEOUS.

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A BOON to every user of electricity.—A new British industry, economy in electric lighting, a great saving in the cost of metallic filament lamps by our patented process. We are now prepared to undertake the repair of burnt-out lamps, and large consumers should write for particulars, &c., THE ALLIES ELECTRIC LAMP REPAIRING CO., LTD., Montgomery Street, Hammersmith, W. 4227

ARMATURE Winding, Field Coils, Bearings, General Motor Repairs.—H. DUNN & SON, 32, Newington Causeway, S.E. 4278

WAR Munitions.—Engineers who are prepared to take on Lathe Repetition work at their own Factory please communicate with 4224, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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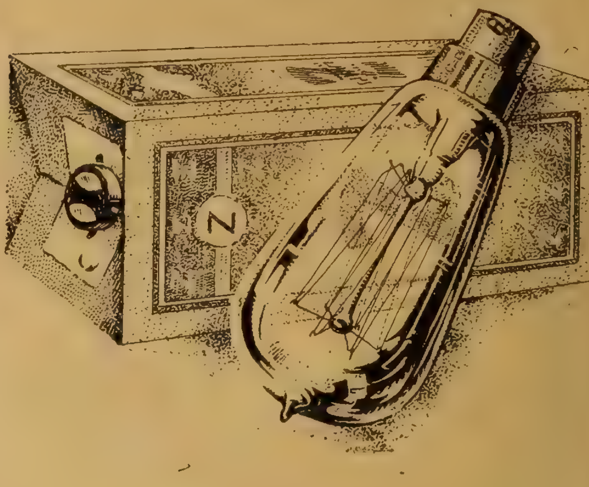
NOTICE.

OWING to the many hundreds of replies passing through this Office each week, we would ask those answering Advertisements to be EXTREMELY ACCURATE with regard to the figures WHEN ADDRESSING REPLIES to Box Numbers.



The Signs of Quality.

EVEN the most casual glance at a "Z" Drawn Wire Lamp will show you that every care is taken in manufacture. The well-finished cap is set on straight, the glass stem is properly centred, and the filament is anchored so that it cannot become detached from the hooks. Compare one of the

"Z" Drawn Wire Lamps

with any of the cheap Continental lamps, and you will see wherein the difference lies, and understand why "Z's" are used by H.M. Government, municipalities, railways, and other large consumers who carry out exhaustive tests *before* placing their contracts. "Z" Drawn Wire Lamps have a ready sale, and yield a good profit. List and terms post free.

Sole Makers:
THE "Z" ELECTRIC LAMP MFG. CO., LTD.
Offices and Works:
Standen Road, Southfields, London, S.W.

Depots:
BIRMINGHAM: 8, CHURCH STREET, COLMORE ROW.
SHEFFIELD: 19, DOVEDALE ROAD.

Wholesale Agents:
VERITYS, LTD., 31, KING STREET, COVENT GARDEN, LONDON, W.C., AND ALL DEPOTS.
SLOAN ELECTRICAL CO., LTD., 12, GOLDEN LANE, E.C., AND MANCHESTER.
BAXTER & CAUNTER, LTD., 219, TOTTENHAM COURT ROAD, LONDON, W.

This talk of War Economy applies to you—

IT isn't only necessary that you economise in the little luxuries of your private life. Economy in your trade buying is just as vital.

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For your next Installation specify

ARMORDUCT

The Quality Conduit,

You will then effect practical economy in Cost, Time and Labour. There are no annoying "after-faults" with Armorduct. It is installed rapidly, with no excessive labour charges, and is steadily reliable under almost all conditions.

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THINK IT OVER!

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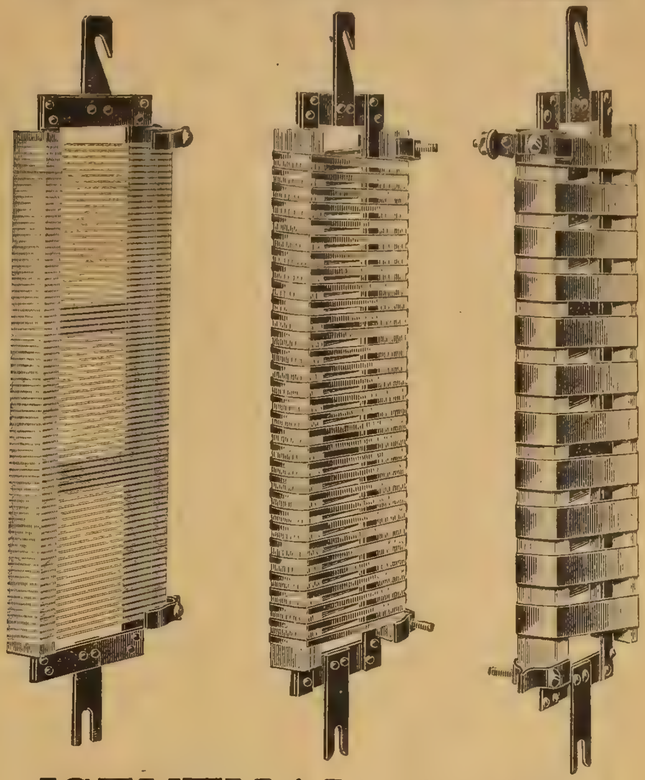
The
ARMORDUCT
Manufacturing Company, Ltd.,
Farringdon Avenue, LONDON, E.C.
Works:
Bathurst Works, Witton, near Birmingham.

RHEOSTATS

NEW LIST IN THE PRESS.



ISENTHAL & CO.,
(DEPARTMENT 3),
Denzil Works, Neasden, London, N.W.
Contractors to the Admiralty, War Office, India Office, Colonial Office, Postmaster-General, &c.

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PROFESSIONAL PAPERS
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THE COUNCIL OF THE INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS.

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"Machine Switching in Telephony."—B. O. Anson	9d.	11d.
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"The Loading of Aerial Lines and their Electrical Constants."—J. G. Hill	1s.	1s. 2d.
"Telegraph Traffic and Power Plant for Pneumatic Tubes in Post Offices."—Alec. B. Eason, M.A., A.M.I.E.E.	1s.	1s. 2d.
"Preparation of Local Underground Schemes."—A. Rattue	6d.	7d.
"Private Branch Exchanges."—D. H. Kennedy and J. W. Turner ...	9d.	11d.
"The Historical Basis of Modern Printing Telegraphy."—H. H. Harrison, A.M.I.E.E.	9d.	11d.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

START THE NEW YEAR WELL

BY INCREASING BUSINESS WITH

1916

ROYAL

EDISWAN

DRAWN - WIRE - LAMPS

FULL PARTICULARS FROM—

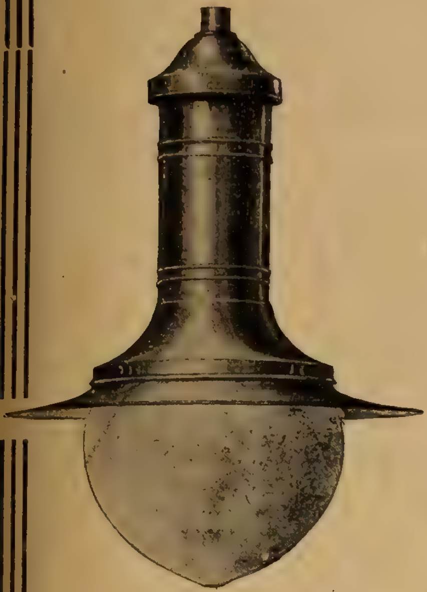
THE EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD.,

Telephone: 520 Enfield. PONDER'S END, MIDDLESEX.

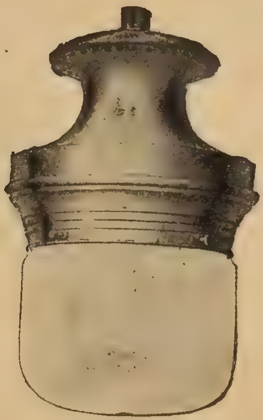
FULLY LICENSED UNDER BRITISH PATENTS NOS 21513/06 27712/03 AND OTHERS

SIEMENS

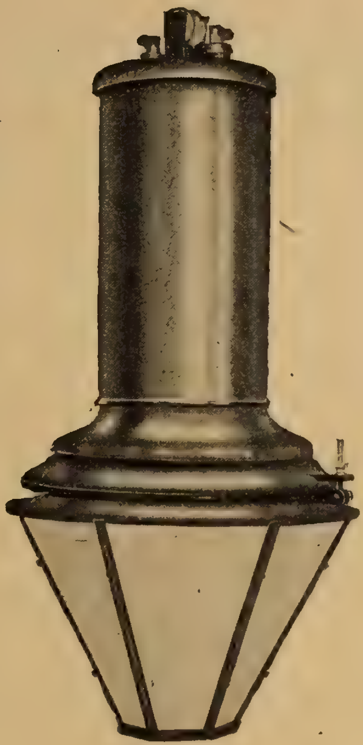
Weatherproof Lanterns
for use with
Half-Watt Lamps.



D 5995.
Hard Stove Enamelled Black Iron with Opalescent Globe.
For one Half-Watt Lamp.
300—1000 Watts.



D 5969.
Polished Copper with ½-in. iron female nipple and opalescent globe.
For one Half-Watt Lamp.
300—500 Watts.



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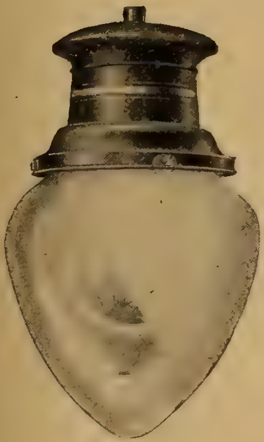
This fitting can be supplied with internal cut-out and substitutional resistance if required.



D 5977.
Green and Gold Vitreous Enamelled Iron with Diagonal Half-Opal Globe.
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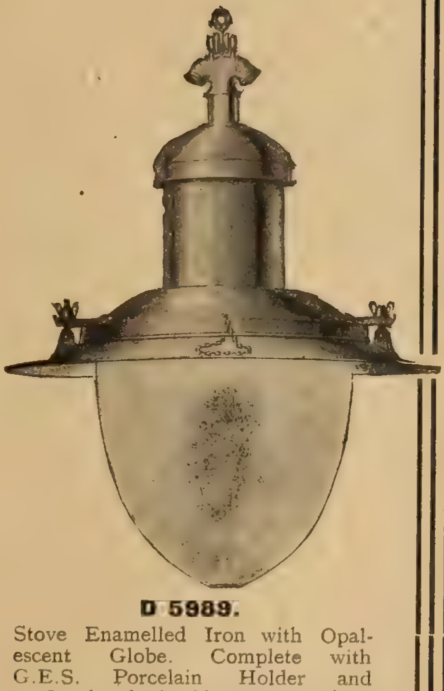

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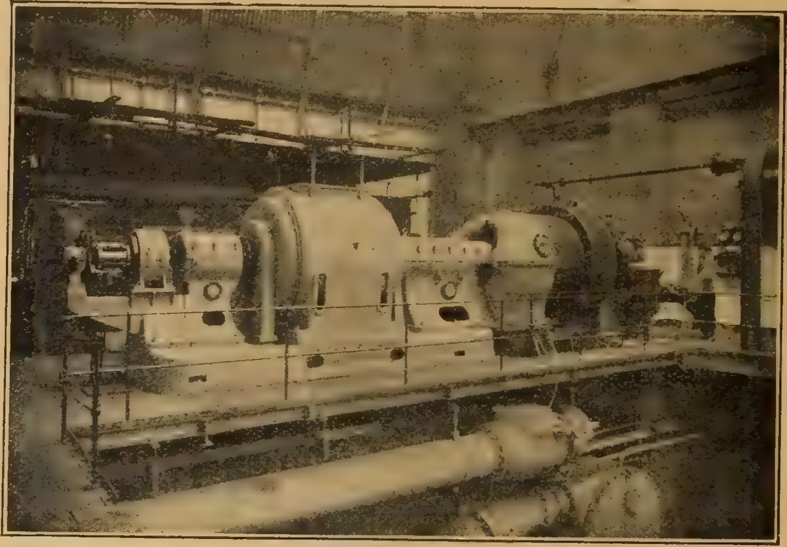

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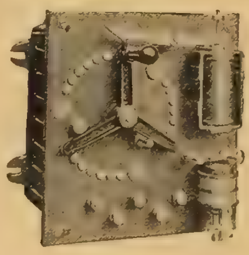

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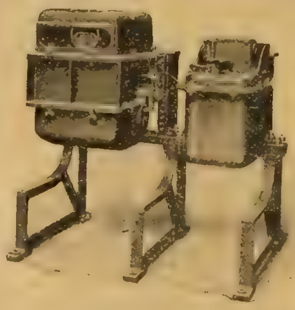

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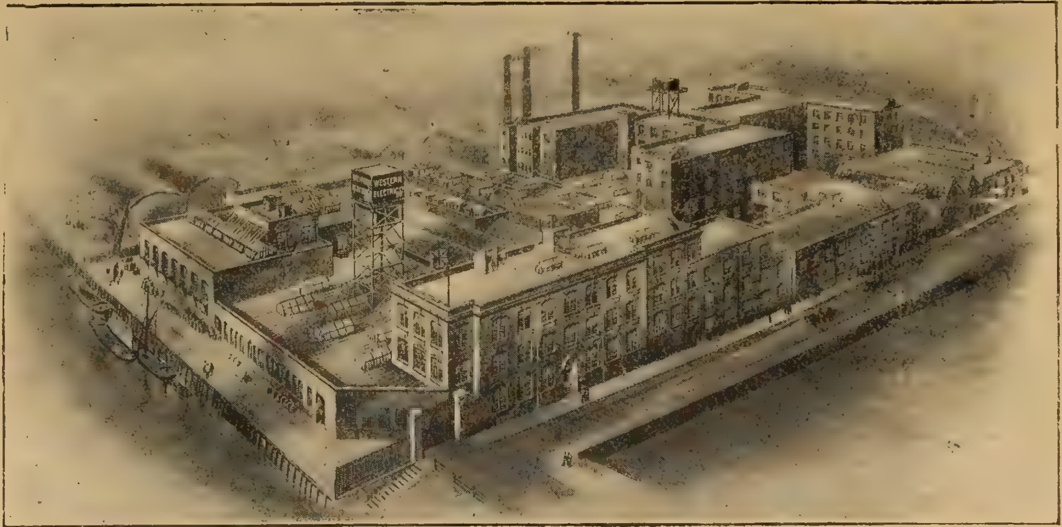

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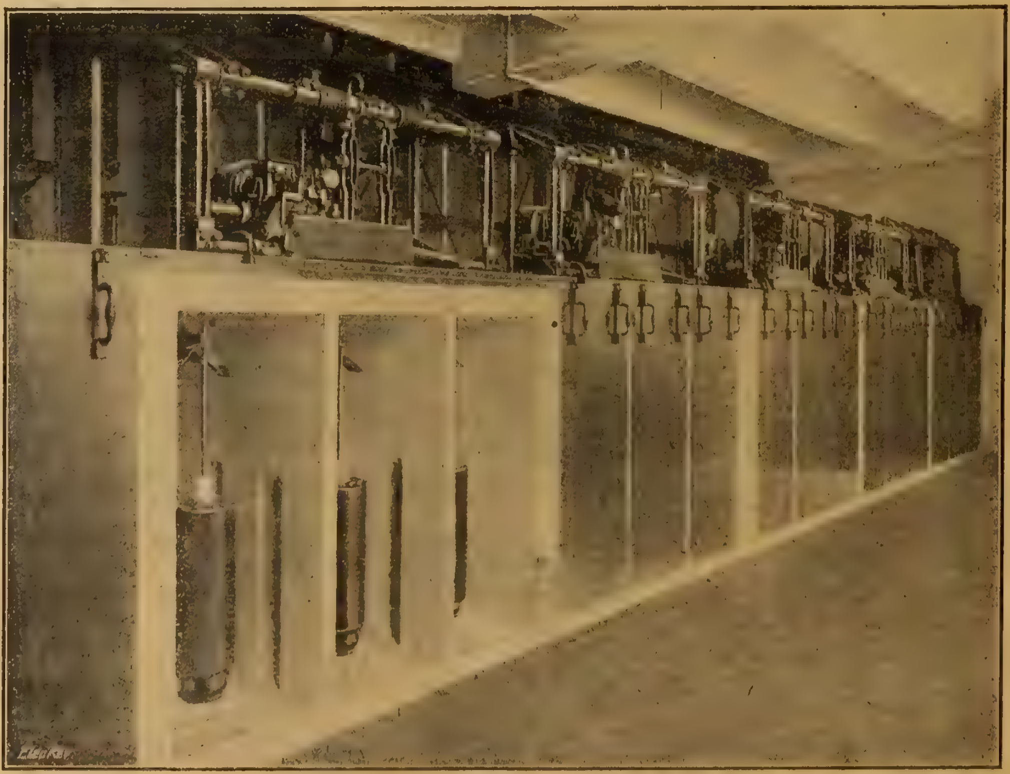

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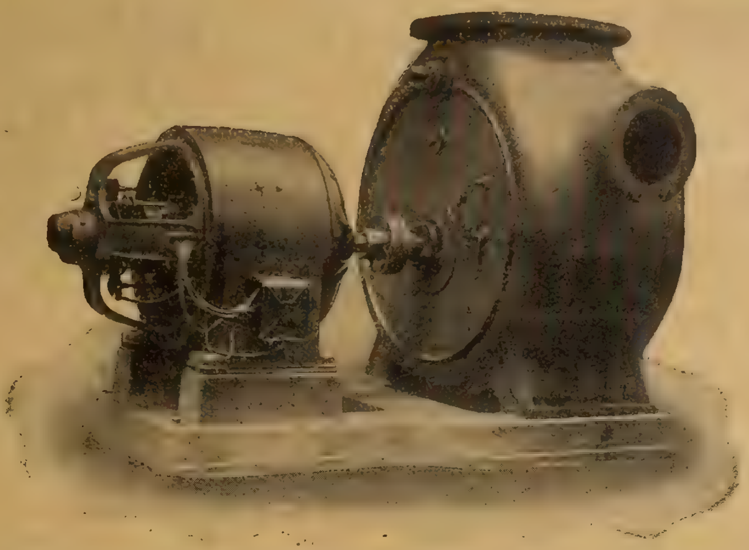

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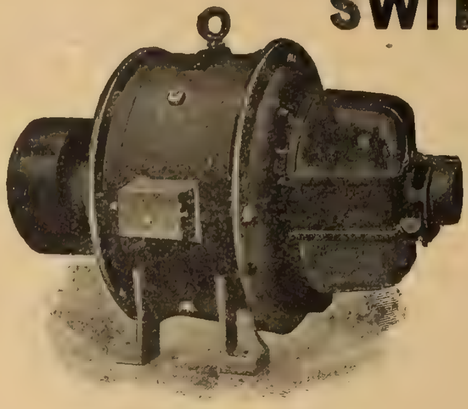

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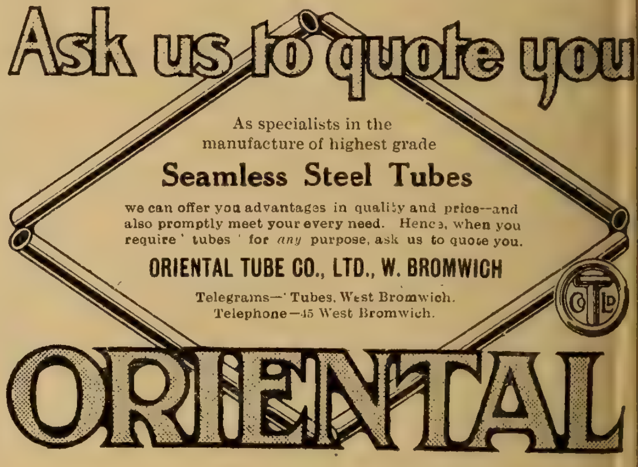

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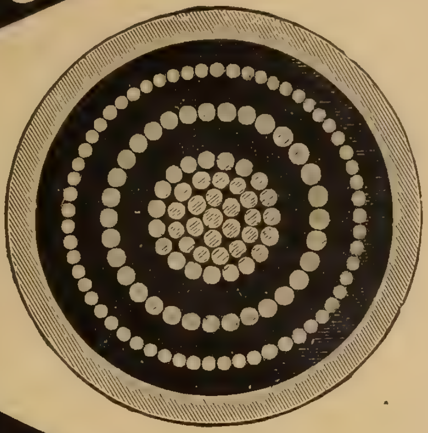

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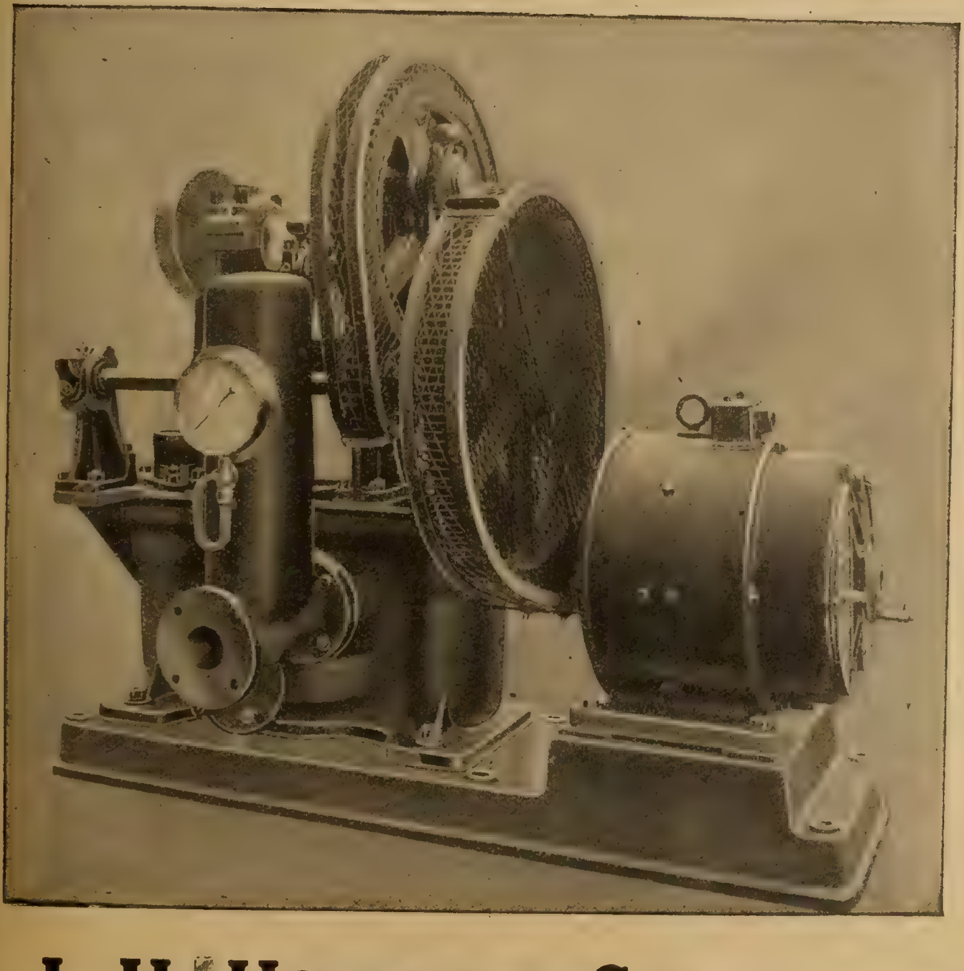

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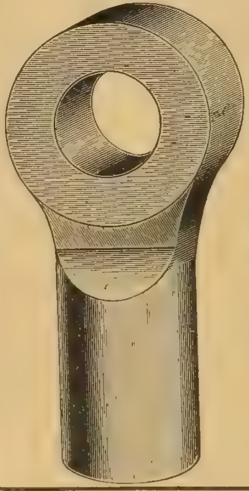

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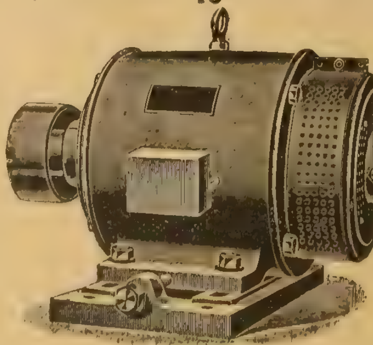

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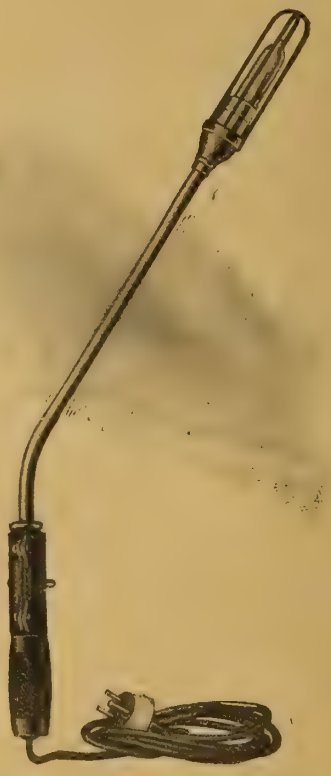

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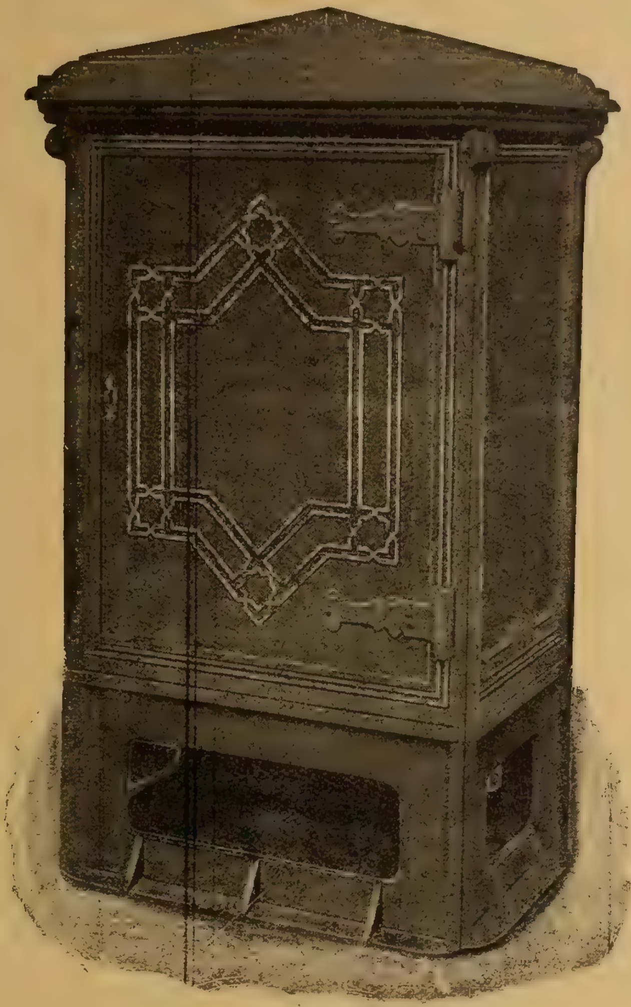

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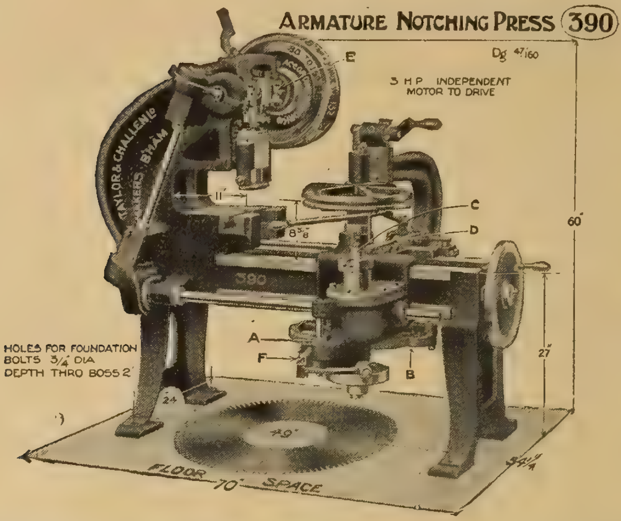
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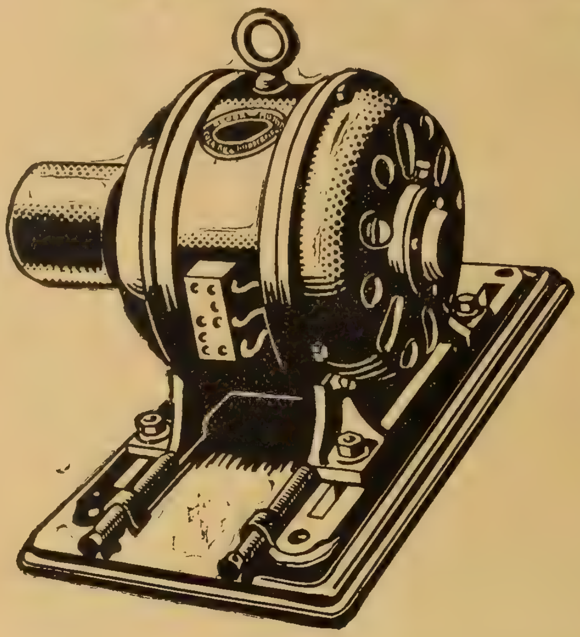

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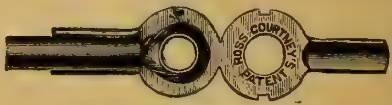

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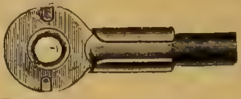

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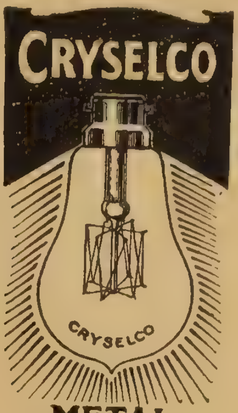

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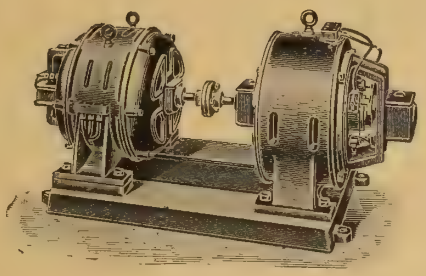

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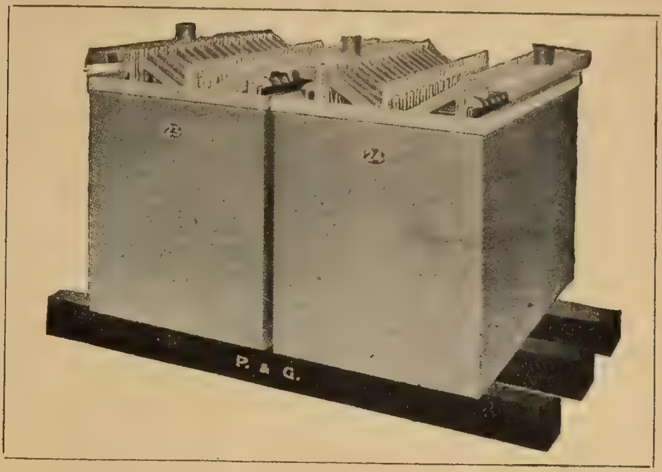

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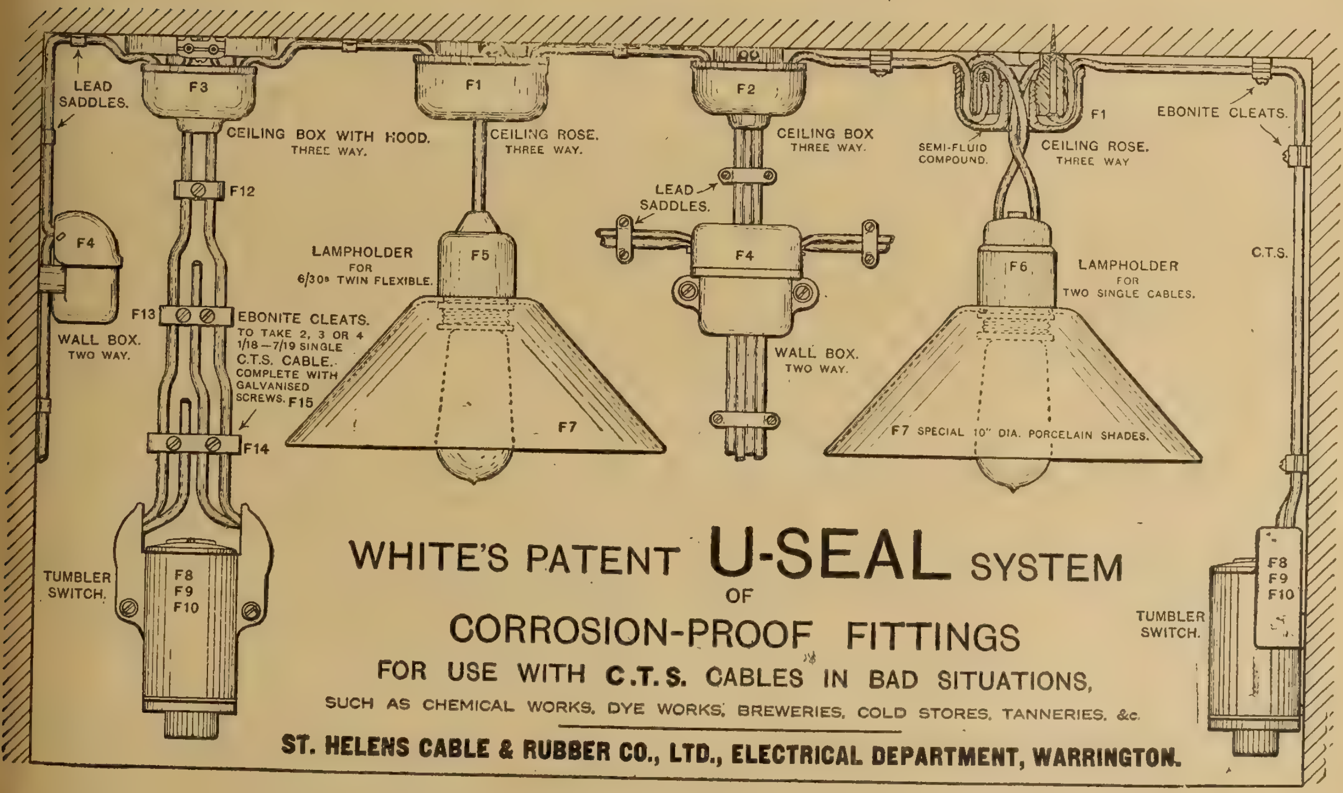

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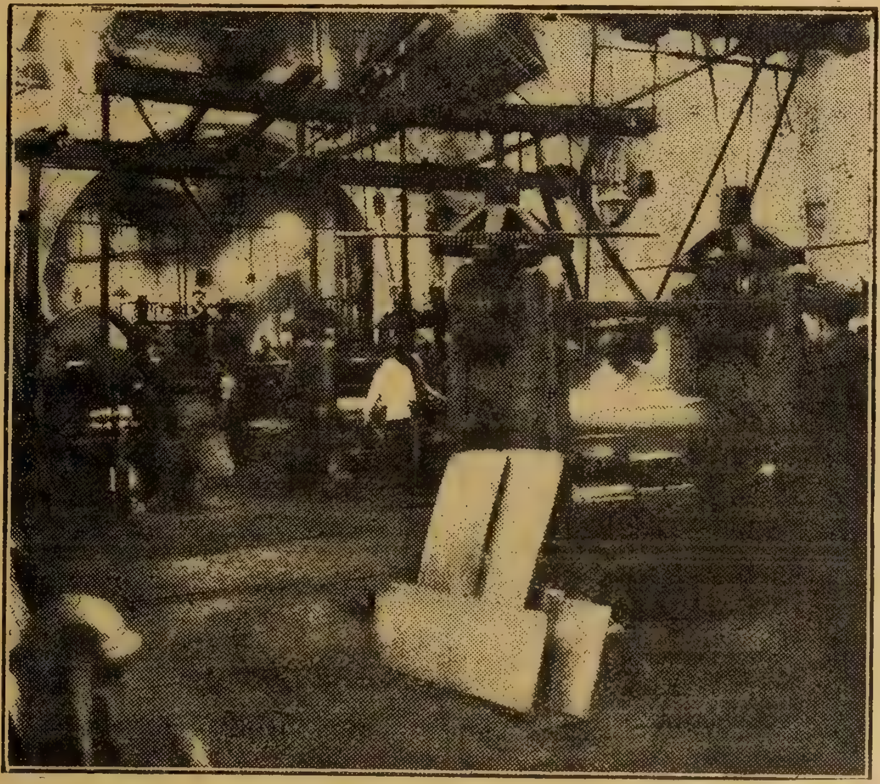

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CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDARE.—Alteration, "Welsh Harp," Commercial Street; T. Roderick, architect, Ashbrook House.

ACCRINGTON.—New Church at Spread Eagle; Trustees. Primitive Methodist Church in Whalley Road; Trustees.

ALTRINCHAM.—Housing scheme; Surveyor to U.D.C.

ATHERTON.—Garage, for Lee Spinning Co., Ltd.

BACUP.—Rebuilding part of Throstle Mill, for J. Maden & Son, Ltd., cotton spinners.

BARNSLEY.—Garage at 36, Pitt Street, for Dr. Sheridan. Extension of workshop at May Terrace, for M. E. Tune. Two dwelling-houses in Locke Avenue, for F. Ward. Additions to shop, for Barnsley British Co-operative Society.

BATLEY.—Garage at Henry Street, Batley Carr, for J. Fenton & Sons, Ltd. Generator house at Lady Ann Mills, for J. B. & W. Hirst.

BIRMINGHAM.—Factory; Buckland & Farmer, architects, Norwich Chambers. Premises (£4,000), for Taylor & Challen, engineers; T. Elvins, builder, Naden Road.

BRADFORD.—Reconstruction of Prospect Cottage, Allerton, as a branch library and reading room; the City Architect, Town Hall.

BREDBURY (CHESHIRE).—Re-erection of portion of works, for the Bredbury Steel Works Co. (£3,000).

BRIGHTON.—Alterations to the "Red Lion," Park Place, for the Licensee.

BURTON LATIMER (NEAR KETTERING).—New Baptist Church; Trustees.

CHACETOWN (LICHFIELD).—Houses, Cross Street, Chase Terrace, for Churchill Bros. Additions to residence, for Dr. Horton.

CHATHAM.—Alterations, 199-203, High Street, for A. J. Whitehead.

CHESTERFIELD.—Boiler-house, Holme Brook Works, for Robinson & Sons, Ltd. Additions to store, Welshpool Pottery, Barker Lane, for Knowles & Son.

CLIFTON (NEAR MANCHESTER).—Additional surface buildings (with electrical installations), at Astley Green Collieries; Clifton & Kersley Coal Co., Ltd.

COVENTRY.—New schools, for Trustees, Gosford Street Baptist Church.

COWES (I.O.W.).—Houses, Park Road; J. Ball & Son, builders, Victoria Road.

DAGENHAM (ROMFORD).—Extensions, for the Sterling Telephone Co.

GLASGOW.—Rebuilding of bonded stores, for the Distilleries Co., Ltd. (£150,000).

GOVAN.—Secondary school; M. Adam, architect, 160, Hope Street, Glasgow.

GRANGEMOUTH.—Extension of shipbuilding yard, for Greenock & Grangemouth Dockyard Co., Ltd.; Manager.

HANDSWORTH.—Cannon Street Memorial Baptist Church, Holyhead Road; Trustees.

HAWICK.—Anderson Sanatorium, additions (£1,500); Clerk, Anderson Sanatorium.

HECKMONDWIKE.—Re-erection of works, Beck Lane, for the Spencer Wire Co., Ltd., & Gills, Ltd.; H. Spivey, owner.

HUDDERSFIELD.—New premises, for St. Saviour's Mission, Leeds Road North; Rev. A. Whorlow, Vicar of Parish.

IRLAM.—Extensions; Partington Steel & Iron Co., Ltd.

ILKLEY.—Primitive Methodist Church Sunday Schools; W. G. Smithson, architect, 2, Basinghall Square, Leeds.

KENMARE (CO. KERRY).—Rectory house; G. A. E. Hickson, architect, 23, Denny Street, Tralee.

KINGSTON-ON-THAMES.—Extensions to works, for Sopwith's Aeroplane Co.

LEEDS.—Additions to Mount St. Mary's Roman Catholic Church; Rector.

LONDON (BERMONDSEY, S.E.).—Temporary wards at the Princess Club Red Cross Hospital, Jamaica Road; J. Carmichael, builder, 331, Trinity Road, Wandsworth Common, S.W.

(LEWISHAM, S.E.).—Houses, Arran Road, Catford; J. Watt, builder, Bromley Road, Catford.

(ILFORD, E.).—Houses, Hickling Road, for A. Burch. Granary, etc., Oakfield Road and High Road; Banks, Martin Hammond & Co., architects. Garage, Balfour Road; Hammond & Miles, builders.

(BARNES, S.W.).—Additions to Sheen Lane Picturedrome; R. B. Rowell. Residence, Bracken Gardens; Hooper Bros. Flats, Castleton Mansions, River View Gardens; Peppiatt & Cooper. Business premises, Upper Richmond Road; Hunt & Jones.

(S.W.).—Rebuilding 25 and 27, Buckingham Palace Road; L. Martin, architect, Seymour House, Waterloo Place, S.W. Building, 2, Little Smith Street; Creed & Heal, architects, 5, Verulam Buildings, Gray's Inn Road, W.C.

MANCHESTER.—St. Dunstan's Roman Catholic School, Bluestone Road, Moston; Rev. Father Routledge. Renovation of Lumb Mill, Droylesden, for McConnell & Co., Ltd., cotton spinners.

NORTHAMPTON.—Alterations for R, W. Sharpe, 29, Abington Street.

NORWICH.—Extensions, St. George's Bridge, for Howlett & White, Ltd.

OSWALDTWISTLE.—Refuse destructor; Surveyor to U.D.C.

OTLEY.—Alterations, for W. Sinclair & Sons, Albert Works. Garage at Beech Hill, Otley, for H. Stephenson.

PATRICROFT (NEAR MANCHESTER).—Rebuilding sewing cotton mills; Erman and Roby, Cawdor Street Mills.

PENDLEBURY.—Additional electrical installations at local collieries; A. Knowles & Sons, Ltd., colliery proprietors.

PUDSEY.—Reinstatement of premises at Union Bridge Mills, for Gerald, Hartley & Co., Ltd.

RADCLIFFE.—Extensions; Radcliffe & Pilkington Co-operative Society.

RICHMOND (YORKS.).—Alterations to "The Board," High Road, for R. V. Kirtley.

ROTHERHAM.—52 houses, Thorpe Hesley, Wentworth, for Newton, Chambers & Co., Ltd., Thorncliffe Ironworks, Sheffield.

SCARBOROUGH.—Wesleyan Church (£8,000), Queen Street; Withers and Meredith, architects, London.

SCOTSWOOD-ON-TYNE.—New St. Margaret's Church; Rev. E. C. Harris, Curate-in-charge.

SEAMER.—Additions at the Seamer Auction Mart; C. H. Channon, architect, Malton.

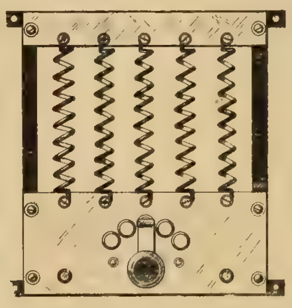
SOUTHEND-ON-SEA.—Additions, 40, Prittlewell Street, for C. Floyd. Houses, North Avenue, for F. H. Farnborough. Bungalows, Leigh Hall Road, for H. Bridge; Marguerite Drive, for S. C. Arnold; Hamstel Road, for J. J. Going; and Blenheim Crescent, for S. Sharp.

STALYBRIDGE.—Rebuilding cotton mills in Quarry Street; R. Platt, Ltd.

THORNABY-ON-TEES.—Re-erection of portion of works, for the Tees Bone Mill Co.

WEST THURROCK (GRAYS).—Houses; Carter & Co., builders, Grays.

WIGAN.—Rebuilding of winding house at Wigan Junction Colliery, Abram.



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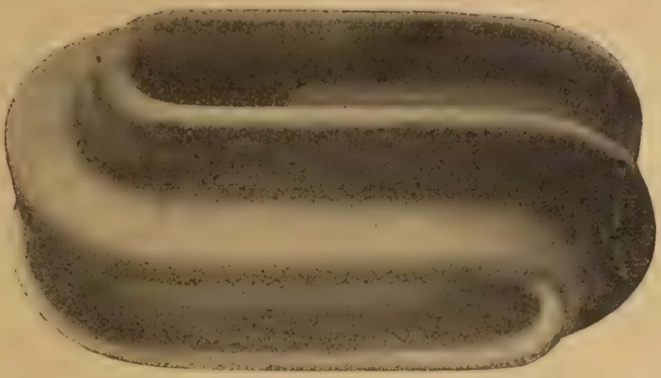

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INDEX TO ADVERTISERS.

PAGE
Acheson, E. G., Ltd. .. ..Sup. 6
Allen, Son & Co., Ltd. .. ..
Allen, E., & Co , Ltd. 12
American Hard Rubber Co. ..
Armorduct Manufacturing Co.. Ltd. .. .. Sup. 15
Armstrong, Addison & Co. ..
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Avery, W. & T., Ltd. .. ..

Bastian Electric Heating Syndicate, Ltd... .. .. ..
Bastian Meter Co., Ltd. ..
Belling & Co. 20
Bennis, E., & Co., Ltd. .. ..Sup. 2
Berry, Skinner & Co. 14
Bertram Thomas .. .. ..
Best & Lloyd, Ltd. .. ..Sup. 1
Bill, S., & Co., Ltd. 9
Bolton, Thos., & Sons, Ltd. .. 17
Braby, Fred, & Co. 9
Brimsdown Lamp Works, Ltd ..
British Electric Transformer Co., Ltd. .. ..
British Insulated and Helsby Cables, Ltd. 19
Brit. L. M. Ericsson Mfg. Co., Ltd. 24
Brit. Thomson-Houston Co., Ltd. 13
British Westinghouse E. and M. Co., Ltd. 8
Brook, E., Ltd. .. .. Sup. 30
Browett, Lindley & Co., Ltd. ..
Brown & Co., Cabinet Makers..
Brown, Boveri & Co., Ltd. ..Sup. 3

Cable Accessories Co., Ltd. . Sup. 5
Callender's Cable & Construction Co., Ltd. .. .. ..
Cambridge Scientific Instrument Co., Ltd. .. .. ..
Campbell, A. 2
Canfield Rubber Co. 9
Canning, W., & Co. .. ..
Cantie Switch Co., Ltd. ..
Carson Evans & Co. 9
Century Electric Co. .. Sup. 26
China Furniture Elec. Fittings Manufacturers' Association..
Chloride Electrical Storage Co. Ltd. .. ..
Churton, T. Harding, & Co., Ltd. 1
Clarke, Chapman & Co., Ltd. ..
Clifford, Charles, & Son, Ltd. Sup. 24
Climax Stopper and Ebonite Co., Ltd. 12
Concordia Electric Wire Co., Ltd. 5
Connolly Bros., Ltd. 1
Consolidated Pneumatic Tool Co., Ltd. 4
Contract Journal . .. Sup. 15
Cressall Manufacturing Co. ..Sup. 6
Croft Granite, Brick & Concrete Co., Ltd. .. .. .. Sup. 22
Crompton & Co., Ltd. .. ..
Crypto Electrical Co. .. Sup. 31
Cryselco, Ltd. .. .. Sup. 31

Davidson & Co., Ltd. .. ..
Davis & Timmins, Ltd. 26
Davis Electrical Co. 5
Dermatine Co., Ltd. 1
Dick, Kerr & Co., Ltd. .. ..Sup. 6
Dickson, Norman, Pringle & Co
Dodimead, J., & Son .. Sup. 24
Dore & Co. 20
Dorman & Smith, Ltd. 10
D.P. Battery Co., Ltd. .. Sup. 28
Drake & Gorham, Ltd. 16
Drysdale & Co. .. .. ..
Dugdell's Patents .. .. Sup. 22

PAGE
Edison & Swan U.E.L. Co., Ltd. .. .. .. Sup. 16
Electric Construction Co., Ltd. 6
Electric & General Works, Ltd.
Electric & Ordnance Accessories Co., Ltd. .. ..
Electrical Apparatus Co., Ltd. Sup. 18
Electrical Contractors' Assoc.
Electrical Supplies Co. .. ..
Electromotors, Ltd. 1
Elliott Bros. .. .. ..
Ellison, George .. .. Sup. 21
Endolithic Manufacturing Co., Ltd. .. Sup. 22
Engineering & Arc Lamps, Ltd. 21
Equipment and Engineering Co. Sup. 23
Everett, Edgcumbe & Co., Ltd.
Evershed & Vignoles, Ltd. ..

Fair, W. D., & Co. 8
Falk, Stadelmann & Co., Ltd...
Ferguson, Pailin & Co. 1
Ferranti, Ltd. .. .. ..
Foster Engineering Co., Ltd... 25
Fraser & Chalmers, Ltd ..
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Gardner, L., & Sons, Ltd ..
General Cable Mfg. Co , Ltd...
General Electric Co., Ltd. 21 & Sup. 8
Gent & Co., Ltd. .. .. ..
Gilkes, Gilbert, & Co., Ltd. .. 18
Gladstone, J. W. 3
Glover, W. T., & Co., Ltd ..
Gordon, Jas., & Co. .. ..
Graham, Alfred, & Co. 8

Hall, J. P., & Sons .. ..
Hall, J. P., & Co., Ltd. .. ..
Hardy & Padmore, Ltd. Sup. 27
Harris, A. E., & Co. .. Sup. 24
Harris, J. F. & G., Ltd. 18
Hart Accumulator Co., Ltd. .. 12
Hartjen, H., & Co. 1
Hartnell, Wilson, & Co., Ltd. Sup. 24
Haslam & Stretton, Ltd. ..Sup. 2
Heathman, J. H., & Co... .. 12
Hendry, J. .. ..
Henley's, W. T., Tel. Wks., Ltd.
Herbert Frood Co., Ltd. .. 1
Higgs Bros. .. .. ..
Hoffman Mfg. Co., Ltd. .. 7
Hogan & Wardrop .. ..
Holmes, J. H. & Co. .. Sup. 25
Hooper's Telegraph and India-Rubber Works, Ltd. .. Sup 19
Howard Asphalt Troughing Co., Ltd. .. ..
Howden, J., & Co. .. ..

Igranic Electric Co., Ltd. Sup. 32
India-rubber, Gutta-percha and Telegraph Works Co., Ltd. .. 28
Ingleby & Co., Ltd. .. ..
International Time Recording Co., Ltd. .. ..
Isenthal & Co. .. .. Sup. 15

Jackson Elec. Stove Co., Ltd... 27
Jaroslaw, D. .. .. ..
Jenkins, Robert .. .. ..
Johnson & Phillips, Ltd. .. 1

PAGE
Keith, J., & Blackman Co., Ltd.
Kelvin, Bottomley & Baird, Ltd. .. ..
Key Engineering Co., Ltd. Sup. 29
Kirk (Wheatley), Price & Co. Sup. 9

Lacy-Hulbert & Co., Ltd. .. 2
Laurence, Scott & Co., Ltd. ..
"Lea" Recorder Co., Ltd. .. 1
Le Carbone.. .. .. ..Sup. 4
L'Electro Journal .. ..
Linolite Co. .. .. Sup. 31
Litholite, Ltd. 1
Liverpool Elec. Cable Co., Ld. Sup. 25
London Electric Firm .. ..
London Electric Wire Co., Ltd.
London & Rugby Eng. Co., Ltd. 1
L.P.S. Electrical Co. .. ..
Lundberg, A. P., & Sons ..

Macintyre, J., & Co., Ltd. ..
Magic Cleaner, Ltd. 8
Marelli, E., & Co... .. ..
Mavor & Coulson, Ltd. 1
McClure & Whitfield .. ..
McGeoch, W., & Co., Ltd. .. 2
Micanite & Insulators Co., Ltd. 4
Mickelwright, Ltd. 18
Midland Elec. Mfg. Co., Ltd. ..
Mirrlees, Bickerton & Day ..
Mirrlees Watson Co., Ltd. .. 9
Monometer Mfg. Co., Ltd. .. 1
Morris, H. N., & Co., Ltd. .. 1
Mosses & Mitchell .. ..
Moy, Ernest F., Ltd. 1
Muirhead & Co., Ltd. .. ..Sup. 2

Nalder Bros. & Thompson, Ld.
National Boiler & Gen. Ins. Co., Ltd. .. ..
National Gas Engine Co., Ltd.
Neal, R. 1
New Garter Foundry Co., Ltd...

Oriental Tube Co., Ltd... Sup. 24

Parmiter, Hope & Sugden ..
Pass, Capper, & Son, Ltd. Sup. 21
Paul, R. W... 1
Peebles (Bruce) & Co., Ltd. ..
Phillips Commutator Grinder Co., Ltd. 23
Phœnix Dynamo Mfg. Co., Ltd.
Phœnix Fire Office .. ..
Pinchin, Johnson & Co , Ltd. .. 5
Pomona Rubber Co., Ltd. .. 15
Pope's Electric Lamp Co., Ltd.
Post Office Electrical Engineers' Journal .. ..
Premier Accumulator Co., Ltd. 3
Premier Electric Control, Ltd.
Pritchett & Gold and Electrical Power Storage Co., Ltd. .. 15
Proctor, J., Ltd .. .. ..
Pulsometer Engineering Co., Ltd. 2

Raworth, J. E. .. .. Sup. 19
Reavell & Co., Ltd. .. ..
Record Electrical Co., Ltd. .. 10
Rees Roturbo Mfg. Co., Ltd. Sup. 28
Reliance Engraving Co., Ltd. .. 1
Rentell, S., & Co., Ltd. .. Sup. 19
Reyrolle & Co., Ltd. .. ..
Roburine Co. 3
Ross Courtney & Co., Ltd. Sup. 30
Rugby Lamp Co., Ltd. .. ..
Ryman, Fred., & Co. ..

PAGE
St. Helens Cable and Rubber Co., Ltd. 15
Saxonia Electrical Wire Co., Ltd. 1
Sandycroft, Ltd. 27
Sax, Julius, & Co., Ltd... .. 1
Scholey & Co., Ltd. .. ..
Showell & Sons, Ltd. .. Sup. 26
Siemens Bros. & Co., Ltd. .. 11
Siemens Bros. Dynamo Works, Ltd. .. .. .. Sup. 17
Simmonds Bros., Ltd. 27
Simplex Conduits, Ltd. .. Sup. 26
Sisson, W., & Co., Ltd. .. ..
Sloan Electrical Co., Ltd. ..
Small Power Dynamo & Motor Co. .. .. Sup. 26
Smith, Frederick, & Co., Ltd.... 7
Smith, Major & Stevens, Ltd. .. 27
Solenoid Regulator Co. .. ..
Sperryn & Co., Ltd. .. ..
Steel Tubes & Conduits Co. . Sup. 4
Stepney Rubber Works .. Sup. 30
Sterling Varnish Co. .. ..
Stone, J., & Co., Ltd. .. ..
Sulzer Bros. .. .. . Sup. 7
Sun Electrical Co., Ltd... ..Sup 4
Superheater Units, Ltd... .
Swiss Insulating Works.. .. 2

Taylor & Challen, Ltd. .. Sup. 28
Taylor & Co. .. .. .
Telegraph Condenser Co., Ltd. Sup. 30
Thermit, Ltd. 1
Townshend's Art Metal Co., Ltd... 18
Tucker, J. H., & Co. .. ..
Tudor Accumulator Co., Ltd...
Turner Bros. .. .. ..
Turners & Manville, Ltd. .. 3

Unbreakable Pulley and Mill Gearing Co., Ltd. .. ..
United Electric Car Co., Ltd... 1

Veritys, Ltd. .. .. . Sup. 1
Vickers, Ltd. .. .. Sup. 18
Victoria Dynamo & Motor Co. 1
Vulcan Electric & Mechanical Co., Ltd. .. ..

Walsall Electrical Co., Ltd. ..
Walters, Austin, & Son .. ..
Ward & Goldstone .. ..Sup. 3
Weir, G. & J., Ltd. .. ..
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Western Electric Co., Ltd 1 & Sup. 20
Westinghouse Brake Co., Ltd.
Westinghouse Cooper Hewitt Co., Ltd. .. ..
Westminster Tool & Elec. Co. Sup. 2
Weston Electrical Instrument Co... 14
White Electrical Instrument Co. .. ..
Wiggin, H., & Co., Ltd... .. 23
Wiggins, F., & Sons .. Sup. 19
Willcox, W. H., & Co., Ltd. .. 4
Wilson, L. E., & Co. .. ..
Witting, H. R., & Partners Sup. 22
Wolverhampton Industrial Development Committee ..
Worthington Pump Co., Ltd. ..
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Wright & Wood, Ltd. .. ..

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(Continued on page xxiv.)

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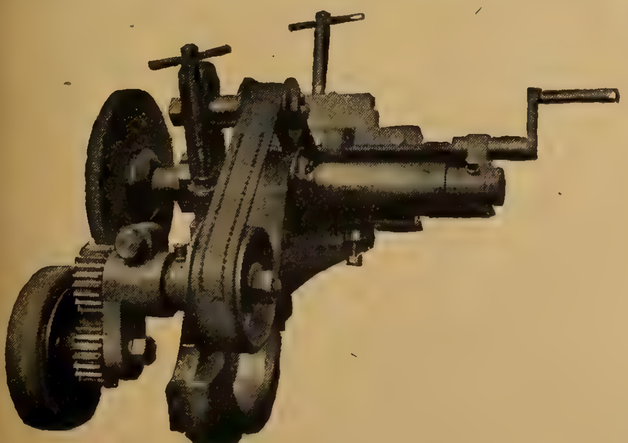

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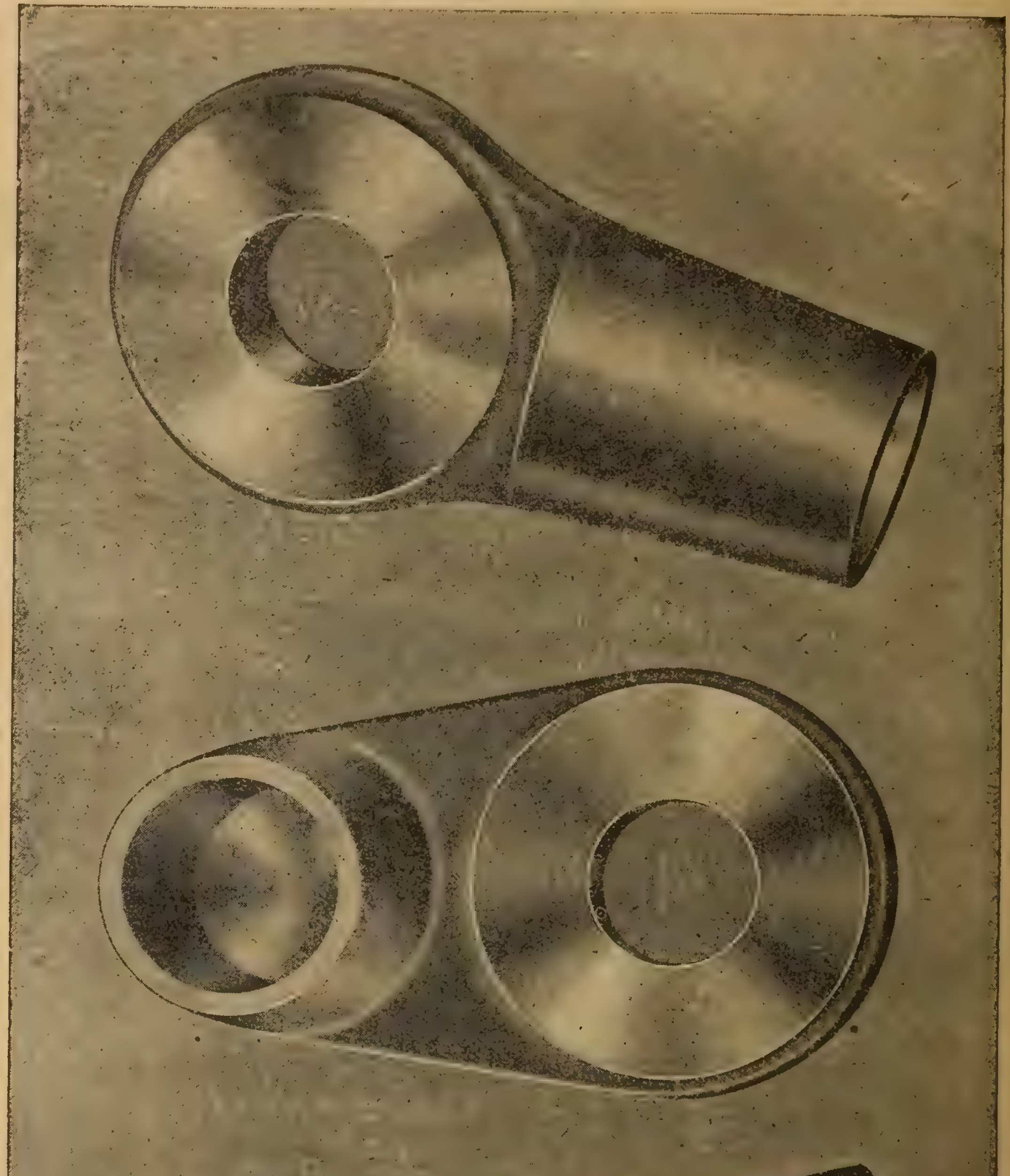

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For Size of Cable	7/20	7/16	19/17	19/14	37/15	37/·092	37/·110	61/·101	61/·118	91/12

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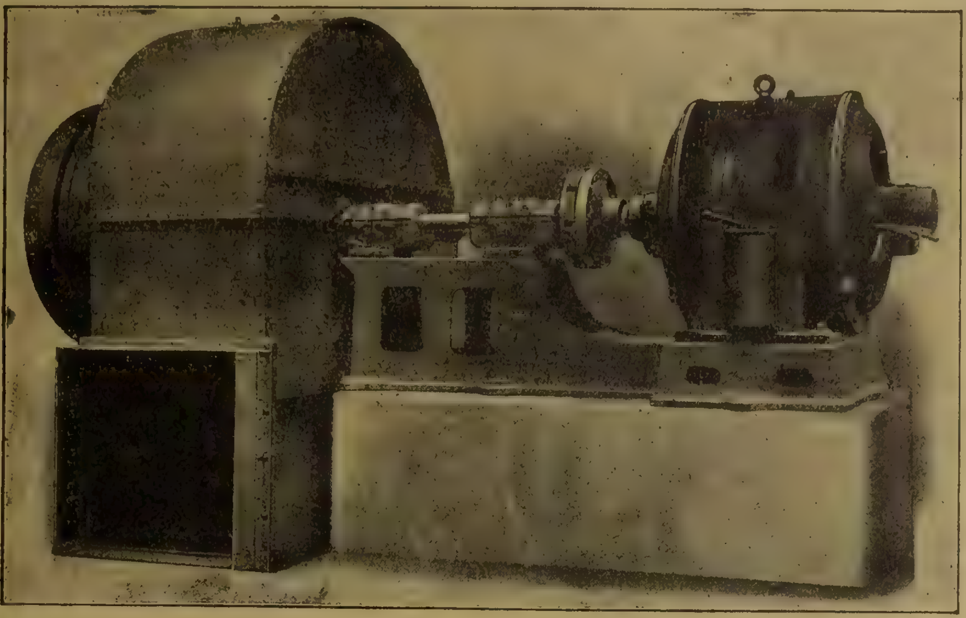

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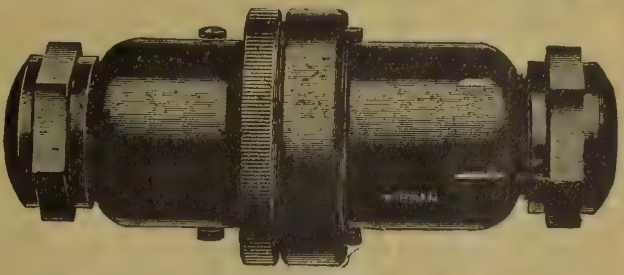

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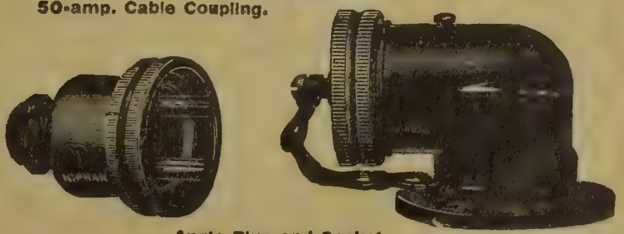

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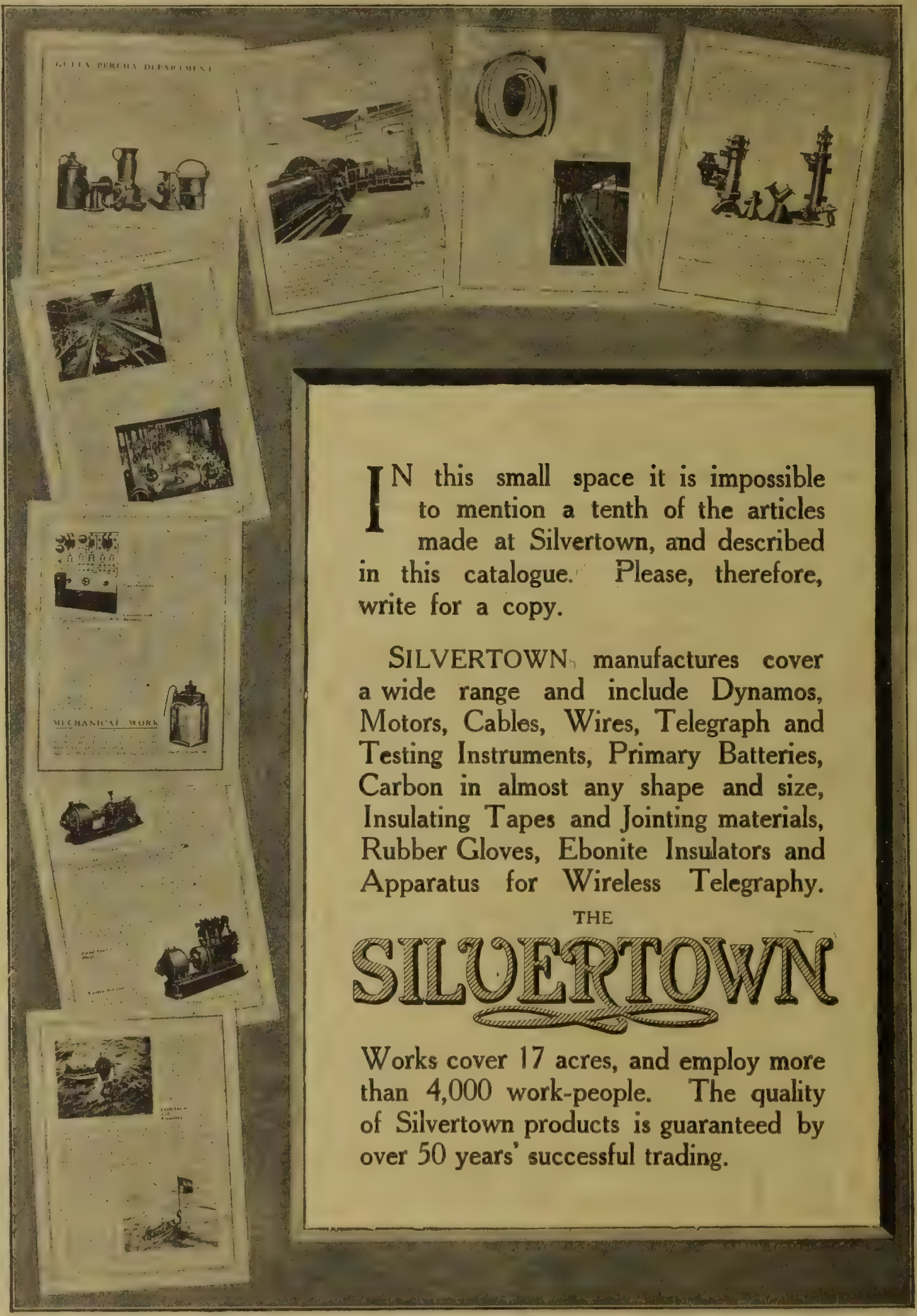

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